

DISEASES OF THE URETHRA AND PENIS

BY

E. D'ARCY McCREA, M.D., M.CH. (Dub.),
F.R.C.S.I., F.R.C.S. (Eng.)

Hon. Surgeon at Salford Royal Hospital, Manchester

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PREFACE

THIS volume represents an attempt to give in some detail an account of present-day knowledge of diseases of the urethra and penis, and to provide as well a means of reference to the literature of this subject. The author is of the opinion that periodical reviews of surgical subjects have become necessities because of the constantly accumulating mass of published material. It is his hope that in its limited field this book may serve such a purpose.

The clinical material utilized comes almost entirely from the Genito-Urinary Department of the Salford Royal Hospital in the charge of Mr. J. B. Macalpine, with whom the author has worked for many years. The work owes its inception to the stimulus of Mr. Macalpine, and it is difficult for the author to express all his indebtedness to him. He is grateful also to his other colleagues at the Salford Royal Hospital for placing valuable material at his disposal, to Dr. Louis Savatard for a fund of information on intra-epidermal carcinoma, and to Professor S. L. Baker for his readiness to examine and advise on pathological material.

The author is fortunate in being indebted to his artist, Miss Dorothy Davison, for work the excellence of which speaks for itself. His thanks are due to the Oxford Press for permission to copy *Figs. 1, 5, and 6*, to Messrs. Longmans, Green & Co. for kindly lending the blocks of *Fig. 2* taken from *Quain's Anatomy*, and to MM. Masson et Cie. for their courtesy in permitting him to reproduce *Fig. 158* from the *Journal de Chirurgie*. The illustrations of instruments have been provided through the kindness of Messrs. The Genito-Urinary Manufacturing Co.

Numerous authorities have been consulted and many references are made to them throughout the text. The opportunity is taken

here of mentioning in particular the names of Cabot, Hinman, Legueu, Marion, Swift Joly, Thomson-Walker, and Young.

In conclusion the author would express his deep appreciation of the considerateness of his publishers, and not only in the manner of production but also in particular for their readiness to publish such a work at a somewhat inauspicious moment.

E. D'ARCY McCREA.

8, *St. John Street,*
Manchester, May, 1940.

DISEASES OF THE URETHRA AND PENIS

CHAPTER I

THE ANATOMY AND DEVELOPMENT OF THE PENIS AND URETHRA

APPLIED ANATOMY

Penis.—The penis is made up largely of erectile tissue arranged in three longitudinal portions; these are the two corpora cavernosa penis and the corpus cavernosum urethræ, the last of which contains the bulbous and penile stages of the urethra. The proximal portion of the penis, or root of the penis, lies in the perineum and is fixed, the distal part or body of the penis is free; in the root the three corpora are separate, but in the body they lie side by side.

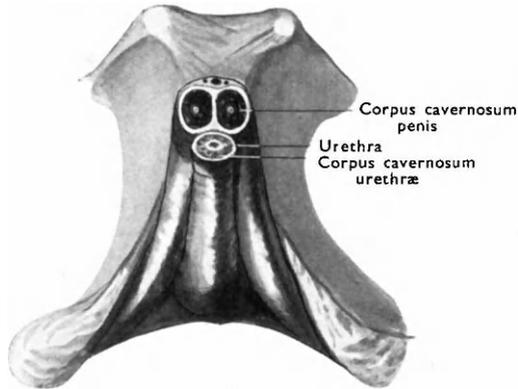


Fig. 1.—Structures composing the root of the penis. The body of the penis is seen in section. (By kind permission from Cunningham's 'Text-book of Anatomy', Oxford University Press.)

Root of the Penis (Figs. 1, 2).—The root of the penis is made up of the bulb of the corpus cavernosum urethræ and the crura of the corpora cavernosa penis. The bulb lies in the median plane and

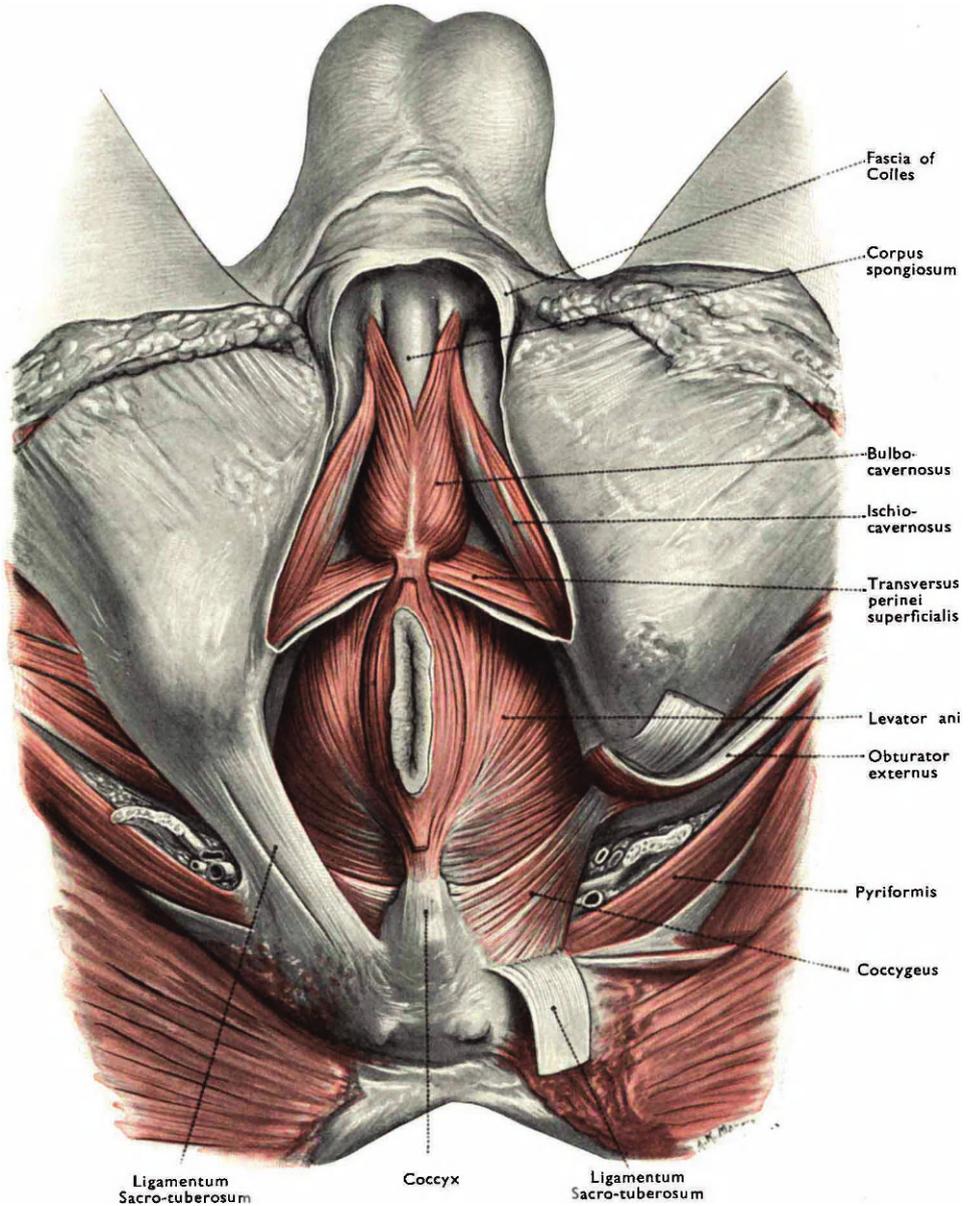


Fig. 2.—The muscles of the perineum. (By kind permission from 'Quain's Anatomy', Longmans, Green & Co.)

is attached to the under surface of the inferior fascia of the urogenital diaphragm. Its posterior extremity is expanded and often shows a notch behind and an incomplete septum within its substance, which indicate the fusion of two separately developed parts. It is covered by the bulbocavernosus muscle, which springs from the inferior fascia and is inserted into a median tendon which runs along the under surface of the bulb. Piercing the inferior fascia of the urogenital diaphragm and entering the bulb are the urethra, the arteries to the bulb, and the ducts of Cowper's glands. Laterally on either side lie the crura of the corpora cavernosa penis, and each crus is firmly attached to the corresponding pubic and ischial rami by its tapering posterior extremity. Each is covered by a dense fibrous-tissue sheath or tunica albuginea, and, externally to this, by the ischiocavernosus muscle, whilst entering each is a deep artery of the penis.

Body of the Penis.—Beneath the subpubic angle the three corpora unite to form the body of the penis, and at this point they are firmly united to the pubic arch by fibrous ligaments, which, diverging somewhat as they approach the dorsal aspect of the penis, leave a passage for the dorsal vessels and nerves. More distally is situated another ligament, the suspensory ligament of the penis; this is a fibro-elastic band which is attached above to the anterior aspect of the symphysis pubis and its aponeuroses, and below to the tunica albuginea of the penis, with expansions to the scrotum. From this point onwards the body of the penis is free and surrounded by skin. The skin is thin, delicate, hairless, and freely mobile; the subcutaneous tissue is loose, free from fat, and contains the superficial dorsal vein and some smooth muscle-fibres which are continuous with those of the dartos of the scrotum. Beneath this lies a thin layer of fascia, the fascia penis, which extends into the prepuce and is continuous posteriorly with the fascia of Colles; deep to this on the dorsal aspect of, and between, the corpora cavernosa penis lie the dorsal vessels and nerves. The corpora cavernosa penis lie side by side enclosed by their tunica albuginea, which forms an incomplete septum between them, the septum pectiniforme. The corpus cavernosum urethræ, surrounding the urethra, lies in a groove on the under aspect of the corpora cavernosa; anteriorly the corpus cavernosum urethræ abruptly expands and forms a cap, the glans penis, covering the blunt terminations of the corpora cavernosa; at the extremity of this the urethra opens through a vertical cleft.

The prepuce is a hood-like fold of skin prolonged to cover the glans either partially or completely; this reduplication of the skin is attached proximally behind the corona of the glans and from here its deep layer is reflected forwards to cover the glans as a layer of skin, modified to resemble mucosa and intimately connected to the erectile tissue. The groove behind the corona receives the name of the retroglandular sulcus. On the under surface of the glans penis a fold of skin, the frænulum of the prepuce, unites the glans to the prepuce, and two small recesses on either side of this are known as the fossæ frænuli.

Blood-supply.—The vascular supply is obtained from the internal pudendal artery through its branches, the deep arteries of the penis to the crura, the arteries to the bulb, and the dorsal arteries of the penis. The veins drain to the pudendal plexus; the dorsal vein, which has on each side of it a dorsal artery, lies in the groove between the corpora cavernosa and passes beneath the arcuate ligament of the pubis to the pudendal plexus.

Lymphatic Drainage.—The following description of the lymphatic drainage of the penis and urethra is based on that given by Rouvière (*Fig. 3*). The cutaneous vessels drain towards the dorsum of the penis and reach the internal, chiefly the supero-internal, group of the superficial inguinal glands of the same side, but occasionally vessels from one side may enter glands of the opposite side.

The lymphatics of the glans, together with those of the glandular and penile parts of the urethra, run with the dorsal vein at first and then form an intercommunicating plexus of lymph-vessels situated in front of the symphysis pubis and suspensory ligament of the penis; from thence the main vessels pass, lying superficially to the spermatic cord, to the superficial inguinal glands (Bruhns), and also to glands, one of which is situated in the femoral canal and another in the external iliac group immediately proximal to this canal. Some vessels pass deep to the spermatic cord to reach another gland of the external iliac group, placed lateral to the vessels (Cunéo and Marcille). Uncommon communications which have been encountered are, first, by means of a lymphatic trunk which, entering the abdomen between the recti abdominis, reaches the hypogastric and external iliac glands, and secondly by a vessel which passes up the femoral canal and enters a gland above the bifurcation of the common iliac artery.

The vessels of the cavernous tissue pass to the presymphysal plexus, which may contain a lymph-node, and from thence, deep to the cord, to the supero-internal group of the superficial inguinal glands; a rare variant is to find a vessel passing to a deep inguinal gland or even to a gland of the external iliac group.

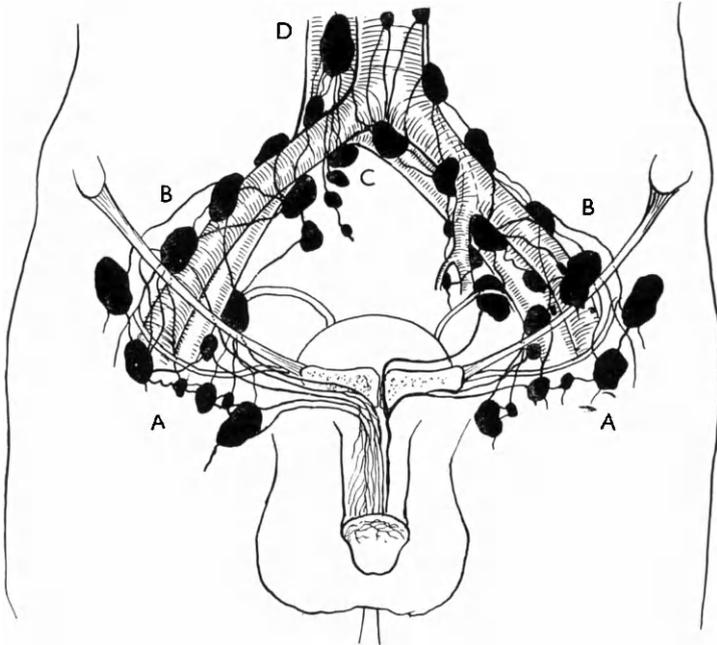


Fig. 3.—The lymphatic drainage of the penis (after Rouvière). A, Superficial inguinal lymph-glands; B, External iliac lymph-glands; C, Common iliac lymph-glands; D, Aortic glands.

The chief lymph-vessels from the bulbous and membranous urethra run with the internal pudendal artery to reach the hypogastric glands (*Fig. 4*); others pass behind the symphysis to the external iliac glands; and some vessels from the membranous urethra pass anterior to the prostate and bladder to reach other glands of the external iliac group (Marcille).

The lymphatics of the prostatic urethra drain with the prostatic vessels to the external iliac and hypogastric groups, and also to glands situated in front of the promontory of the sacrum. Numerous small glands are interposed along their course (Parker).

Nerve-supply.—The nerve-supply originates from the hypogastric ganglion and is derived from the hypogastric nerves of the sympathetic system and the nervi erigentes of the parasympathetic system.

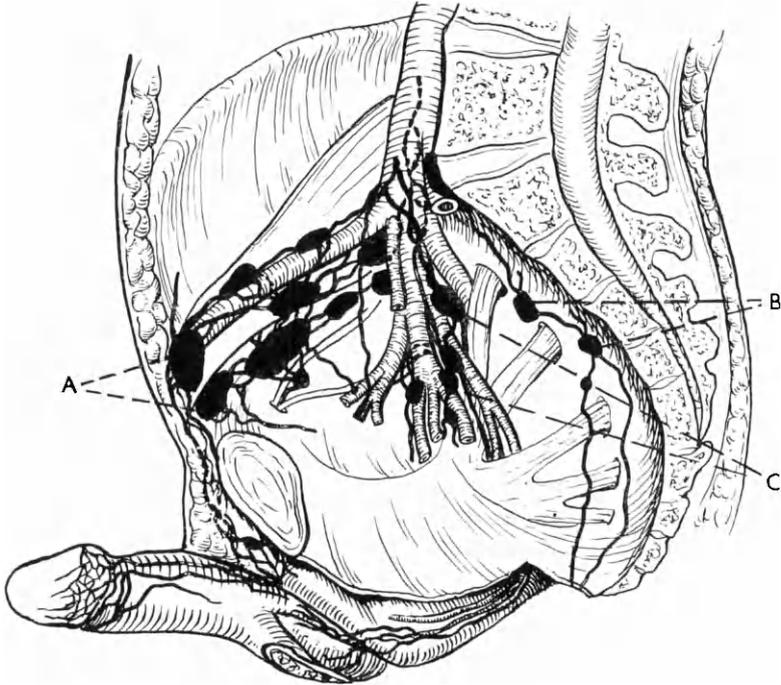


Fig. 4.—The lymphatic drainage of the penis and urethra (after *Cunéo and Marcille*). A, External iliac lymph-glands; B, Lateral sacral glands; C, Hypogastric lymph-glands.

Urethra.—The male urethra is a canal of about 8 in. in length, which extends from the internal urinary meatus of the bladder to the external urinary meatus of the glans penis (*Fig. 5*). It is the channel for the urine and the secretions of the testis, prostate, glands of Cowper, and urethral glands. In its course the urethra describes a double curve resembling the letter S; the first curvature, the subpubic curve, is that of the fixed urethra and is concave forwards and upwards and extends as far as the attachment of the suspensory ligament of the penis; the second curvature is that of the pendulous urethra and is open downwards—it disappears if the penis is in erection, when the curve of the whole canal becomes U-shaped.

Anatomically the urethra is considered in three parts—the prostatic, membranous, and cavernous stages.

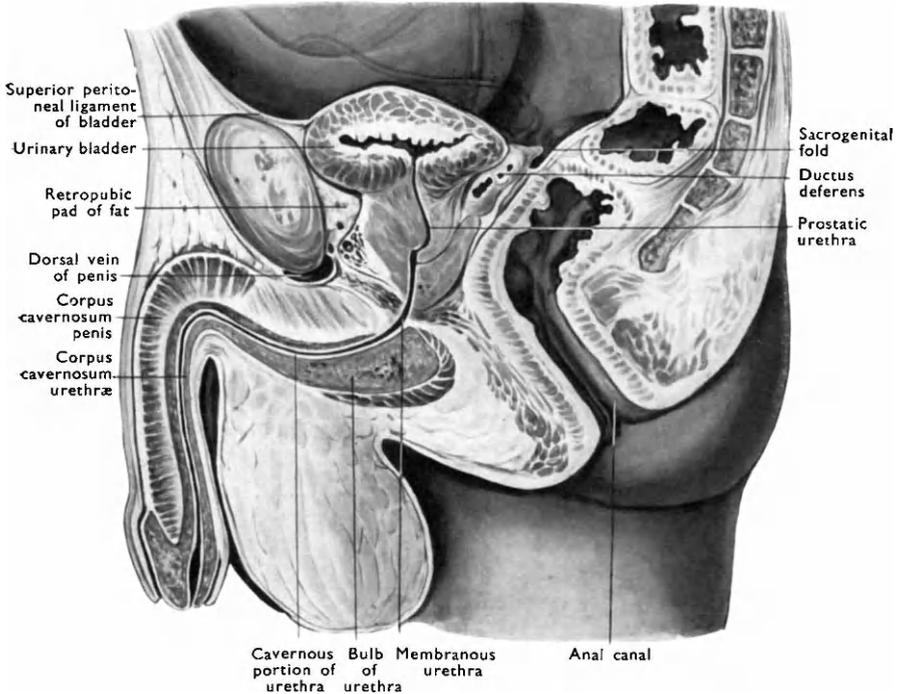


Fig. 5.—Adult male pelvis in median section. (By kind permission from Cunningham's 'Text-book of Anatomy', Oxford University Press.)

The *prostatic urethra* extends from the bladder to a point immediately in front of the apex of the prostate; it is about $1\frac{1}{4}$ in. in length, is the widest part of the canal (33–45–30 Charrière), and is easily dilatable. It is spindle-shaped, and its crescentic transverse section, with the concavity directed posteriorly, is the result of the projection into the posterior wall of the urethra of a longitudinal ridge, the *crista urethralis* (Fig. 6). Into the grooves, the prostatic sinuses, on either side of the crista, open the ducts of the prostate; at the summit of the ridge which forms the *verumontanum* is found a small blind pit, $\frac{1}{4}$ to $\frac{1}{2}$ in. in depth, the *utriculus prostaticus*, and on either side of this lies the small opening of an ejaculatory duct. Variations in the arrangement of these have been studied by Fanz and McCrea, who describe three main types: in the first the

ejaculatory ducts open upon the verumontanum lateral to the orifice of the utricle; in the second the ducts open in common with the utricle, their orifices being either on its floor, wall, or lip; whilst

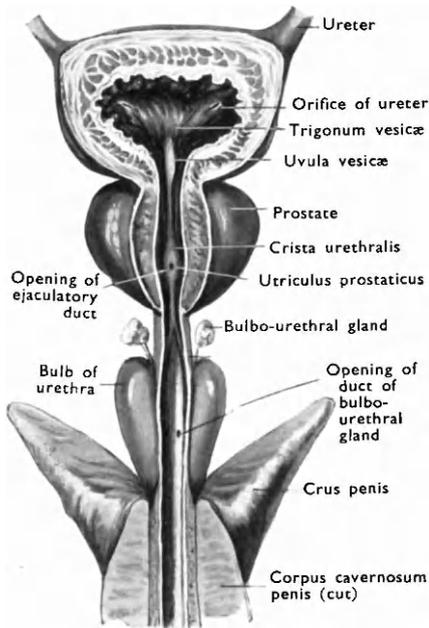


Fig. 6.—Dissection showing the trigone of the bladder and the posterior wall or floor of the urethra in its prostatic, membranous, and the upper part of its cavernous subdivisions. (By kind permission from Cunningham's 'Text-book of Anatomy', Oxford University Press.)

in the third the ejaculatory ducts open on the summit of the verumontanum without any visible opening of the utricle. The utriculus prostaticus is a remnant of the Müllerian ducts, and is the homologue of the vagina in the female; it has been stated that the verumontanum and ejaculatory ducts contain erectile tissue and become swollen during ejaculation, but McCarthy, Ritter, and Klemperer find that although rich in blood-vessels they do not possess cavernous tissue; Begg has reviewed the anatomy and physiology of the verumontanum.

The *membranous urethra* is the shortest stage of the urethra, about $\frac{1}{2}$ in. in length, and unites the prostatic portion to the penile; it passes for the most part between the layers of the urogenital diaphragm, where it is firmly fixed, but the terminal portion before entering the corpus cavernosum urethræ, half an inch in front of the latter's posterior extremity, lies superficial to the inferior fascia of the urogenital diaphragm. This is, with the exception of the meatus, the narrowest and least dilatable portion of the canal (27 Charrière) and is stellar in cross section. In its course through the pelvic diaphragm the urethra is surrounded by the sphincter urethræ membranaceæ, while behind and to either side lie the bulbo-urethral glands or glands of Cowper. It pierces the inferior fascia of the urogenital diaphragm at a point about 1 in. from the arcuate ligament of the pubis.

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The *cavernous urethra* is the longest stage and extends from the point at which the membranous urethra reaches the bulb to the external urinary meatus. The various aspects assumed by this opening have been described by Pasteau. The bulbous portion is the widest part of the urethra and often presents a shallow cul-de-sac posteriorly; on the inferior wall of this region the ducts of Cowper's glands open. The intermediate part of the canal is narrower than that of the bulb and of fairly uniform calibre (27–30 Charrière) until the glans penis is reached, where another dilatation occurs, the fossa navicularis; this opens on to the surface by a vertical cleft, the external urinary meatus, which is frequently the narrowest and least dilatable portion of the whole canal. Sometimes another narrowing is found between the fossa navicularis and the penile urethra. On cross section the cavernous urethra appears as a horizontal slit except in the glans penis, where it assumes a vertical aspect; when empty the walls of the canal are in contact throughout.

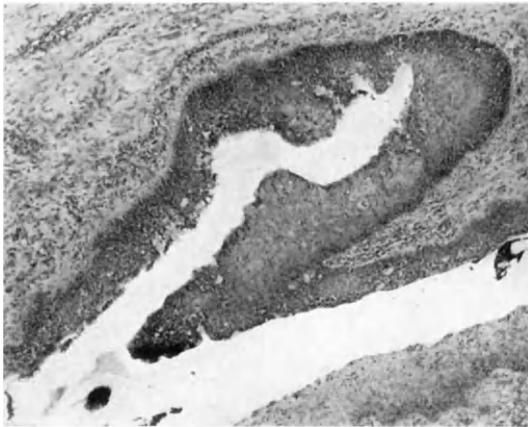


Fig. 7.—Photomicrograph of a urethral lacuna opening into the urethra.

Urethral Mucosa and Glands.—The prostatic urethra is lined by transitional epithelium which merges into the columnar epithelium of the membranous and cavernous urethræ, whilst in the fossa navicularis squamous epithelium is present. The lacunæ of Morgagni (Fig. 7) are simple recesses of the mucosa, and are variable in number and size; the larger ones lie in the midline of the superior wall, with their orifices looking towards the meatus; their depth

varies from 5 mm. to a recorded maximum of 27 mm., and their appearance has been compared to that of a swallow's nest; the largest and most constant is the lacuna magna, or sinus and valve of Guérin, which is situated on the superior wall between 1 and 2 cm. from the meatus. The smaller lacunæ, which are variable in number and size, lie on the lateral walls. The urethral glands proper are of three types, and are described by Lichtenberg as: (1) Tubo-alveolar, which are sub-epithelial glands in relation to the epithelium, and communicate with the urethra by narrow ducts;

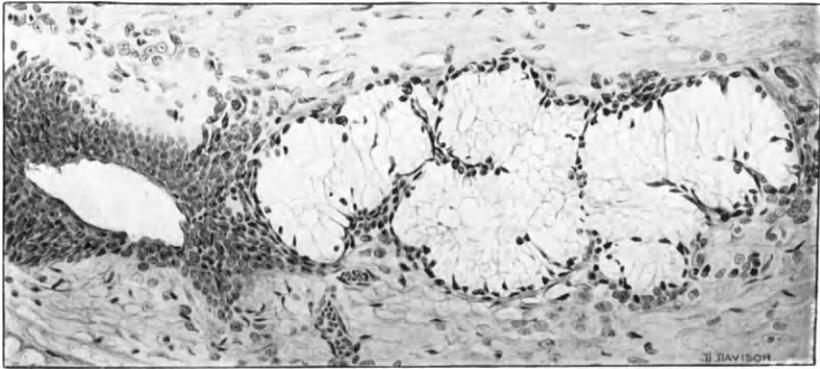


Fig. 8.—Drawing from a section showing a urethral gland in the vicinity of a lacuna.

(2) Depressions of glandular shape, probably not true glands in man; and (3) Submucous glands, the glands of Littré, which are few and rudimentary in the prostatic urethra, scattered in the membranous, and plentiful in the cavernous urethra, where they open mainly on the superior and lateral walls. Their ducts, which vary in length, open either upon the surface of the mucosa or into the lacunæ, and their orifices are directed towards the meatus (*Fig. 8*).

The urethra possesses a muscular coat of two layers, an inner longitudinal, which is a continuation of longitudinal fibres of the bladder, and an outer circular coat. The circular coat of the internal urinary meatus is largely composed of unstriated muscle, the internal vesical sphincter, but there exists also a striated sphincter, the external vesical sphincter (*Fig. 9*). The prostatic urethra possesses a circular coat, mainly made up of striated muscle, but much broken up by the prostatic tubules, whilst the membranous urethra is surrounded by the striated sphincter urethræ membranaceæ

(Guthrie's muscle). The longitudinal coat is best marked proximally, and gradually fades away in the region of the cavernous urethra.

For clinical purposes the urethra is described as being composed of two portions, a posterior and an anterior, which are separated from one another by the sphincter urethræ membranaceæ; the anterior urethra is again subdivided for descriptive purposes into perineo-scrotal, penile, and glandular stages. The narrowest parts of the canal are at the external meatus, the junction of the fossa navicularis and penile urethra, the membranous urethra, and the internal urinary meatus. The wall is thinnest and least protected in the membranous portion and immediately distal to the inferior fascia of the urogenital diaphragm, at which point the superior wall in particular is unprotected.

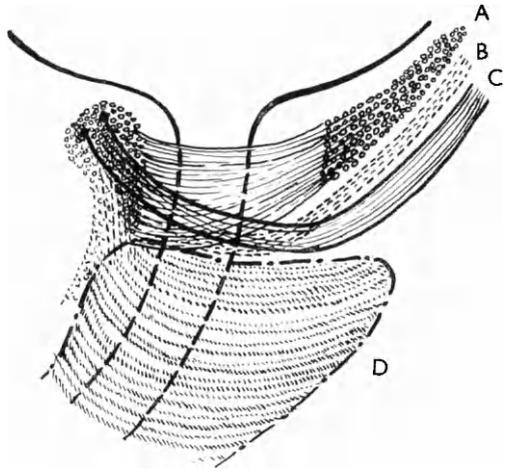


Fig. 9.—The musculature of the internal urinary meatus. A, The unstriated sphincter; B, Striated sphincter; C, Posterior longitudinal fibres of the bladder joining the sphincter; D, Striated urethral fibres overlying the prostate.

DEVELOPMENT OF THE URETHRA AND PENIS

The development of the urogenital organs is described by Tourneux, Born, Keibel, and Felix. The cloaca, which is a derivative of the hind-gut, is in embryos of 1.4 mm. in contact with the ectoderm ventrally, and the two layers of ectoderm and endoderm together constitute the cloacal membrane (*Fig. 10*). Later the cloaca and cloacal membrane are separated into two by the development and downgrowth of the septum between the allantois and gut, the urorectal septum. In this manner the urogenital sinus and membrane are formed anteriorly, and the rectum and anal membrane posteriorly (*Fig. 11*). In embryos of 11 mm. Felix finds that the urogenital sinus shows differentiation into two parts, a dorsal vesico-urethral anlage and a ventral phallic portion; the former, the pars pelvina of

Felix, receives the allantois and mesonephric ducts and is joined by an isthmus to the pars phallica. The pars pelvina is destined to form the bladder and intrapelvic portion of the urethra, and the pars phallica the extrapelvic portion of the urethra (see Fig. 13).

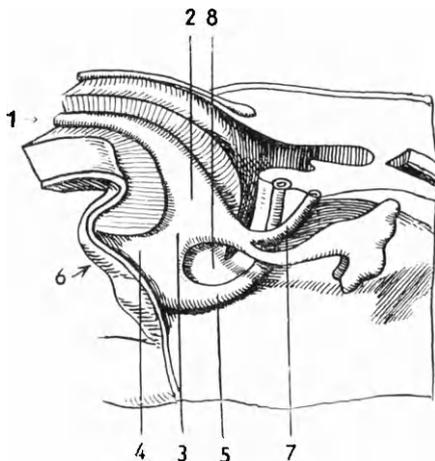


Fig. 10.—The cloacal region of an 11.5-mm. embryo (after Keibel). 1, Urachus; 2, Vesico-urethral anlage; 3, Isthmus; 4, Pars phallica of the cloaca; 5, Rectum; 6, Cloacal membrane; 7, Wolfian duct; 8, Urorectal septum.

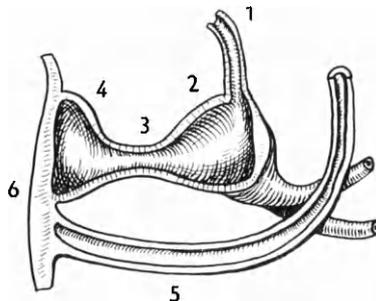


Fig. 11.—The cloacal region of an 11-mm. embryo (after Keibel and Mall). 1, Urachus; 2, Vesico-urethral anlage; 3, Isthmus; 4, Pars phallica of the cloaca; 5, Rectum; 6, Cloacal membrane.

The external genitalia are developed in the ectodermal cloacal fossa, sexual differentiation commencing during the third month of intra-uterine life (Fig. 12). At an early stage a swelling is formed in the midline at the anterior extremity of the cloacal fossa, the cloacal tubercle; then upon this a second swelling develops, the phallus, and together they form the genital eminence. Cranially to the phallus the cloacal tubercle forms a crescentic swelling, the genital tubercle, which later gives rise to the right and left genital swellings or folds. The phallus is the anlage of the penis which, as it grows, carries with it the phallic portion of the urogenital sinus; the glans becomes marked off by a groove in embryos of 21–26 mm. The primitive slit-like urogenital opening is formed by the breaking down of the phallic portion of the urogenital membrane in embryos of 12 mm.

Differentiation in the male occurs as follows: The phallus grows rapidly at its base so that the glans and urogenital opening are separated from the anus. The urogenital sinus (pars phallica) is carried with, and extends into, the phallus (Fig. 13). In the

glans it is continued as a solid urethral septum or plate (Tourneux). The sinus becomes elongated with the rapidly enlarging phallus and ultimately will form the greater part of the penile urethra; it closes from behind forwards as it extends, and its fused margins form the median raphé and, posteriorly, the perineal body. At 70 mm. (third month) the rhomboidal urogenital opening, now situated at the base

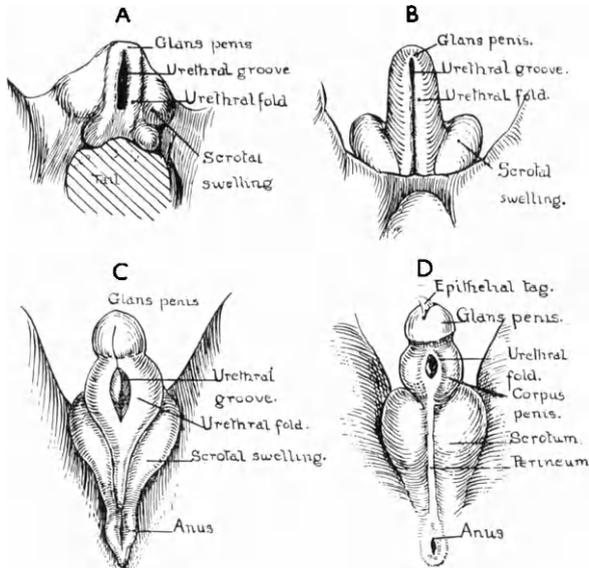


Fig. 12.—Stages in the development of the external genitalia of the male (after Spaulding). A, At nearly seven weeks; B, At nearly eight weeks; C, At ten weeks; D, At twelve weeks.

of the glans penis, begins to close and so to complete the penile urethra; at 100 mm. the epithelium of the urethral septum splits to form a sulcus on the under surface of the glans penis; and finally this closes from behind forwards to complete the urethra to the permanent meatus.

The prepuce is developed as follows (Berry Hart, Wood Jones): A cylindrical collar of epithelium, incomplete inferiorly, grows down into the extremity of the glans, and by the disappearance of the central cells of this downgrowth an outer mantle is provided. This mantle is the prepuce, which envelops the glans except inferiorly, where it is deficient and where the frænulum remains.

The cavernous tissue of the penis is formed during the fourth month by the enlargement of capillary vessels of the genital tubercle;

that of the corpus cavernosum urethræ arises from the vessels of the fused genital folds. Cowper's glands appear at 30 mm. as epithelial outgrowths from the urethra, which later acquire a lumen; the glands of Littre are formed similarly at 50 mm.

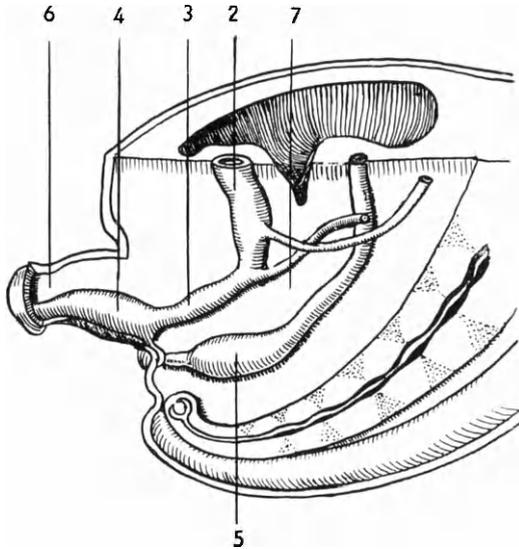


Fig. 13.—The cloacal region of a 29-mm. embryo (*modified from Keibel*). 2, Vesical anlage; 3, Urinogenital canal; 4, Phallic urethra; 5, Rectum; 6, Phallus; 7, Urorectal septum.

The male urethra is therefore developed from the following anlagen:—

1. The pars pelvina of the urogenital sinus, which, together with a part of the walls of the Wolffian ducts, give rise to the proximal portion of the prostatic urethra.

2. The isthmus of the urogenital sinus, from which the distal portion of the prostatic urethra and the membranous portion of the urethra are formed.

3. The pars phallica of the urogenital sinus, from which the bulbous and penile parts of the urethra are developed.

4. The urethral plate of the glans, which forms the glandular urethra.

The fused Müllerian ducts which open into the urogenital sinus persist in the male as the utriculus prostaticus.

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CHAPTER II

DEVELOPMENTAL ANOMALIES OF THE URETHRA
AND PENIS

Embryology.—The origin of certain of these abnormalities is obscure and classification therefore unsatisfactory; they may, however, be considered under four main headings:—

1. Defects resulting from polar dichotomy.
2. Defects due to polar hypogenesis.
3. Hermaphroditism, the existence in the one individual of organs characteristic of both sexes.
4. Local malformations:
 - a. Due to hyperplasia and hypoplasia of organs.
 - b. Defects arising at an early stage of development.
 - c. Other defects arising at a later stage of development.

1. Polar Dichotomy.—Accepting the theory of Adami which assumes the existence of two primary growing points at either extremity of the chorda dorsalis from which the anlagen of the

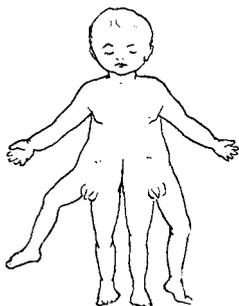


Fig. 14.—Katadidymus.

various structures are laid down and from which secondary growing points also arise, it is found that abnormal cleavage of the caudal growing point will lead to duplication of organs—that is to say, a teratoid development. In its extreme form this leads to katadidymus (Fig. 14), whilst in its minimal manifestation it results in a bifid formation of the glans penis and perhaps of the terminal urethra. In short, cleavage at an early stage of development will result in the production of monstrosities, whilst at a later stage duplication of organs occurs.

2. Polar Hypogenesis.—In this condition premature cessation of growth of the 'growing point' has occurred and resulted in a failure in the appearance of certain anlagen or in their deficient

formation (*Fig. 15*). This may entail the total absence of an organ, its hypoplasia, or even the entire absence of the external genitalia.

In both polar dichotomy and polar hypogenesis it is usual to find, as is only to be expected, other malformations associated with those of the urogenital tract.

The writings of Needham indicate the modern conception of these processes and disclose an entrancing vista. It is pointed out that the destinies of the parts of the embryo only become fixed as development proceeds owing to the ordered action of a series of determining agents or organizers. These morphogenetic hormones or evocators act upon the undifferentiated tissues, which must, however, possess competence—that is to say, the capacity to respond to an organizer if individuation is to be effected. The evocators are related very probably to the sterols, just as are the hormones of the adult body and as are the vitamins. “Appearance of supernumerary evocators may be a normal process, as in some sorts of polyembryony, or it may be a pathological process. If the first-grade organizer is concerned, the result will be a complicated monster; if second or third-grade organizers are concerned, the result will present itself to the morbid anatomist as a teratoma. In the latter case we have also to consider the persistence of competence in cells where it should have disappeared. . . .

“The converse of too many evocators is not enough, and indeed we know of conditions in which there is a suppression of induction. This may be of the first or any subsequent grade. It may be due to nutritive factors, such as avitaminosis A.” It is moreover probable that genes play some part in the governance of evocators, “but that some kind of genetic control of evocators exists . . . is certain enough.”

It should be possible to build an explanation of the varied degrees of these deformities on this basis.

3. Hermaphroditism.—The term ‘hermaphroditism’ implies that in one and the same individual there exist organs peculiar to both sexes. Such a condition is normally present in certain representatives of the animal kingdom, but is never a normal occurrence in the mammalia, and when present is termed ‘accidental’.

Embryology.—The sex of the human embryo cannot be determined at 12 mm., but at 13 mm. the distinguishing features of the

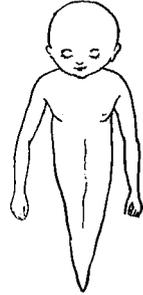


Fig. 15.—Polar hypogenesis.

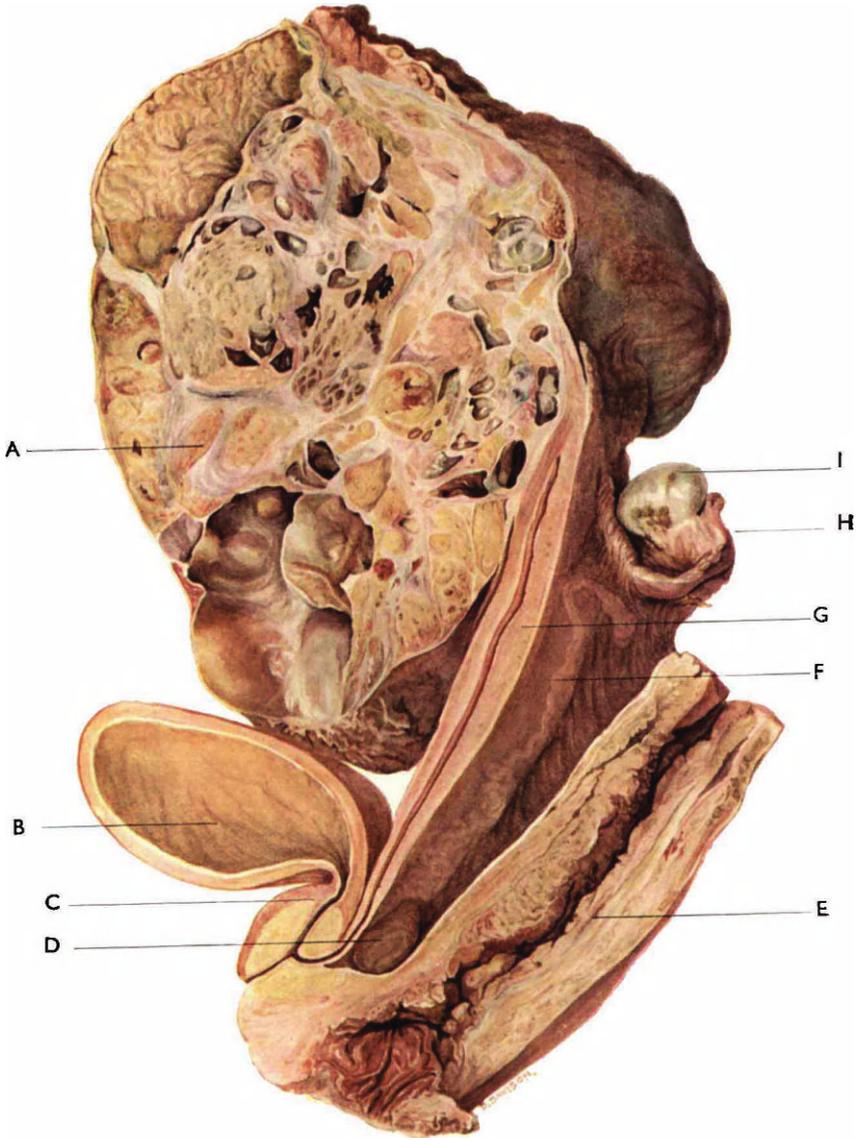


Fig. 16.—Sagittal section through the genito-urinary organs and rectum of a tubular hermaphrodite; the large tumour is a teratoma. The external genitalia were male and normal except that the testes were missing from the scrotum. A, Teratoma; B, Bladder; C, Prostate; D, Seminal vesicle; E, Rectum; F, Vas deferens; G, Uterus; H, Fallopian tube; I, Testis.

male sex appear, although it is not until later—from 50 to 80 mm.—that the ovary is differentiated.

The normal procedure during development in man appears to be the total suppression or absence of the gonad of the opposite sex, with, however, persisting rudiments of the excretory canals of that sex. The morphological and functional homologues of the male and female reproductive systems have been discussed by Zuckerman.

The male genital ducts are derivatives of the Wolffian duct, and remnants of this persist in the adult female as the hydatid of Morgagni, the ducts of the epoöphoron and paroöphoron, and the duct of Gärtner. The female ducts are developed from the Müllerian duct and are represented in the male by the sessile hydatid of Morgagni and the utriculus prostaticus. An abnormal persistence of these canals has been termed 'tubular hermaphroditism' (*Fig. 16*). True or glandular hermaphroditism implies the presence of gonadal tissue of each sex.



Fig. 17.—A female pseudo-hermaphrodite. The external genitalia of a girl of seven in whom hyperplasia of the adrenal cortex was found. (Mr. Macalpine's case).

The external genitalia may or may not be affected in glandular and tubular hermaphroditism. In pseudo-hermaphroditism the external genitalia alone are malformed; perineal hypospadias, especially when associated with cryptorchidism, and hyperplasia of the clitoris are conditions giving rise to pseudo-hermaphroditism (*Fig. 17*).

The latter is stated to be associated with either hyperplasia or tumours of the adrenal cortex in some 15 per cent of patients. It has been shown in these adrenal conditions that for pseudo-hermaphroditism to develop the condition must be congenital.

Classification.—Stephan classifies hermaphroditism in vertebrates as follows: (1) Effective hermaphroditism, which may be autogamous, reciprocal or successive, and the last may be protandrous or gynandrous. (2) Potential hermaphroditism, where all the parts necessary for hermaphroditism exist, but for some reason one of these systems does not function. (3) Rudimentary hermaphroditism, which may be glandular, tubular, or external.

Klebs's classification of hermaphroditism into true and false has been widely used. Tubular and pseudo-hermaphroditism come into the category of false.

Complications: Errors of Sex.—Glandular and tubular hermaphroditism may or may not affect the external genitalia. On the other hand a subject of tubular hermaphroditism with male gonads may have such defects of the urethra and penis as to be reared as a female. Pseudo-hermaphroditism can have a similar result. Such errors of sex are made evident when the secondary sexual characteristics develop, but in the glandular hermaphrodite the sexual inclinations are sometimes by no means parallel to either the secondary sexual characters or the configuration of the external genitalia.

Treatment.—Sudden and unexpected decision may be required when, during an operation, an obvious testis is found in a supposed female. It is questionable whether the removal of male gonads from a tubular or a pseudo-hermaphrodite, socially a female, is justifiable or vice versa. As a rule male pseudo-hermaphroditism requires, when possible, appropriate treatment of the defects of the urethra and penis, and, if necessary, social adjustment of the sex of the individual.

4. Local Malformations.—

a. Hyperplasia and Hypoplasia.—These defects are explained simply by overgrowth or underdevelopment of certain organs and structures, the cause of which in some varieties possibly lies in the formation of their anlagen and so originates in polar hypergenesis and hypogenesis; they are probably dependent upon morphogenetic hormones. Hyperplasia perhaps is represented best in the female by hypertrophy of the clitoris, resulting in one form of

pseudo-hermaphroditism. Hypoplasia is seen when with apparent absence of the penis in reality a small and buried organ is present; a cleft scrotum and hypospadias are often associated with this condition, the result being a form of pseudo-hermaphroditism.

b. Other Defects Arising at an Early Stage of Development.—These include:—

i. Defects due to abnormalities in the separation of the cloaca into urogenital sinus and rectum. Incomplete or abnormal development of the urorectal septum may leave a recto-urethral fistula when a communication between rectum and prostatic urethra exists, or a cloacal condition may persist and either the anus is imperforate or the urethra obliterated.

ii. Defects arising from abnormal extension and breaking down of the urogenital membrane. In these it is assumed that the urogenital membrane undergoes excessive extension in a forward and ventral direction, and, in order that this may take place, the fusion of ectoderm and endoderm forming the abnormally extensive cloacal membrane must occur before the anlagen of the external genitalia are laid down. As a result the genital tubercle may lie dorsal to the membrane or be cleft by it, and when it breaks down the primitive urogenital opening may be ventral to the tubercle or between its cleft halves.

The results are:

a. Ectopia vesicæ, an extreme variety, in which the whole urogenital sinus is laid bare by the splitting of the ventral extension of the urogenital membrane. A complicated form of this involves the intestinal tract as well (Wood Jones). In order to explain this last variety it would seem necessary to assume a coincident and gross deficiency of the urorectal septum.

β. Epispadias of varying degree, either with or without concealed ectopia; in this form the urogenital membrane has broken down ventrally to the genital tubercle, and the splitting process has or has not involved the urethro-vesical anlage of the sinus as well as the pars phallica. In the female a cleft clitoris has been found with epispadias, thus demonstrating cleavage of the genital tubercle.

γ. (1) 'Double urethra', one dorsal, one ventral, to the corpora cavernosa of the penis. (2) Dorsal accessory urethral canals and fistulæ, dorsal to the normal urethra. (3) Dorsal penile sinuses.

In these varieties it is assumed that ectopia of the cloacal membrane has taken place and that the pars phallica has broken down

ventrally as well as dorsally to the genital tubercle, whilst secondarily the halves of the later-formed penile Anlagen have united to separate the normal and abnormal tracts. The changes must take place before cavernous tissue is laid down. Wood Jones, however, uses the term 'rupture' in describing the breaking down of the anterior wall of the urinary tract. He considers that a comparatively late yielding produces epispadias, and an earlier, extroversion or ectopia vesicæ. Keith concludes that as embryological evidence stands to-day we must infer that the cleft which exposes the bladder and urethra represents the hinder end of what once was the primitive mouth of a cœlenterate ancestor. He quotes Florian, who showed that the cloacal membrane represents the primitive mouth and is much more extensive in the early stages of development than later. Abnormal persistence and breaking down then account for the various degrees of ectopia.

c. Other Defects Arising at a Later Stage.—After the development of the pars pelvina and pars phallica of the urogenital sinus and after the formation of the primitive urogenital opening, various defects may arise during the completion of the external genitalia and closure of the sinus:—

i. Defects of the lips of the urogenital fissure, the resultant deformities including: (*a*) Various degrees of hypospadias. (*β*) Accessory urethral canals (congenital fistulæ) ventral to the otherwise normal urethra.

ii. Abnormalities due to incomplete union of the lips of the urogenital fissure, which include: (*a*) Defects due to ectodermal failure—either a track opens to the surface ventral to the urethra, or if this becomes closed at its superficial extremity, a dermoid cyst of the raphé is formed. (*β*) Defects due to endodermal failure; if the track is shut off from the urethra mucoid cysts of the raphé result; if the tract communicates with the urethra, congenital dilatations, diverticula (cysts), or blind ventral accessory urethral canals are present.

iii. Abnormalities resulting from excessive closure of the urogenital fissure. There may occur: (*a*) Obliteration of the entire urethra, which is transformed into a solid cord. (*β*) Partial or complete obstruction of the urethra at some point.

iv. Defects resulting from maldevelopment of the urethral plate of the glans: (*a*) The urethral plate is absent, the primitive meatus then remaining at the base of the glans; this is one variety

of penile hypospadias. (β) The gutter developed from the urethral plate fails to close, and glandular hypospadias results. (γ) The gutter closes to an excessive degree and stricture or obliteration of the meatus results (Menegaux and Boidot).

v. Malformations in the development of the prepuce : (α) Adhesions between glans and prepuce result if cleavage is incomplete (*Fig. 18*); the prepuce may be completely adherent if cleavage is lacking. (β) Excessive narrowing of the preputial orifice produces phimosis, and very rarely obliteration of the preputial orifice.



Fig. 18. — Congenital adhesions between glans and prepuce causing some obstruction at the meatus.

The clinical aspect of these malformations requires a rather different presentation to allow of their description, and in the following pages the varieties met with will be described and an attempt made to indicate their origin according to the foregoing schema.

Thompson has suggested the following classification for the various congenital fistulæ of the lower urinary tract :

- | | | |
|--|---|---------|
| 1. Superior congenital fistula, urachal fistula | } | Bladder |
| 2. Complete congenital fistula, ectopia vesicæ | | |
| 3. Inferior congenital fistula, epispadias without control. | | |
| 4. Epispadias with control and without separation of the pubic rami. | } | Urethra |
| 5. Hypospadias. | | |

A reference to what has been said previously on local malformations arising at an early stage and at a late stage of development, as well as to the views of Wood Jones and Keith, will show how useful such a classification is.

Mention needs to be made of an anomaly which is not included amongst the abnormalities discussed in this classification : it is that variety of ectopia of the ureteral orifice in which the ureter opens into the posterior urethra above the verumontanum. Thom has collected 33 examples from the literature, whilst since his article appeared a review of 29 cases by Lepoutre, Laurent, and Berthelot has added several fresh examples ; one has been observed at the Salford Royal Hospital. The aberrant ureter is as a rule, although not always, one of the ducts of a ' double ' kidney, and then according

to rule drains the upper pelvis, its partner opening at the normal site. The great majority have been discovered at post-mortem examination and it is extremely rare to diagnose the condition during life. The condition may be symptomless or cause a tickling irritation which produces frequency of micturition; however, if discovered during life, it is as a rule on account of symptoms originating in the upper urinary tract.

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CHAPTER III

CONGENITAL MALFORMATIONS OF THE URETHRA
AND PENIS

THESE defects as met with clinically are either: (a) Of both penis and urethra; (b) Of the penis alone; (c) Of the urethra primarily, when the associated penile defects are dependent upon those of the urethra.

DUPLICATION OF THE PENIS AND URETHRA

It is probable that true duplication of the urethra only exists together with duplication of the penis, and that other passages which have been included under the name of "double urethra" are considered more properly under the title of accessory urethral canals. Bruni in 1925 collected 16 examples of duplication, which were all examples of complete duplication. Seth and Peacock in 1932 stated that 29 cases had been recorded; in their patient one penis was without a urethral channel and the bladder was unaffected. Partial duplication also may be found, as in the case of Nesbit and Bromme, in which the glans penis alone was duplicated, and as in Marion's patient, who had a cleft of the glans penis and a bifid terminal urethra. Up to 1933, 45 examples of duplication, either partial or complete, had been recorded.



Fig. 19.—Duplication of the penis and urethra (after Hart).

These deformities are in reality minor manifestations of caudal polar dichotomy, and in Hart's patient a third median limb was present and showed evidence of attempts at cleavage into two (Fig. 19),

whilst in a number of examples either the bladder alone or bladder and rectum were duplicated. Treatment as a rule is not advisable; however, should the urethra of one penis lack urinary connexion amputation is to be considered.

ABSENCE OF THE PENIS AND URETHRA

Polar hypogenesis may be responsible for the absence of both penis and urethra and also for hypoplasia of either. Seven examples of absence of the penis and anterior urethra are on record, 6 having been collected by Harris and 1 reported by Drury and Schwarzell; sometimes a rudimentary penis is found, but no trace of urethra. Complete absence of the penis and urethra is associated with other gross malformations, and the urine in these patients escapes either through the urachus and so from the umbilicus, or through rectal openings. It is rarely possible to consider any treatment.

CONGENITAL MALFORMATIONS OF THE PENIS

It is rare to find penile defects without urethral abnormalities. However, as indicated above, a certain number of examples of hypoplasia of the penis have been recorded, and other defects which have been noted include absence of the glans penis (Atkinson, de la Penya), phimosis of congenital origin, and *verge palmée* or webbed penis (Lockhart-Mummery), in which adhesions bind the penis to the scrotum. Torsion of the penis and congenital penile fistulæ are primarily of urethral origin. Escat, however, has reported an extraordinary case of complete inversion of the external genitalia and urethra which it is difficult to explain, and Hinman states that 3 such cases have been reported.

CONGENITAL MALFORMATIONS OF THE URETHRA

Congenital absence of the urethra has been noted already, but the following defects require consideration: (1) Recto-urethral fistula; (2) Congenital obliteration and obstruction of the urethra; (3) Accessory urethral canals and congenital urethral dilatation; (4) Hypospadias; (5) Epispadias.

The last two defects are dealt with in Chapter IV.

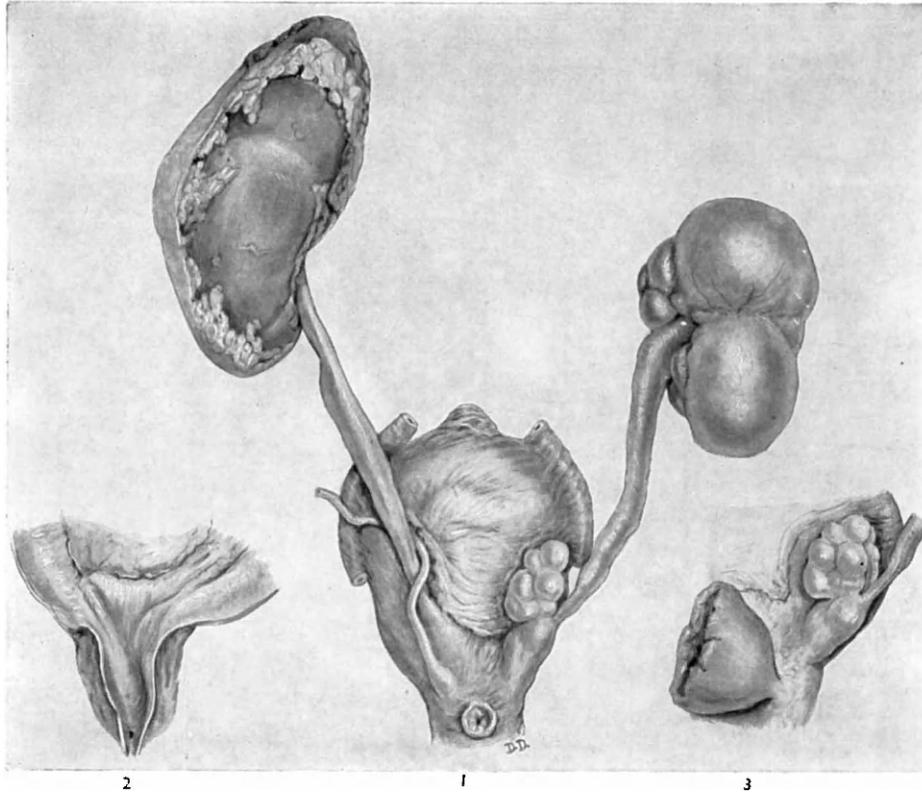


Fig. 20.—Parts removed from an infant the subject of several deformities, including congenital recto-urethral fistula. (1) The rectum appears as a small rosette entering the posterior aspect of the prostate; (2) The small orifice is just visible in the posterior urethra; (3) A postero-lateral view of the terminal rectum as it appeared before complete dissection.

1. RECTO-URETHRAL FISTULA

As a rule a congenital recto-urethral communication is found in the region of the posterior urethra, and the prostatic urethra is affected more often than the membranous; rarely the communication is with the anterior urethra (*Figs. 20, 21*). Another deformity of similar origin which has been found is a "double urethra", the one passage urinary, the other fæcal (*Fig. 22*). An imperforate anus is always associated with these deformities. As Legueu and Thunig

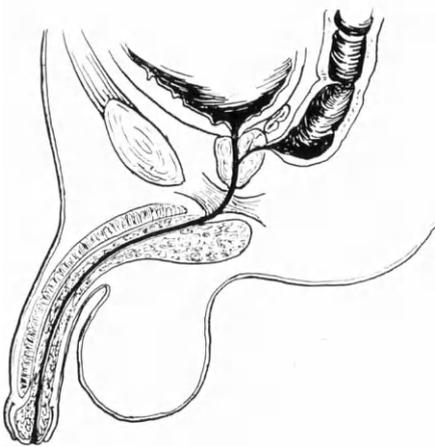


Fig. 21.—Congenital recto-urethral fistula. The rectum terminates in the posterior urethra.

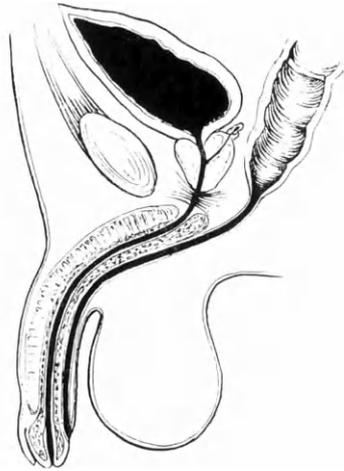


Fig. 22.—A variety of double urethra; one channel is urinary, one fæcal.

point out, they are the result of cloacal malformation, and from the foregoing schema it would appear that the error lies in the development of the urorectal septum. Le Fort, however, ascribes certain congenital recto-urethral fistulæ to secondary pathological changes taking place in utero.

2. CONGENITAL OBLITERATION AND CONGENITAL OBSTRUCTION OF THE URETHRA

Complete and partial urethral obstructions are of similar origin, their differences being only a matter of degree.

Complete Obstruction.—In its most extreme form this appears as total obliteration (Kaufmann), one of the known examples of which was recorded by Guyon. In total obliteration the whole length of the urethra is transformed into a solid cord. The condition

is associated with bilateral hydronephrosis and survival is usually impossible, but sometimes the urachus remains patent (*Fig. 23*) or a rectal fistula exists and life is maintained. Either the urethral gutter has closed to an excessive degree or the cloacal bouchon of Tourneux has persisted. Localized areas of obliteration of the urethra are of less rarity and are found most often in the region of the glans penis.

A thin diaphragm may exist between the penile and glandular stages of the urethra or the whole glandular urethra may be absent; possibly this is due to deficiency of the urethral plate, or, more probably, to excessive closure of the gutter to which it gives rise. Sometimes meatal obliteration is due to phimosis and union of the prepuce and meatus. Kaufmann has collected a number of cases of obliteration in other regions of the urethra—cavernous, membranous, and prostatic—and in several instances more than one area of obliteration was found. If no outlet, such as a patent urachus or rectovesical fistula, exists, life is brief, and in spite of treatment it usually is so in any case owing to the coexistence of marked hydronephrosis. The condition is first recognized when the infant fails to micturate and catheterization proves to be impossible.

Treatment.—Treatment is difficult, but it may be possible to break down a septum, or if this is near the meatus to divide it; in other patients suprapubic drainage or puncture is the sole resort, for urethrotomy is rarely possible, and retrograde catheterization then may prove a valuable aid to later treatment.

Partial Obstruction.—

Aetiology.—Congenital stricture of the urethra has been considered by Foisy; it is distinctly rare, but the following types have been described: (a) Cylindrical and annular strictures which occupy a certain length of the urethra. (b) Diaphragms, which may be met with at the meatus, the base of the glans penis, in the posterior urethra, or in the bulb (*Fig. 24*). (c) Valves, encountered in the



Fig. 23.—Total obliteration of the urethra, with urachal fistula.

posterior urethra. (d) The iris or bridle type, which occurs at the base of the glans, in the posterior urethra, and in the bulb.

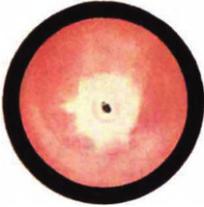


Fig. 24.—Urethroscopic view of a congenital stricture of diaphragm type situated near the bulb.

The most frequent site of partial obstruction is the posterior urethra, and the stricture is usually valvular and consists of folds of mucosa extending from the internal meatus to the verumontanum; a pocket the mouth of which opens towards the bladder consequently results.

The varieties which may be encountered have been investigated by Foisy, Young, Frontz and Baldwin, Young and McKay, and Hinman and Kutzmann; the various forms are illustrated in Fig. 25. They originate presumably from an incomplete breaking down of the urogenital membrane. A

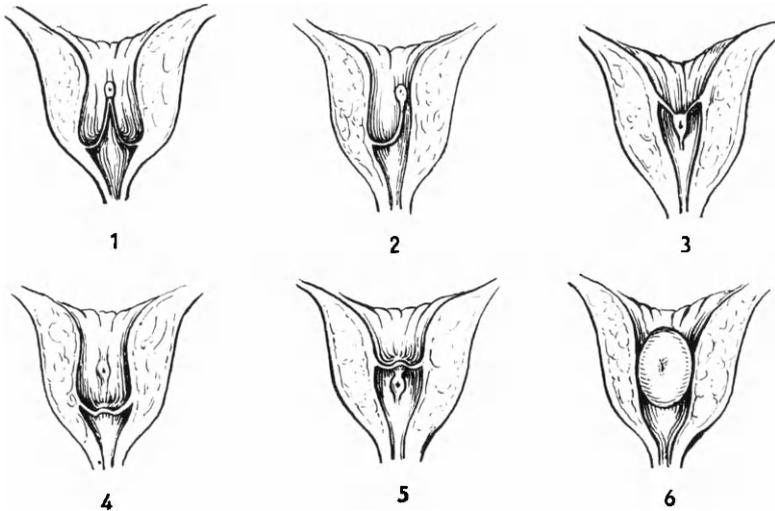


Fig. 25.—Various types of partial obstruction of the posterior urethra. 1-5, Valves of the posterior urethra (after Young); 6, Hypertrophy of the verumontanum.

variety due to obstruction by a hypertrophied verumontanum has been described by Bugbee and Wollstein and also Baldrige; it is possibly at times related to cysts of the utriculus. Less often the obstruction is situated in the anterior urethra and is either meatal or lies at the base of the glans penis; the latter variety probably

results from deficient union between the pars phallica of the urogenital sinus and that portion of the urethra which is developed from the urethral plate of the glans penis.

Pathology.—Congenital urethral stricture produces first hypertrophy of the bladder and dilatation of the posterior urethra behind the obstruction (*Fig. 26*); with dilatation of the sphincters open communication is established between bladder and urethra. The later results vary with the degree of stenosis and the individual patient: dilatation of the ureters and renal pelves follows in the



Fig. 26.—Cystogram of a case of congenital obstruction of the posterior urethra in a man of 20. The bladder is sacculated, of pyramidal form, and the posterior urethra is dilated.

more severe or long-standing cases, and occasionally such dilatation may be only unilateral. If life is prolonged for some years, which is a rare event, the hypertrophied bladder is replaced ultimately by a hugely dilated and atrophied organ which is associated invariably with marked bilateral hydronephrosis (*Fig. 27*).

Partial obstruction, therefore, produces results ranging from obstruction to micturition to interference with secretion, and the rapidity with which the latter stage is reached depends on the degree of stenosis present and on the failure of compensatory hypertrophy. It is to be noted that these phenomena are not always due to recognizable organic obstruction, and would seem sometimes to be dynamic and the result of neurogenic dysfunction.

The sequelæ, obstruction and hydronephrosis, are sometimes termed concomitant complications, whilst the coincident abnormalities

which may be present, phimosis, hypospadias, urethral dilatation, patency of the urachus and urinary fistulæ, have been called contemporary complications.

Symptoms and Diagnosis.—The diagnosis of partial obstruction is rarely made in the infant ante mortem; it may be observed that micturition is difficult, that the act is accompanied by straining and flushing, whilst the stream may be poor or dribbling. Attention may be drawn first to the urinary tract by pyuria or hæmaturia, or abdominal tumours may be found which prove to be the bladder and hydronephrotic kidneys. Usually in valvular obstruction of the

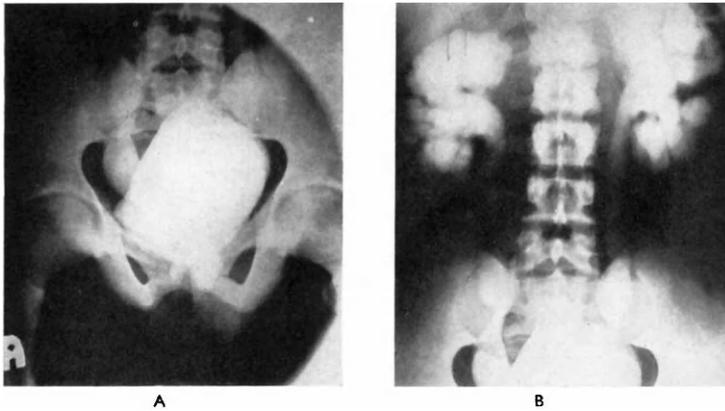


Fig. 27.—Cystograms of a case of congenital obstruction of the posterior urethra in a man aged 22. A, The bladder is a distended sac and the dilated posterior urethra is shown; B, Reflux up the dilated ureters has occurred, demonstrating advanced hydronephrosis of both kidneys.

posterior urethra instrumentation is of no diagnostic value, for the valves may permit easy ingress to the bladder whilst yet presenting almost complete obstruction to the exit of urine. A cystogram will confirm the diagnosis almost certainly, and is considerably more useful than a cystoscopic examination.

From childhood onwards to adult life urinary symptoms become more prominent and attract attention; frequency is a common complaint, and there is sometimes hæmaturia and also dribbling incontinence, which is more marked at night, as is to be expected when the only functioning sphincter is the sphincter urethræ membranaceæ. Straining is often present and its presence may be elicited on close cross-examination, otherwise it may escape notice since to the patient it is normal. Sometimes the atrophy of the

kidneys leads to renal dwarfism, and the undeveloped appearance of the patient first attracts attention. Pain may be present, and becomes prominent when urinary infection supervenes.

Examination reveals a distended bladder and perhaps bilateral renal swellings, whilst the passage of a catheter, which may or may not meet with an obstruction, demonstrates a large quantity of residual urine. The diagnosis of the valvular type in an adult again is often not arrived at ante mortem, but may be suggested by cystoscopic examination, which reveals the large bladder, gaping ureteral orifices, and dilated posterior urethra. More conclusive is cystography or intravenous urography, either of which will outline the dilated renal pelves, ureters, bladder, and posterior urethra. If it should happen that the bladder is still compensating to some extent, then its outline frequently is pyramidal, suggesting a persistence of the foetal form (*see Fig. 26*).

Prognosis and Complications.—The prognosis must depend upon the degree of obstruction and on infection. It is rare for those patients with marked obstruction to survive infancy, and extremely uncommon for them to reach adult life. The complication which arises, and, in the presence of the gross renal damage, soon terminates life, is urinary infection.

Treatment.—When the obstruction is non-valvular the usual methods of treatment of urethral stricture are employed. Dilatation may be sufficient; it may, with benefit, be supplemented by internal urethrotomy, or external urethrotomy may become necessary, perhaps together with autoplasmic operations if a defect such as hypospadias coexists. If the existence of valves in the prostatic urethra is discovered, it is necessary to break these down, and in the infant this usually necessitates a suprapubic cystostomy, with the retrograde passage of instruments. It is sometimes possible to destroy them by transurethral methods, either by means of a urethrotome, a punch, or diathermic fulguration. In the older patient it is as a rule possible to pass these instruments (*Figs. 28, 30*) and to carry out successful treatment (*Fig. 29*); alternatively suprapubic cystostomy is required. Baldridge has successfully destroyed an enlarged verumontanum by diathermy. The prognosis after operation depends on the degree of renal damage and the presence or absence of infection. The diagnosis, however, is not often made, and treatment is rarely successful, but even with extensive renal damage any relief of these organs may lengthen the span of life.

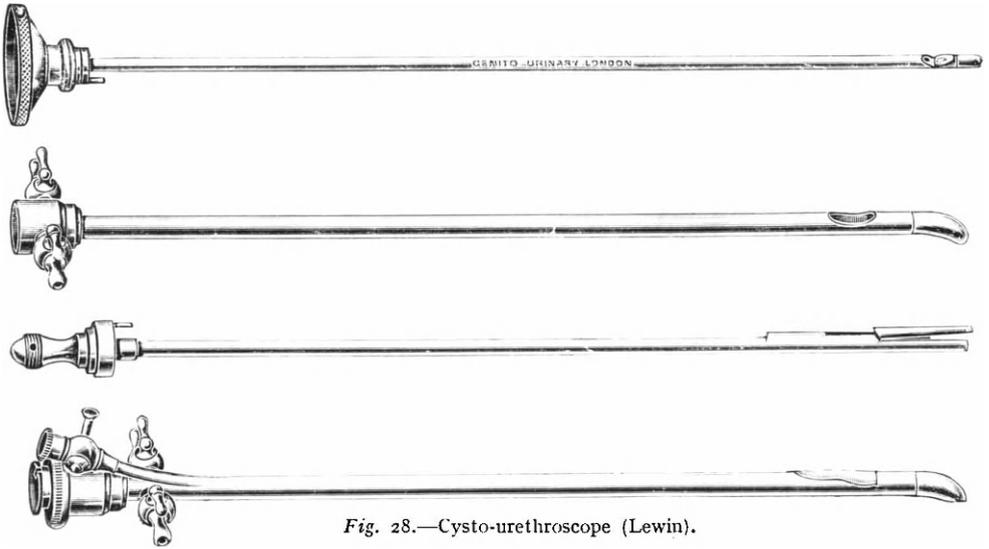


Fig. 28.—Cysto-urethroscope (Lewin).

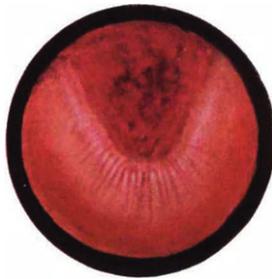


Fig. 29.—A partial obstruction (congenital) of the posterior urethra as seen through the cysto-urethroscope.

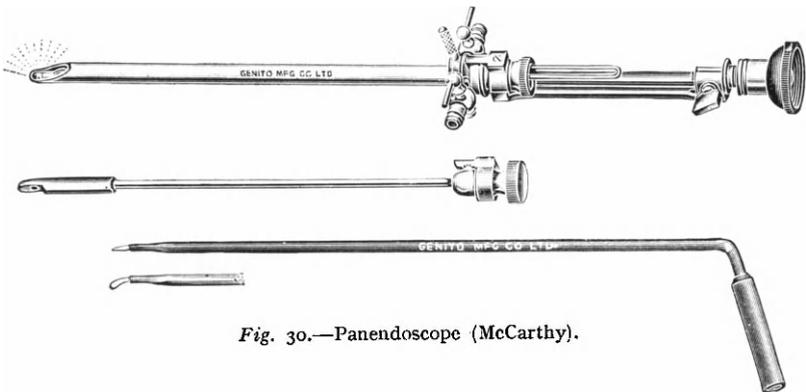


Fig. 30.—Panendoscope (McCarthy).

3. ACCESSORY URETHRAL CANALS

The classification used by Young in his description of these canals is convenient, and, with the exception that he includes amongst them true duplication of the penis and urethra, which has been discussed in the preceding pages, it is utilized in slightly

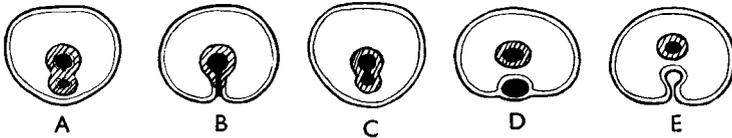


Fig. 31.—The formation of various accessory urethral canals, fistulæ, and cysts (after Mermel). A, Double urethræ; B, Congenital urethral fistulæ; C, Congenital urethral diverticula; D, Dermoid cysts of the raphé; E, Sub-urethral canals and blind fistulæ of the raphé.

modified form here: (a) Accessory canals situated dorsally to the normal urethra (supra-urethral canals); (b) Accessory canals situated ventrally to the normal urethra (sub-urethral canals); (c) Meatal and para-urethral accessory canals; (d) Congenital urethral dilatation. (Fig. 31.)

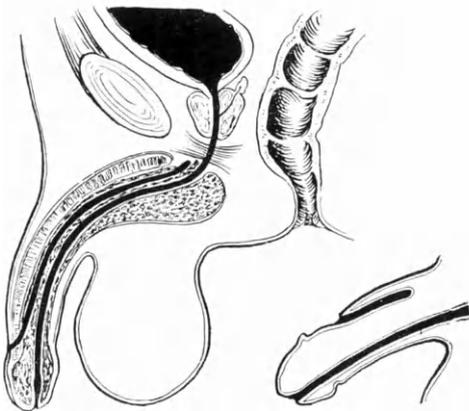


Fig. 32.—Supra-urethral canals.

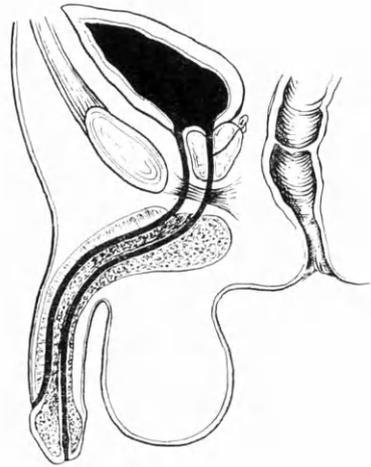


Fig. 33.—A variety of double urethra.

a. Dorsal or Supra-urethral Accessory Canals.—

Anatomy.—The urethra is present and apparently normal in every respect, but an accessory canal is found dorsal to it between the corpora cavernosa (Fig. 32). In its most advanced form the dorsal canal communicates with the bladder and possesses a meatus

on the glans dorsal to the normal opening (Lebrun); this is one variety of the 'double' urethra, which has been studied by de Berne-Lagarde and by Chauvin (*Fig. 33*). More often such a canal has undergone partial obliteration, especially in its intrapelvic course, and is represented there by a solid strand. The majority of the longer canals have been described as terminating blindly at the level of the pelvic diaphragm; one, however, was a continuation of the ejaculatory ducts and is described by Cruveilhier. Their distal opening may be at any point along the dorsum of the penis and occasionally is continued by an epispadiac groove to the glans. Irregularities of obliteration give rise to various sinuses or fistulæ. An extreme rarity is the presence of a channel, blind distally, but communicating with the bladder; it is much more common to find anterior channels opening on to the dorsum of the penis, but ending blindly proximally (Le Fort, Lebrun). When present these canals are usually of irregular calibre and may show a series of dilatations. Lipiodol injection has proved of value in their study. It is of interest to note that when at all developed these accessory canals possess coats similar in every respect to those of a normal urethra. It is usual to exclude from consideration sinuses which are confined to the glans penis, although it is necessary to bear in mind that they may be representative of these canals (*see Fig. 36*).

Ætiology.—Following Le Fort and Oudard and Jean it must be accepted that supra-urethral canals are developed from the urethral anlage by a cranial extension of its epithelium. This later becomes separated from the urethra by the laying down of the corpora cavernosa except in those rare instances when, after a passage of variable length, an opening into the urethra is found. Lebrun and Oudard and Jean consider that they may be explained as resulting from an abnormal prolongation of the urorectal septum which continues the cleavage of the cloaca and its membrane. Some urethral canals are, however, abnormally developed sinuses of Morgagni, and sometimes the sinus of Guérin forms a blind tube which may cause some difficulty in instrumentation.

Symptoms and Treatment.—These canals are symptomless as a rule and then do not require treatment, but sometimes if a communication with the bladder exists, or if infection (usually by the gonococcus) occurs, they are a cause of prolonged or repeated inflammation. Under such circumstances their excision or obliteration should be attempted, bearing in mind that subsequently scarring may interfere with erection.

b. Ventral or Sub-urethral Accessory Canals.—

Anatomy.—These canals lie on the under aspect of the penis, which itself is normal; they have been studied by Lévy and Planson, and by Oudard and Jean. They may be short or long, and the anterior opening may be at any point from the perineum to the meatus, although most commonly situated near the frænulum; at

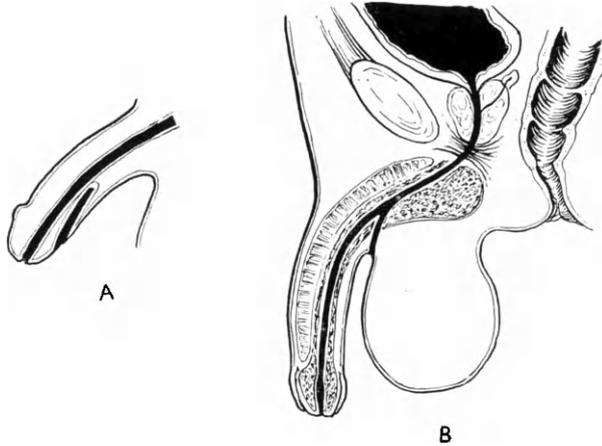


Fig. 34.—A penile sub-urethral canal (A) and a congenital urethral fistula (B).

their posterior extremity they may terminate blindly or open into the urethra, when a congenital urethral fistula exists (Fig. 34). The posterior extremity usually lies anterior to the pelvic diaphragm, but in one recorded case lay proximally to this, between the rectum and prostate.

Aetiology.—The most satisfactory explanation of such an anomaly lies in the assumption that the lips of the primitive urethral opening

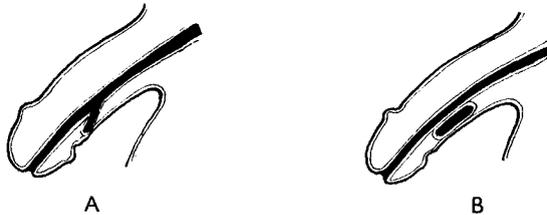


Fig. 35.—A, Blind sub-urethral canal; B, Mucoïd urethral cyst.

have failed to unite in their entirety; this failure may be confined to the ectodermal layer or to the urethral epithelium, or both may be at fault, when a congenital fistula results; Girard has observed

a urethra with four such fistulæ. Ectodermal failure may give rise to dermoid cysts (Englisch, Mermet) or to blind fistulæ of the raphé, urethral failure to blind urethral diverticula (Guyon, Johnson), and to cysts (Ottow) (*Fig. 35*); these are considered later.

Duplication of the urethra at some point is another eventuality. The tracks of these sub-urethral canals are usually easily palpable throughout their course.



Fig. 36.—A suprameatal canal limited to the glans penis and suggesting a supra-urethral canal rather than the meatal pit of a glandular hypospadias.

Treatment.—Treatment is unnecessary except in the presence of infection or when there is a troublesome leakage of urine during micturition. Sinuses of the raphé commonly only become manifest after infection, which is usually of gonococcal origin (Rupel). External fistulæ should be excised, and internal tracts thrown into one with the urethra by incision of the dividing septum.

c. Meatal and Para-urethral Canals.

—These small canals open into the meatus or on to the glans penis and commonly terminate blindly proximally; they have been studied by Churchman. Certain of them may represent vestiges of the canals described above (*Fig. 36*), but the majority do not appear to fall into this category. They are probably the result of developmental defects of the urethral plate, and are often multiple and associated with glandular hypospadias.

d. Urethral Dilatation (Urethrocele).—Primary or congenital dilatation alone is considered here. The dilatation is of either the anterior or posterior urethra, the latter variety being extremely rare. The dilatation may be fusiform, the whole circumference of the urethra being involved (*Fig. 37*), or saccular



Fig. 37.—Fusiform dilatation of the urethra.

(*Fig. 38*), when the dilatation is confined to the inferior wall of the urethra, as a rule just proximal to the glans or in the region

of the bulb (Guyon, Paris and Fournier, Johnson). It has proved difficult to distinguish true congenital dilatation from that acquired later and termed secondary, and no two observers are in agreement as to the numbers of authentic examples recorded in the literature ; it is agreed, however, that to be classified as congenital, obstruction must be absent and the urethra normal both proximal and distal to the dilatation.

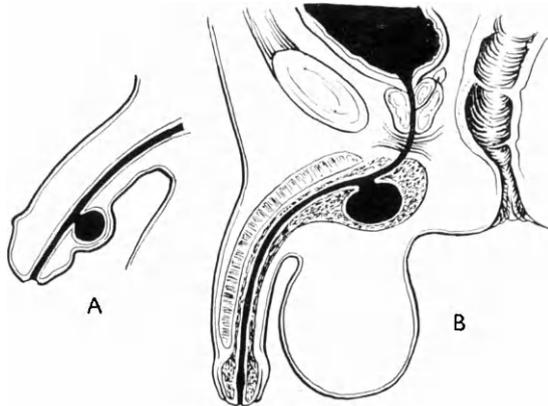


Fig. 38.—Saccular diverticulum of the urethra: (A) of the penile urethra ; (B) in the neighbourhood of the bulb.

Aetiology.—

Anterior urethra: Various theories have been advanced to explain dilatation in this situation, and those which are most satisfactory state that it results from a failure of closure of the epithelium of the primitive urethral opening and groove. Dilatations are therefore of a similar origin to the ventral accessory urethral canals and to hypospadias, but differ from the latter in that ectodermal union has occurred. The most common variety, situated just proximal to the frænulum, is explained by a deficient union of the primitive urinary meatus and the urethral plate gutter. Whilst satisfactorily accounting for the saccular type, with small or large orifice, it must be assumed in the fusiform variety that an abnormal urethral lumen is associated with congenital weakness of the urethral wall.

Posterior urethra: The aetiology of dilatations of the posterior urethra is obscure, largely because of their extreme rarity. One example associated with persistence of the Müllerian ducts has been described, but this is to be regarded as merely a degree of tubular hermaphroditism.

Pathology.—

Anterior urethra: The cavities are lined by urethral mucosa and usually surrounded by compressed erectile tissue, which, however, may become fibrotic or atrophic and even disappear.

Symptoms.—In order that they may not be confused with the acquired variety, it is customary to confine description to those discovered in infancy. Most commonly the parents observe a swelling of the penis which enlarges during micturition, but sometimes dribbling after micturition is noticed first, being due to the slow emptying of the pouch. At other times the symptoms are those of infection or of difficulty in micturition, for the orifice of a saccular diverticulum often projects as a valve and secondarily causes

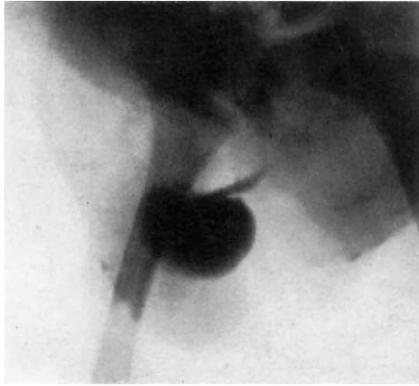


Fig. 39.—Urethrogram of a congenital urethral diverticulum at the peno-scrotal junction; from an infant aged 2 months (Mr. Wilson's case).

obstruction (Legueu). On examination a penile or scrotal tumour of varying shape is found which increases during micturition and which can be diminished by manual expression of the contents. No stricture is to be found and in the saccular form a catheter easily enters the bladder, although in the fusiform type it may lose itself in the cavity and fail to enter the orifice of the proximal urethra. A urethrogram made by the injection of lipiodol will demonstrate the pouch or dilatation (*Fig. 39*).

Complications.—The risk of infection of stagnant urine is always present, and infection may give rise to periurethral suppuration or to urethral calculi. In later life the condition is a cause of sterility, for emission may be delayed until after coitus.

Treatment.—Treatment is considered later with that of the acquired variety.

Congenital Cysts of Cowper's Gland.—Congenital cysts of the bulbo-urethral glands associated with obstruction of their ducts have been found (Elbogen). This author discusses both congenital and acquired cysts, having found examples at all ages. Johnson has reported a large intrascrotal cyst which had probably originated from Cowper's duct.

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CHAPTER IV

MALFORMATIONS OF THE URETHRA AND PENIS :
EPISPADIAS AND HYPOSPADIAS

EPISPADIAS

IN epispadias the urethra possesses an abnormal termination on the superior aspect of the penis. The condition is an extremely rare one, of which Burckhardt collected 60 examples from the literature.

Four anatomical types are described :—

1. Glandular Epispadias.—The urethral orifice is situated at the corona and its lips are prolonged into a gutter over the glans penis. The penis is short, with a flattened glans, and the prepuce is vestigial, its frænular attachment extending to the apex of the glans. Some five examples of this variety are on record.

2. Penile Epispadias.—The orifice is found at some point along the dorsum of the penis and is continued as a mucosal groove to the glans (*Fig. 40*); the pubic rami have united.

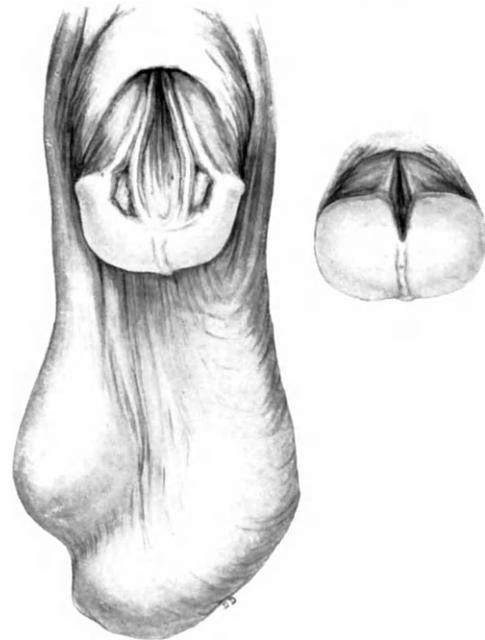


Fig. 40.—Penile epispadias in a patient aged 31 (Mr. Macalpine's case).

3. Subpubic Epispadias.—The urethral orifice is represented by a funnel-shaped opening at the base of the penis, a gutter again

extending from this along the dorsum of the penis. The penis is even more distorted, shorter, and more flattened than in the other varieties, and perhaps exhibits torsion; it is usually turned upwards, concealing the opening (*Fig. 41*).



Fig. 41.—Subpubic epispadias (Mr. Wilson's case).

4. Complete Epispadias.—The condition is in reality one of concealed exstrophy of the bladder. The pubic rami are separated.

Symptoms.—In the glandular and sometimes in the penile varieties, urinary control is present but the stream sprays out and coitus is difficult because of the short penis. In the more advanced forms urinary control is often, though not invariably, deficient, and there is sometimes complete incontinence. Coitus is usually impossible.

TREATMENT

Numerous operative sittings are required. First a perineal urethrostomy is established, when this is possible (Thompson); secondly, the penis is freed from the adhesions which bind it to the pubic region; thirdly, a new urethral canal is formed by one of various methods; and, fourthly, this canal is united to the abnormal urethral opening and trimming of the prepuce *que pend lamentable et disgracieux* is carried out. The formation of the urethral canal, if sufficient tissue is present, may be attempted by the method of Thiersch or Duplay as for hypospadias: if not, Nové-Josserand's

technique for hypospadias is utilized, or the Cantwell-Young operation performed, in which the new urethra is displaced between the corpora cavernosa to the inferior aspect of the penis. Reasonable success is obtained by operation in patients who possess partial or complete urinary control. In the incontinent a variety of procedures have been recommended (Young, Thompson), but it is questionable whether they are justified by the results, although, *mirabile dictu*, control is sometimes regained after minor operations which have in no way affected the sphincters. Barney utilizes the long prepuce which hangs inferiorly: it is buttonholed transversely near the frænulum, the opening being made sufficiently large for the glans to pass through; the glans is passed through it, and after freshening of its edges, the margin of the prepuce is joined to the fold of skin on the pubes over the base of the penis. The penis is at the same time freed, the result being an improvement in appearance and position. Cabot prefers ureteral transplantation to plastic operations on the penis in these incontinent patients.

Cantwell-Young Operation.—The operation is performed at from 7 to 10 years of age. The various stages are as follows:—

1. A perineal urethrostomy is established; the finger is pushed down from within the bladder and is cut down upon in the perineum, a tube being inserted.

2. Two parallel incisions are made along the dorsum of the penis from the apex of the glans to the symphysis; these are united transversely to one another anteriorly and also posteriorly behind the abnormal orifice. The strip of tissue between these incisions must be of sufficient width to form a urethra when its edges are sutured together.

3. *Cantwell's method*: the whole flap outlined in the previous stage is raised from the glans back to the urethral opening. The corpora cavernosa are separated from one another by blunt dissection—a simple procedure in the epispadiac, although impossible in the normal subject. The urethral flap is placed in this deep gutter between the corpora and held there by sutures which pass through the skin of the under aspect of the penis. A catheter is now laid in the gutter and the margins of the flap are sutured about it; the corpora cavernosa are then united dorsal to this, and the skin can usually be approximated over them; if not, the prepuce may be utilized as a graft (Barney). The catheter is retained for several days.

Young's method (Fig. 42): The incision on the right side is deepened, and the corpora cavernosa exposed and separated as above. The left corpus cavernosum, which bears the still attached gutter, is further mobilized and rotated so that the urethral flap occupies

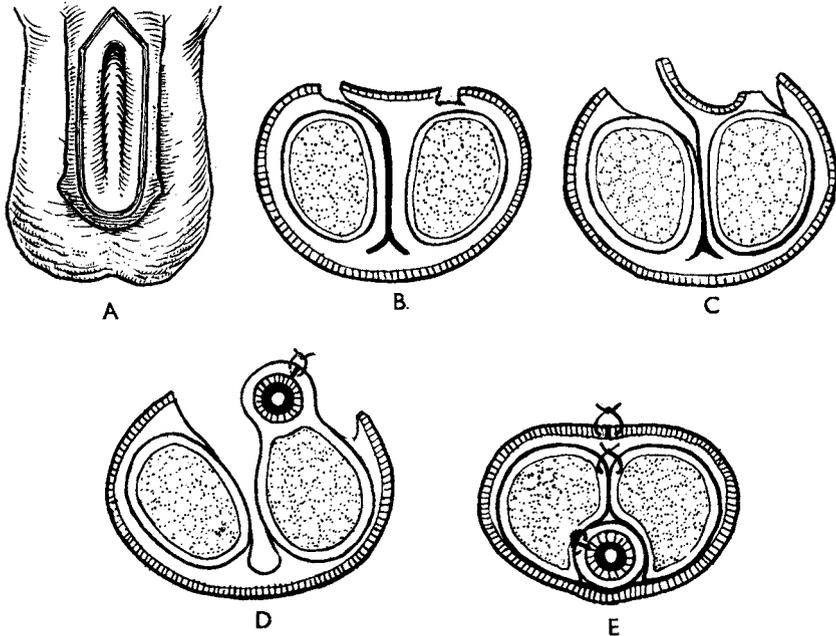


Fig. 42.—Young's operation for epispadias. A, Outline of the incisions; B, The incision in a coronal section; C, Raising the flap; D, Formation of the urethra about a catheter; E, Rotation of the corpus which bears the urethra and suture of the urethra in the cleft below the corpora cavernosa.

the cleft and the gutter is transformed into a canal by suture about a catheter. The corpora are then brought together and sutured on the dorsal aspect. Perineal drainage is maintained for about ten days.

It is stated that a better blood-supply to the graft is ensured by Young's method.

HYPOSPADIAS

The defect consists of an abnormal termination to the urethra, the external orifice of which lies at some point on the caudal aspect of the normal course of the anterior urethra; there is a hereditary element associated with this malformation. It is the commonest

urethral defect found, and it is associated with various penile and, at times, scrotal malformations. Mowry, examining 1000 recruits, found hypospadias of some degree in 2 per cent. Urinary control is always present because the posterior urethra and the sphincters are normal. For descriptive purposes hypospadias is divided into several types according to the anatomical situation of the abnormal orifice. Fowler states that eleven varieties have been described, but here four groups will be discussed: (1) Glandular; (2) Penile; (3) Scrotal; (4) Perineal.

1. Glandular Hypospadias (*Fig. 43*).—The abnormal opening is situated on the glans penis at any point between the site of the



Fig. 43.—Glandular hypospadias. A gutter continues to the normal site of the meatus.

normal meatus and the corona. This is the commonest and least marked variety of the deformity; in a series of 150 men it was found in 4 per cent. There may be merely a ventral extension of the normal meatus, and the inferior wall of the terminal urethra is then made up of a thin mucocutaneous fold; or the urethra may open at the base of the glans and be prolonged as a cleft-like gutter to the normal site of the meatus; the gutter and meatus may be lacking, or the latter may exist as a blind pocket. Sometimes multiple openings are present. The glans penis is always somewhat broadened and flattened and the frænulum absent, whilst the prepuce is hood-like and usually redundant. The abnormal opening is often concealed by a fold of skin. It is unusual to find any other local malformation.

Aetiology.—The condition results from a failure in the development of the urethral plate which should form the glandular portion of the urethral canal; this is either completely lacking, when the primitive meatus persists at the base of the glans, or its gutter has formed but has failed to close, either completely or in part.

2. Penile Hypospadias (*Fig. 44*).—The abnormal opening is situated at some point on the inferior surface of the penis between the glans and penoscrotal junction. The orifice, which is in some instances stenosed, may be slit-like or rounded, or it may be U-shaped, when its lips are sometimes continued as a mucosal groove along the under aspect of the penis. The meatus may be present as a blind pit or may be absent; sometimes the urethra distal to the orifice is formed but may be imperforate or only partially canalized. The penis as a rule is flexed and bound down by adhesions in the median plane ('webbed penis'). The glans and prepuce are always deformed, as in the glandular type.

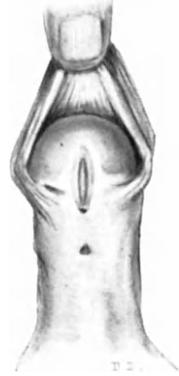


Fig. 44.—Penile hypospadias. The urethral orifice is situated about midway between the glans penis and scrotum. A cleft represents the glandular urethra.

Aetiology.—This and the following varieties are the results of a failure of union of the lips of the primitive urogenital fissure.

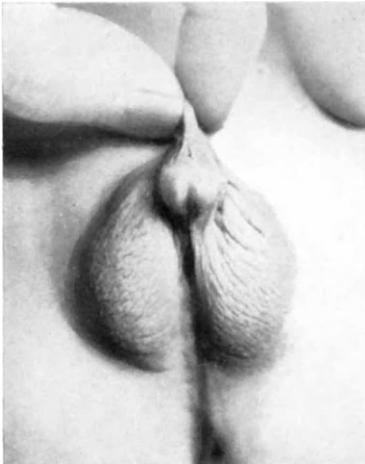


Fig. 45.—Scrotal hypospadias. The scrotum is cleft and the penis bound down (Mr. Wilson's case).

3. Scrotal Hypospadias (*Fig. 45*).—The orifice is in the path of the perineoscrotal urethra and the scrotum is cleft, partially if the opening lies near the penoscrotal junction, completely if more posteriorly. The urethra may or may not be continued as a gutter to the glans. There are always marked abnormalities of the penis, which is flexed, often bound down by adhesions, and sometimes hypoplastic. The glans and prepuce again are malformed.

4. Perineal Hypospadias.—The posterior urethra alone is

normal, the anterior urethra being absent; the abnormal orifice is situated in the perineum posterior to the scrotum which is cleft and bifid. The penis and glans are hypoplastic and bound down in the scrotal cleft by adhesions; at times the testes are undescended and then a condition of pseudo-hermaphroditism exists, the appearance of the external genitalia being 'vulviform', and the labia minora simulated by the lips of the urethral gutter.

Symptoms.—Hypospadias may give rise to urinary and sexual dysfunction.

Urinary.—When the abnormal orifice is situated proximally to the glans, projection of the stream during micturition becomes difficult, and this is the more marked the further posteriorly the opening lies, becoming accentuated if any contraction exists. The patient, therefore, may be obliged to squat in order to micturate and to avoid soiling. Incontinence is never present as the posterior urethra and sphincters are intact.

Sexual.—In glandular hypospadias no inconvenience may arise, and even the penile variety may not hinder fertility (Australian aborigine quoted by T. Walker), but when the orifice is placed far back, ejaculation occurs outside the vagina and sterility ensues. Furthermore the curved penis and the adhesions so frequently present may render coitus impossible. It is said that gonorrhœal infection occurs more readily by the abnormal opening than by the normal. These patients are often extremely sensitive about their condition and tend to become neurasthenic and sometimes even suicidal.

Diagnosis.—No difficulty should exist in diagnosis, the history and the appearance of the penis, prepuce, and scrotum sufficing to differentiate the condition from acquired fistulæ. The only difficulty which may arise is that of the determination of the sex in a pseudo-hermaphrodite.

TREATMENT

GENERAL PRINCIPLES

Many ingenious operations have been devised for the cure of the various types of hypospadias. A number are now in desuetude, but certain of these remain of importance, either because the plastic surgery of urethral defects is based upon them or because of their suitability for the exceptional case. Operations believed to be the best for routine use will be described, and also those in occasional employment which either illustrate principles of value or meet unusual cases.

Treatment of glandular hypospadias is unnecessary, except for such attention as is required for a contracted orifice. The treatment of other varieties necessitates plastic operations, and each type requires one or more special procedures suited to it. The surgeon must not expect to attain a successful result at the first attempt, and usually a series of operations are needed; nevertheless attempts to remedy a marked hypospadias are always justifiable. In general three operative procedures are successively executed: The flexed penis is straightened and adhesions are divided; a urethral canal is created; the new canal is united to the urethral opening, if such a step is necessary.

At the preliminary operation, when the penis is, if necessary, being freed from adhesions, a series of transverse incisions are made

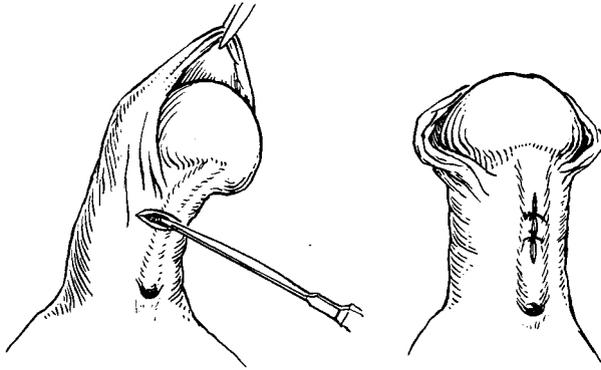


Fig. 46.—Correcting curvature of the penis as a preliminary to operation for hypospadias (after Marion).

which divide the fibrous tissue on the under aspect of the penis (Fig. 46). The organ is then straightened and maintained thus against the anterior abdominal wall, the incisions being sutured in the vertical direction. A repetition of this procedure may be required, and it may prove necessary to divide the tunica albuginea and even to dissect up and free the urethra if it is a cause of flexion. Straightening of the penis must precede secondary operations by some considerable period, and should be performed before the age of two years.

Secondary operations for the constitution of a urethra vary with the site of the abnormal meatus.

1. Glandular Hypospadias.—If operation is desired the operations recommended are those of Ombredanne and Mathieu; alternatively Beck's, Bevan's, or Duplay's methods may be used,

or the prepuce may be utilized in a variety of ways to form the urethra (Russell).

2. Penile Hypospadias.—When the urethral orifice is distal to a non-bifid scrotum the operation of Bucknall, with the addition of Winsbury-White's modification, is probably the method of choice, alternatives being the methods of Thiersch, Edmunds, and Ombrédanne. The procedures of Nové-Josserand and Nové-Josserand-Rochet can be utilized. Recently McIndoe has modified the Nové-Josserand tunnelling operation and applied the Esser inlay-graft method to it; he has limited the procedure to adults. In these operations, and in those to be described later, it is almost essential for success that a preliminary perineal urethrostomy or suprapubic cystostomy should be established; the latter is to be preferred. The exceptions to this rule will be indicated.

3, 4. Scrotal and Perineal Hypospadias.—The methods which may be adopted are those of Thiersch, originally devised for epispadias and resembling the operation of Guyon for fistula, of Ombrédanne, Duplay, and Nové-Josserand, and also Cantas's modification of Tanton's venous graft, which is described by Legueu. The Thiersch operation is to be preferred. After urethral repair the scrotal halves are united.

In these operations it is essential to utilize the principles of Duplay, who showed that the linear approximation of flaps is insufficient, and that to avoid failure surface contact must be maintained. Cabot, Walters, and Counseller recommend the Ombrédanne technique for glandular hypospadias and for the lesser degrees of penile hypospadias. Legueu employed the Hacker-Beck operation for the former and Nové-Josserand's method or the venous graft for other types, preferring these to Rochet's modification of the Nové-Josserand method because the hair-follicles present in a whole-skin graft are avoided. He operated for glandular hypospadias at from two to three years of age, and for other varieties between the seventh and eighth years, when the child is sufficiently docile and before erections have become troublesome. Cabot, Walters, and Counseller remedy deformity between one and two years and create the urethra about the sixth year. Marion prefers to retain Duplay's method, as does Edmunds, and Young has in the main employed this technique. Cecil advocates the Thiersch operation, and Cabot, Walters, and Counseller also believe that this technique is the best for all save the lesser degrees of hypospadias.

OPERATIVE TECHNIQUE

I. Glandular Hyospadias and Lesser Degrees of Penile Hyospadias.—

POUCH OPERATION OF OMBRÉDANNE (Penile Hyospadias).—The operation comprises three procedures performed in series and at intervals. At the first or preliminary stage the penis, if it is deformed, is straightened; indeed this step is an essential preliminary to any type of operation for hyospadias. The second stage is the operation proper, and consists of the formation of the pouch which continues the urethra to the glans penis. At the third stage the meatus is advanced and measures are taken to improve the cosmetic appearance.

Preliminary Operation.—One or more transverse incisions are made on the under aspect of the deformed penis so that all adhesions and fibrous bands producing flexion are divided. As a rule it is necessary to expose the corpora cavernosa and to liberate the hyospadiac orifice; if necessary the tunica of the corpora is incised. The penis then is hyperextended forcibly and the wounds are sutured in the vertical direction, one result being that the urethral orifice shrinks backwards. The sutures may be removed in about twelve days. During healing the penis is maintained erect against the anterior abdominal wall and hyperextension must be continued until all tendency to recurrence of the deformity has vanished—this usually takes from two to four months.

Formation of the Urethral Pouch (Fig. 47).—The first step of this stage is the insertion of a purse-string suture of linen thread. It begins in the midline on the under surface of the penis at a point which is the same distance posterior to the urethral orifice as that opening is behind the tip of the glans. It passes up beneath the penile integument and then beneath the epithelium of the glans to its apex, after which it retraces its path on the opposite side to the starting-point. The area between its ascending and descending limbs should be equal in breadth to one-third of the circumference of the penis. After the suture has been inserted an incision is made 1.5 mm. external to it, which parallels the penile course of the suture but bifurcates on reaching the level of the corona on either side. Each lateral branch continues up to the corresponding lateral angle of the outstretched prepuce, whilst each medial branch passes across the glandular surface of the prepuce 2 mm. from the corona to join

its fellow of the opposite side. On the prepuce the inner leaf of the prepuce alone is divided, the incision being made of just sufficient depth to effect this.

On the penis the flap proximal to the urethral orifice is dissected up as far as the opening; care is necessary and the insertion of a catheter helps to avoid damage to the urethra. Distal to the urethra

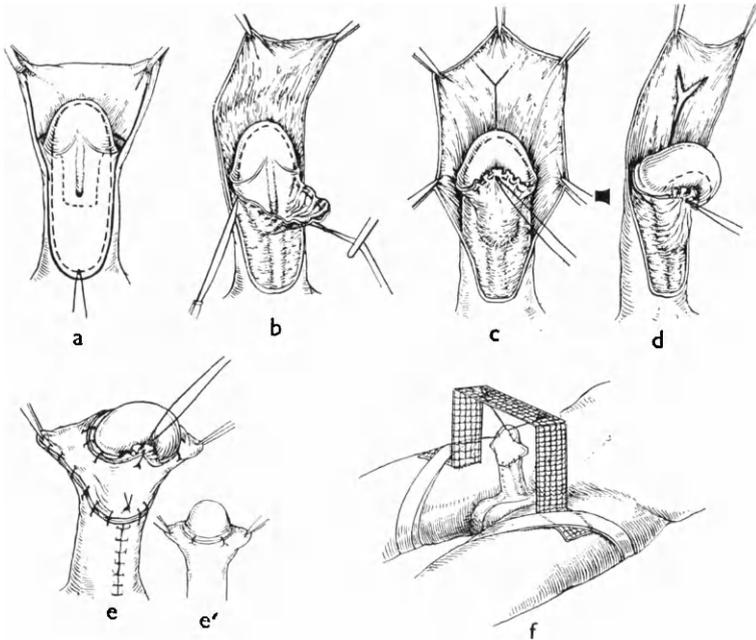


Fig. 47.—The various steps in Ombrédanne's pouch operation for hypospadias. *a*, The line of incision is indicated by an unbroken line, the purse-string suture by a dotted line, and the area near to the urethral opening, which must remain undisturbed, by a lightly dotted line. *b*, The incision has been made, the prepuce spread into a single layer, the flap dissected up from the penis and partially gathered by the purse-string suture. *c*, The Y incision of the prepuce is outlined. *d*, The Y incision has been made. *e*, The glans and purse-string suture have been passed through the Y incision. The prepuce covers the distal portion of the raw area of the penis. The inset (*e'*) shows the appearances from the dorsum. *f*, Method of suspension of the penis at the completion of the first stage.

the edges of the area marked out are freed to a small extent in the medial direction, but the central area equal in breadth to one-quarter the circumference of the penis is left adherent and undisturbed. Attention is directed now to the prepuce; its inner layer is dissected up, freed, and turned distally as a flap hinged at the free margin of the prepuce. The next step is the tightening of the purse-string

suture so that the penile flap is drawn up towards the glans as a sac. Sufficient space for micturition is left.

The operation is continued by the manufacture of a Y-shaped buttonhole in the preputial flap. The vertical limb of the Y begins in the midline at the level of the collar left about the glans; its limbs diverge distally. The opening is of sufficient size to admit the glans penis. An avascular area is selected and any visible vessels should be displaced by pressure before the skin surface of the prepuce is incised. On completion of the opening the glans is passed through it, together with the ends of the purse-string suture, and this suture is then tied. The divergent limbs of the Y-shaped incision are sutured on either side to the margins of the opening of the sac, and, the shoulders being pulled laterally by means of tissue forceps, two sutures are inserted on the dorsum between the collar attached to the glans and the cut edge of the prepuce which has been drawn over it. The preputial flap serves to cover the raw surface of the sac and the distal portion of the bed from which it came; proximally the exposed area on the penis is covered by suture of the penile integuments from either side across the raw area. The skin edges of the penile and preputial flaps are then sutured together, and in the median plane a mattress suture closes the gap at the point where the transverse and vertical suture lines meet.

On completion of this stage the penis is suspended from a cage placed across the thighs and gentle extension is maintained for four or five days. Dressings are unnecessary, and after each micturition it suffices to dust the wounds with powder. Excessive œdema of the penis is treated by puncture at several points and the application of adrenaline. Small areas of the flaps may slough at different sites, but this is a matter of no great moment.

Third Stage (Fig. 48).—After some four months the final stage is undertaken. It is termed by Ombrédanne the union of the 'tubercle' to the glans. The 'tubercle' consists of the mound of tissue which has been gathered up immediately proximal to the orifice of the pouch as the result of the preceding stage. Two tissue forceps are applied, the one to the tip of the glans penis and the other to the tubercle. Tension upon these in opposite directions causes the sac mouth to gape like a fledgling's beak. The cutaneous surface of its inferior aspect is inspected and, if hair-bearing, is excised with fine curved scissors; the mucosa of the roof always suffices to complete the canal. Curved incisions, convex laterally, are made

from forceps to forceps on either side of a median area which includes the pouch orifice and an oval strip of tissue five to six millimetres in width. Lateral to each incision a raw surface three to four millimetres in thickness is bared by excision of the covering epithelium. On the glans care is taken that the mucosa alone is removed. There remain on either side of the urethral opening two raw strips; the tubercle is brought up to the glans so that each

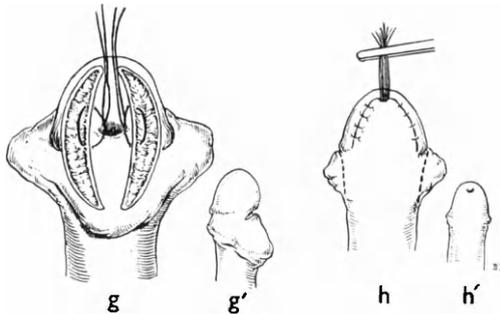


Fig. 48.—The final stage of Ombrédanne's operation. *g*, Curved raw areas have been prepared on the 'tubercle' and glans. The first sutures have been inserted. The inset (*g'*) shows the appearance before the final stage is begun. *h*, The final sutures and lines of incision for removal of the lateral ears. Inset is the completed operation (*h'*).

raw area is folded at its midpoint and the distal and proximal halves of both come into contact. They are sutured thus: The ends of the inner layer of catgut sutures are brought out through the new meatus, whilst the external non-absorbable sutures are placed so as to include a bite of three-quarters of the denuded surface, thus obtaining surface apposition, and are tied as in repair of the cervix. Finally the ears of tissue which project on either side are excised, care being taken that the urethral pouch is not entered.

Comments.—The age of choice at which to operate is stated to be from the sixth to the eighth year. Diversion of the urine is unnecessary. The operation as described serves for both glandular and penile hypospadias; with the former the prepuce serves to cover the whole of the bed from which the pouch is taken. Should the tubercle be deficient at the third stage as the result of sloughing, it is lengthened by making a transverse incision proximal to it and then suturing this in the vertical direction. The operation can be employed for perineal hypospadias when two or even three pouches are formed in succession.

MATHIEU'S OPERATION (*Fig. 49*).—This operation is simple and in the hands of its author has given good results. The technique appears in the accompanying diagrams, which are adapted from those of an article by Mathieu. He insists that the base of the flap must be wide, for on it the blood-supply depends, and it should be only slightly longer than the area to be covered since it is extensible.

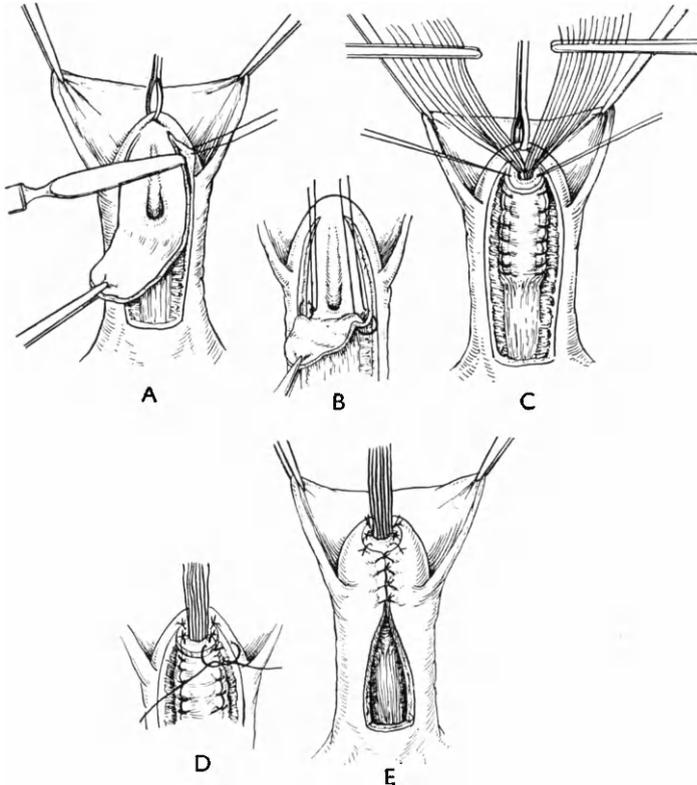


Fig. 49.—The stages of Mathieu's operation. **A**, Formation of the flap; **B**, The first sutures; **C**, The first layer of sutures completed; **D**, Suture of the meatus; **E**, Burying the first suture layer and closure of the flap bed.

It should be as thick as possible without endangering the urethra, and the incisions on the glans penis should be just of sufficient depth to enable suturing to be performed satisfactorily. The sutures are of fine silk; those within the urethra separate about the fifteenth day. The operation can be used for the lesser degrees of penile hypospadias as well as for glandular defects; it avoids, like that of

Ombredanne, the necessity of making a union between the urethra and the new canal.

BEVAN'S OPERATION.—The technique of this operation is apparent from a study of the accompanying illustrations (*Fig. 50*).

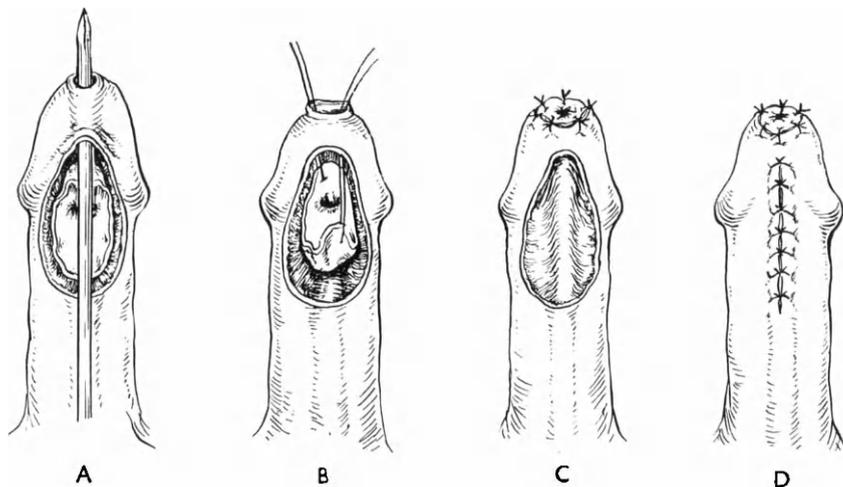


Fig. 50.—The steps of Bevan's operation. **A**, The flap is outlined and the glans tunnelled; **B**, The flap is raised and sutures pass from it through the glandular tunnel; **C**, The flap has been drawn through the tunnel and sutured to the margin of the opening on the glans penis; **D**, The raw area is obliterated by suture.

2. Operations for Penile Hypospadias.—

BUCKNALL'S OPERATION (*Fig. 51*).—This operation is to be recommended more particularly when the abnormal orifice is situated at the penoscrotal junction, but can be adapted to penile and even glandular defects (Leveuf and Godard). The procedure is designed so that at the first stage the penis is attached to the scrotum in order that, at the second, when the penis is freed, it may carry with it a continuation of the urethral canal formed by the mucosal groove and a longitudinal strip of scrotal skin. The operation, like those of Ombredanne and Mathieu, therefore avoids the final and often most troublesome step of other methods—namely, the union of the urethral orifice to the newly formed canal.

Preliminary steps include the division of penile adhesions and the straightening of the penis. At the first stage of the operation proper two parallel incisions are made on the under surface of the penis from the base of the glans to the urethral orifice; they enclose

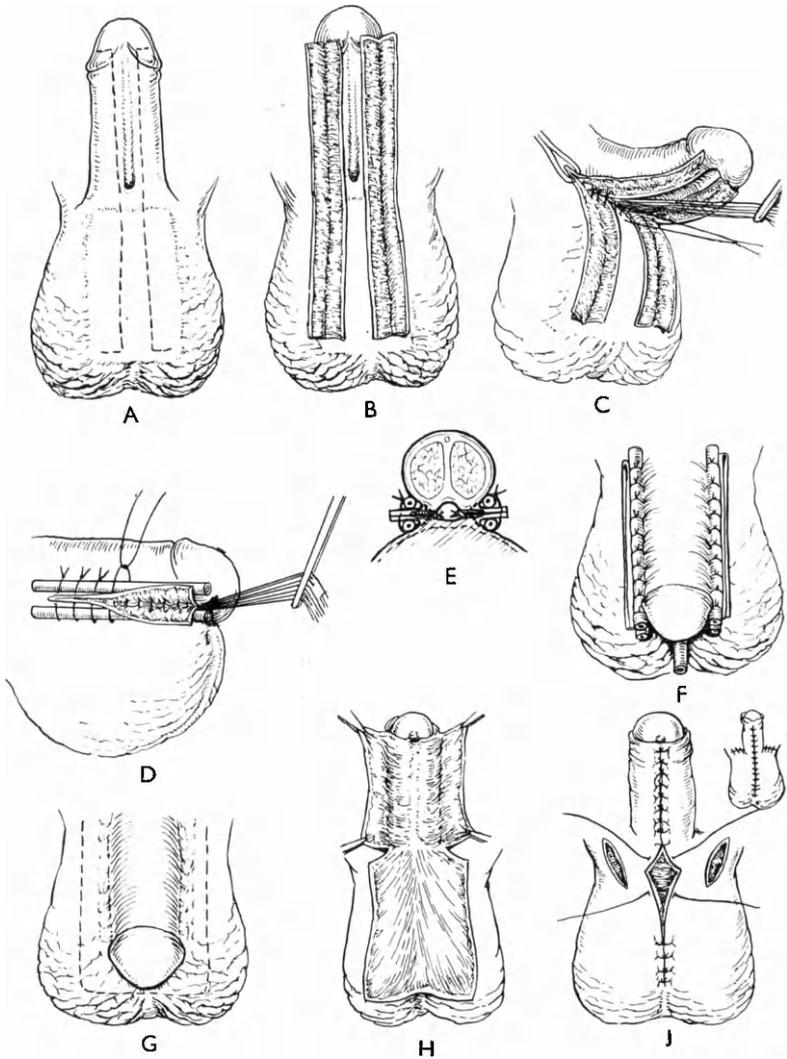


Fig. 51.—The steps of Bucknall's operation. **A**, The incisions are outlined. The prepuce is illustrated as transplanted to the scrotum (Winsbury-White). **B**, The flaps are raised laterally. **C**, Method of suture (Leveuf and Godard). **D**, Suturing of the flaps. **E**, The completed suture line seen in coronal section. **F**, The appearance at the completion of the first stage (the sutures emerging from the meatus have been omitted). **G**, Outline of incisions for freeing the penis and new urethra. **H**, Commencement of the second stage. The penis has been freed together with lateral flaps from the scrotum. **I**, Suturing is almost complete. Lateral incisions relieve tension and are sutured transversely.

the mucosal gutter, if it is present, and are sufficiently far apart to provide a roof for the future urethra. They are continued over the antero-inferior surface of the scrotum parallel to the median plane, and are rather farther apart and extend for a greater distance than they do on the penis so as to allow for subsequent shrinkage of the scrotal skin. The area between them is the future urethral floor. Lateral incisions are made outwards now at either extremity of each of these incisions and skin-flaps are dissected up laterally. There is then an isolated median strip of skin occupying the longitudinal axis of the under aspect of the penis, reaching the urethral opening, and continued beyond it by a similar and rather wider and longer median scrotal strip. Lateral to these on either side is a parallel raw area, and lateral to each of these raw areas are parallel flaps of skin.

A rubber catheter is now passed through the urethral orifice and the penis is placed with its under aspect in contact with the scrotum, the catheter intervening. Each corresponding penile and scrotal raw area is thus in contact, and, similarly, their lateral skin-flaps lie in apposition; this position is maintained by suturing the corresponding penile and scrotal skin-flaps together, raw surface to raw surface. Some additional sutures aid in maintaining contact between penis and scrotum, and the catheter is securely held by a suture which passes through it and the glans penis. The sutures may be removed at the end of a week, and when the wounds are healed satisfactorily, the second stage is undertaken and the penis is freed.

Parallel incisions are made in the scrotum on either side of the attached penis and three-quarters of an inch from it; they commence at the base of the scrotum to end at the level of the corona, where a transverse incision unites them. The flaps marked out are dissected up, and the penis, together with the flaps, freed. Finally the flaps are folded round the under aspect of the penis, so as to cover the exposed raw area on its under surface, and are sutured together, whilst another series of sutures closes the median scrotal wound. The urethral canal, therefore, has been extended to the base of the glans penis by a tube the roof of which is formed by penile skin, and, very probably, by mucosa of the urethral gutter, and the floor by scrotal skin.

Comments.—Cabot, Walters, and Counseller find that the one weakness of Bucknall's operation is the possibility of the growth of

hairs from the transplanted portion of scrotum. Winsbury-White overcomes this risk by a preliminary operation at which he grafts the prepuce mucosa outwards to the median plane of the scrotum. The manner in which the operation can be adapted to lesser defects is illustrated in a figure taken from Leveuf and Godard (*Fig. 52*); their manner of suture of the penoscrotal flaps, which improves

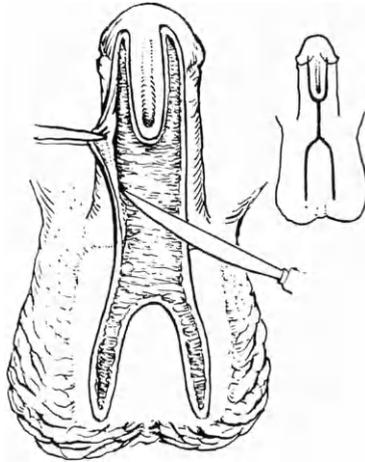


Fig. 52.—The operation of Bucknall applied to lesser degrees of hypospadias (Leveuf and Godard).

on that of Bucknall, is seen in the illustrations (*Fig. 51, C*). An instructive review of the methods which utilize scrotal flaps in urethroplasty has been made by Godard.

THE THIERSCH OPERATION.—Cecil has modified and applied to hypospadias the Thiersch operation which was devised originally for epispadias. The steps of the operation are shown in the accompanying diagrams (*Fig. 53*). It is a method utilized by Cabot, Walters, and Counseller.

3, 4. Perineal and Scrotal Hypospadias.—

DUPLAY'S OPERATION (*Fig. 54*).—This procedure is applicable to almost all varieties of hypospadias, and in the scrotal and perineal type is only rivalled by Cecil's modification of the Thiersch method.

The preliminary step again is the freeing and straightening of the penis, and often a series of transverse incisions in ladder form is necessary. The penis is maintained erect against the anterior abdominal wall during healing, and nothing further is undertaken

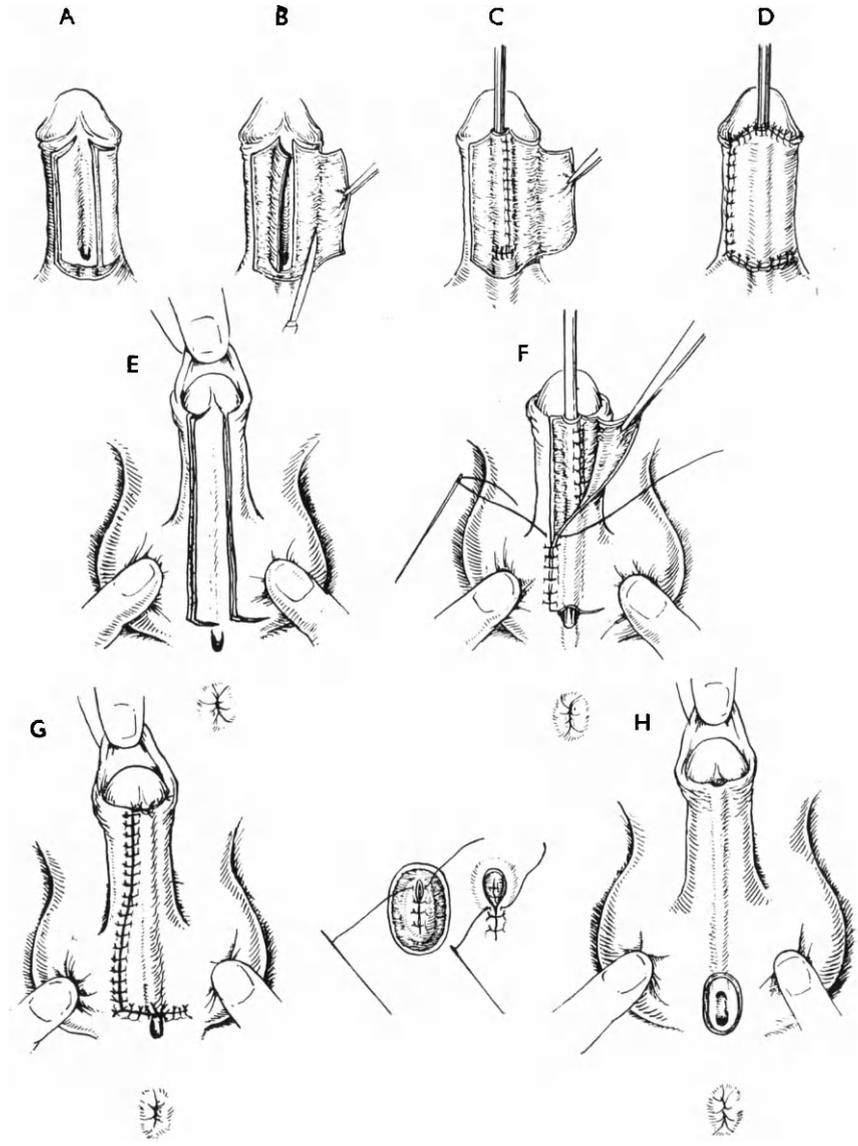


Fig. 53.—The Thiersch operation (after Cecil).
Penile Hypospadias.—A, The flaps outlined; B, The flaps raised; C, Completed suture of the urethra; D, Covering skin-flap sutured.
Perineal Hypospadias.—E, The incisions for the flaps; F, The urethra is formed, suture of the covering flap; G, Suture of the flaps completed; H, Union of the new canal to the urethral opening. *Inset:* After enclosure by an elliptical incision the defect is sutured in layers.

until the object of this stage has been satisfactorily achieved. At the second stage, the penis being held vertically, two parallel incisions are made on either side of the median line of its under aspect and 4 mm. from it; they extend from the apex of the glans to the urethral opening. The distance between them (8 mm.) is increased in older patients. From the extremities of these incisions transverse incisions

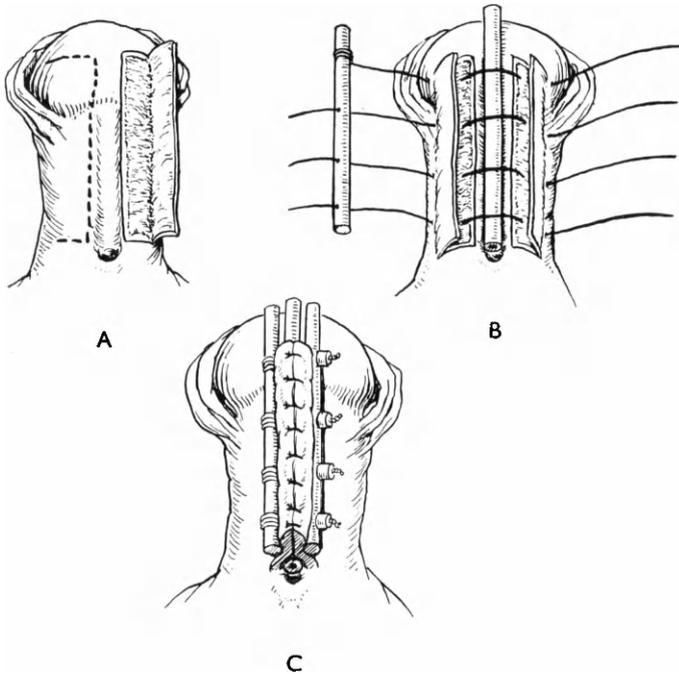


Fig. 54.—Duplay's operation (after Marion). A, The flap on the right side is outlined, that on the left side has been freed; B, Insertion of the first sutures; C, Completion of suturing, with splints in position.

pass laterally for approximately 0.5 to 1 cm. The lateral longitudinal skin-flaps are then dissected up; on the penis they consist of whole skin, but on the glans of epithelium with a thin layer of cavernous tissue. Suturing is now carried out, and to be successful must follow a strict routine, as ordinary methods inevitably fail. The union of the flaps must be accurate, and the silver wire sutures used must be limited to the flaps, otherwise, if encroaching on the penis, they tear out during erection. Using a fine needle each suture traverses the base of one lateral flap, courses beneath the raw area, and emerges from this surface at a distance of 1 mm. from the medial

cut edge, crosses to the opposite side, and pursues a symmetrical course. The sutures are spaced so as to correspond with perforations in lateral lead splints. After their insertion a portion of a catheter pierced for drainage purposes is introduced beneath the sutures, and then the sutures are passed through the perforations in the side splints. On the one side they are fixed by a number of turns about the splint; on the other, Galli's tubes are placed on the sutures, which are then drawn sufficiently tight to bring the raw surfaces of the flaps into apposition over their whole extent, and on each suture the Galli's tube is crushed with forceps in order to anchor it. A few fine superficial sutures unite the margins of the flaps. The sutures of one side are cut on the eighth day, which allows their removal, together with both splints. Antiseptic dressings are still needed for some days, and if the patient is an adult it may be wise to forbid sleep for one or two nights in order to prevent erections.

The next stage is the establishment of a suprapubic cystostomy, which is infinitely preferable to the indwelling catheter. Not less than two months later the new canal is united to the urethral opening. The urethral orifice, together with that of the new canal, is surrounded by an elliptical incision which is prolonged proximally and distally in the midline for about 1 cm. in either direction; lateral transverse incisions at the extremities of these prolongations permit of the formation of lateral flaps, which are sutured together over splints exactly as described above. When union is complete the cystostomy is permitted to close, an indwelling catheter being avoided. Small urethral fistulæ often remain and require closure, but only at a later date.

EDMUNDS'S PRELIMINARY OPERATION FOR DUPLAY'S METHOD (*Fig. 55*).—Edmunds prefers to operate at 4 years of age. He divides the operation into three stages, allowing three months to elapse between the stages.

At the first stage a transverse buttonhole is made through the dorsum of the hood-like prepuce; it is approximately 1 cm. across and 1 mm. from the corona. The margins of the hole are sewn exactly as for a buttonhole. If the urethral opening is stenosed it is slit up at this time.

At the second stage the penis is freed and straightened, and in the process the urethra is dissected up and permitted to shrink backwards. The prepuce is slit in the mid-dorsal line to the buttonhole, and two wing-like lateral projections result. The incision utilized

to dissect up the urethra is prolonged to the region of the frænulum and here divides to encircle the prepuce partially, reaching the mid-point of each lateral projection and from thence being carried outwards into each flap; the skin only is divided. An irregular lateral

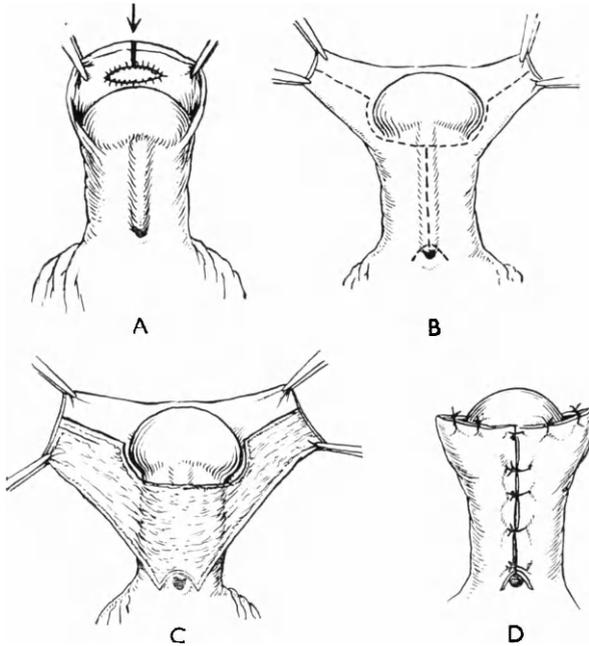


Fig. 55.—Edmunds's operation. A, The buttonholed prepuce—its incision is indicated. B, After incision of the buttonhole, the subsequent incisions are marked out. C, The urethra has been dissected up. The incisions shown in (B) have been opened up. D, The flaps sutured across the raw surface.

flap then extends down each side of the penis, and by means of some blunt dissection is easily freed sufficiently to cover the raw area left when freeing the penis and dissecting up the urethra. The margins of these flaps are stitched together in the midline, the first suture being inserted posteriorly and including the margin of the urethral opening; suturing proceeds until the apex of the glans is reached.

Three months later the third stage, which is a modified Duplay's operation, is undertaken. The manner in which this stage is executed differs in several details from that already described here. A catheter is introduced for two or three inches and fixed so as to lie along the future penile course of the urethra. The incisions on either side are continued back to include the urethral opening and meet behind

it; one is made rather farther from the catheter than the other, so that the line of urethral suture will not fall in the midline and will not correspond exactly with the line of skin sutures. Moreover, a layer of urethral sutures is employed and its knots are made to lie inside, whilst surface apposition of the covering skin-flaps is obtained by the use of interrupted vertical mattress sutures (*Fig. 56*). All sutures are of the finest gauge obtainable. At this stage, therefore, the urethra is continued into the new canal, the method of suturing is improved, and splinting is omitted.



Fig. 56.—The inverted mattress suture, giving flap apposition.

Comments.—Cabot, Walters, and Counseller find the first stages of this procedure most valuable as an initial step to subsequent plastic operations on the penis, because, in addition to the provision of tissue, it remedies deformity efficaciously. They operate between the ages of one and two years. An operation on similar lines and with a similar object has been devised by Browne. It will be observed that Ombrédanne makes use of the prepuce in rather like manner.

SUMMARY

In these plastic operations upon the penis and urethra the principles of Duplay must be respected. The operations are complicated and delicate procedures needing several stages for their completion, and they often require additional and accessory operations as success is attained only rarely at the first attempt. The Duplay method itself has been in use for many years; it is, however, tedious and uncertain in its results, and fistulæ needing repair are the rule rather than the exception, whilst at times there is insufficient penile tissue to provide a canal of the required calibre, even when the prepuce is utilized as by Edmunds.

The operations of Ombrédanne and Mathieu are to be recommended for glandular defects and the lesser degrees of penile hypospadias. Major penile defects, including penoscrotal hypospadias, are remedied best by Bucknall's operation with Winsbury-White's addition. Marked hypospadias associated with a cleft

scrotum requires treatment by the Thiersch method (Cecil). Edmunds's operation is a most satisfactory preliminary procedure to the Thiersch and Duplay operations.

Diversion of the urine is a necessity in many patients. A point of technique in the establishment of a perineal urethrostomy has been emphasized by Young. It is customary to introduce a sound into the hypospadiac orifice and to cut down upon it in the perineum. Young, before making the incision, encircles the urethra and sound with a suture so that the urethra may be occluded distal to the urethrostomy and urine prevented thus from reaching the operative field. Cabot, Walters, and Counsellor, however, do not favour this step, and in general a suprapubic cystostomy is preferable to a perineal urethrostomy.

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CHAPTER V

INJURIES OF THE URETHRA

THERE are two chief types of urethral injury—wounds and ruptures—in the latter of which the integrity of the skin is maintained; nevertheless a strict line of distinction cannot always be drawn between the two groups. A third and uncommon injury is caused by burns of the urethra.

WOUNDS OF THE URETHRA

Wounds of importance are characterized by hæmorrhage as their immediate sign, secondarily by the phenomena of infection, and thirdly and later by fistula or stricture development. In civil

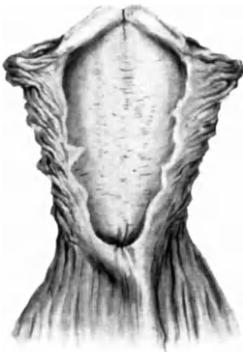


Fig. 57.—A wound of the urethra which has resulted in an artificial hypospadias (Mr. Macalpine's case).

life punctured or incised wounds are uncommon; they may, however, be inflicted from within by instrumentation. Punctured wounds are stated to heal readily if of small size—for example, those caused by needles, etc.; if larger they require treatment similar to that of the incised wounds, which form the more important group. Incisions may be either transverse or longitudinal (*Fig. 57*); with the former the erectile tissue is involved extensively and then hæmorrhage is copious; the former require suture, the latter heal readily without interference, but nevertheless Legueu counsels that all incised wounds should be sutured immediately. A sound is introduced, the urethral wall is sutured over it with catgut, and a second layer of stitches

closes the skin; thus the risk of fistula formation is reduced and stricture development minimized.

Contused wounds are uncommon; their early treatment is by cystostomy and repair of the urethra, if this appears possible,

otherwise cystostomy alone is undertaken. This latter procedure is the only interference permissible in wounds of the posterior urethra. If infection has become established cystostomy again is essential as the first step, and is followed at once by treatment of the infection, whilst the urethral lesion is left untouched. The later stages marked by fistula and stricture formation require the appropriate operative repair.

Extensive damage is best studied together with war wounds.

War Wounds.—

Anterior Urethra.—Projectile wounds naturally vary considerably in site and dimension with the nature and direction of the traumatizing body. Frequently much more extensive damage to the urethra and neighbouring parts is met with than is seen in civil life. The urethra may be extensively destroyed and the penis, scrotum, or testes torn or perforated. Hæmorrhage is again a prominent and dangerous concomitant. The sequence of events may be described as being in three stages: at first urethral hæmorrhage occurs and retention of urine is present, although later micturition occurs through the wound; secondly, infection leading to abscess formation or phlegmonous suppuration occurs; and, thirdly, a fistula is an almost inevitable sequel and is associated with stricture formation, which may proceed even to complete obliteration of the urethral lumen. The treatment consists of cystostomy and the toilet of the wound, followed after a long period of temporization by operative interventions, which usually consist of plastic procedures designed to repair the urethra and which must be preceded by wide ablation of all scar tissue. It has been observed that the majority of these extensive wounds heal in a comparatively satisfactory manner under palliative treatment and that plastic operations then prove satisfactory. Nevertheless some patients with extensive urethral destruction may require operation by the technique of Rochet, who dislocates the pelvic diaphragm and mobilizes the prostate in order to gain sufficient length of urethra for repair, while for others an adaptation of Young's method for tumours may be more suitable; in this, after excision of the perineal urethra, he has bodily transplanted the penis so that the penile urethra is joined to the membranous at the pelvic diaphragm. Should repair prove impossible a permanent perineal urethrostomy may be the best procedure.

Posterior Urethra.—These wounds are complicated as a rule by injuries of neighbouring viscera, of the prostate almost invariably,

and frequently of the rectum. The urethra may be torn across, partially or completely, or it may be dislocated with or without partial tearing when there is a fracture of the ischial rami. *Fistulæ* result which may occupy almost any site, perineal, inguinal, or recto-urethral, and traumatic stricture is an inevitable sequel, whilst, sometimes following on a cystostomy, the urethra becomes obliterated.

The immediate treatment is cystostomy and the introduction of an indwelling catheter, for which retrograde catheterization is usually necessary; however, in the presence of sepsis or extensive pulping of the parts, it may be advisable after cystostomy to ignore the urethral lesion and to combat infection until the time is more favourable. Later, in either event, treatment directed to the urethra is undertaken as follows: (*a*) When the stricture admits an instrument dilatation is instituted, and if necessary internal urethrotomy is performed; (*b*) When the stricture is impassable the posterior urethra is exposed through the perineum and communication with the meatus re-established, a catheter is then inserted and emerges both from the meatus and the suprapubic wound; the perineal wound is partially closed and the catheter changed weekly. Each catheter is utilized as a guide to its successor, an instrument being thus kept continuously in place until healing is complete. Recto-urethral *fistulæ* are treated best by perineal exploration and the separate suture of the urethral and rectal orifices (*see* Chapter XI.) It would seem that even in the presence of rectal injury colostomy is unnecessary. Legueu finds that the wounds which are most troublesome and difficult to deal with are those situated at the junction of the posterior and anterior urethra, for the passage of a catheter is exceedingly difficult, and he holds that plastic repair of a urethra which cannot be catheterized is doomed to failure. Stricture formation must receive treatment after operation, otherwise relapse is certain to occur.

RUPTURE OF THE URETHRA

Traumatic injury of the urethra as the result of a contusion and without an open wound is spoken of as 'rupture' of the urethra. Rupture may be of the penile, bulbous, or membranous urethra, and its site largely depends upon the form of violence suffered. Rupture of the prostatic urethra has been recorded, but is of

extreme rarity. Peacock and Hain found that 71 per cent of cases of rupture were associated with fracture of the pelvis, but that less than 10 per cent of fractured pelvises exhibited injury of the urethra.

Actiology.—

Rupture of the Penile Urethra.—The injury is uncommon because of penile mobility, but the organ may be trapped between two objects or crushed against the symphysis pubis. Sometimes acute flexion of the erect organ is the cause of the accident, and this may happen during coitus, the “faux pas de coit” of Guyon, or it may occur in attempts to straighten the penis during chordee; the commonest site of such an injury is at the peno-scrotal junction.

Rupture of the Bulbous Urethra.—This is the result of a severe perineal contusion caused either by a kick or by falling astride an object like a beam or the edge of an opening, for example a manhole. The rupture is caused either by compression of the urethra against the boundaries of the pubic arch, or by a shearing force which tears the urethra from its fixed attachment as it pierces the inferior fascia of the urogenital diaphragm. Rupture by compression occurs in front of the bulb; by shearing, close to the urogenital diaphragm.

Rupture of the Membranous Urethra.—The rupture takes place at some point between the apex of the prostate and the inferior fascia of the urogenital diaphragm. The injury is most often the result of severe violence, such as a crush, and is associated ordinarily with fractures of the pelvic bones forming the subpubic arch, or with dislocation of the symphysis pubis. At times the urethra is torn by a bony fragment, but more commonly the rent results from distortion of the pelvic wall, of which the urogenital diaphragm is morphologically a part and in which the membranous urethra is embedded with firm attachments; the fasciæ of the urogenital diaphragm may be torn, thus demonstrating the manner in which the urethra suffers. It must be remarked here that it is sometimes astonishing how the urethra escapes, and rupture is far less common than one might expect in these fractures of the pelvis. More rarely the membranous urethra is ruptured by force applied to the buttocks, for instance a fall in the sitting position, and the pelvis remains intact; again, rarely, there may occur a temporary luxation of the symphysis when the urethra is torn probably by torsion between the two fasciæ. An unusual site of the rupture is at the apex of

the prostate, where the urethra, emerging from the prostate, passes through the superior fascia of the diaphragm, and it may be assumed that here the tear is the effect of a shearing force displacing the prostate from its normal relationship to the superior fascia of the urogenital diaphragm. Rupture of the membranous urethra is sometimes the result of a perineal contusion, especially when the violence is directed from behind forwards, and then it may be associated with a second rupture of the bulbous urethra.

Rupture by distension is an uncommon event, but it has been produced by the passage of an instrument of too great calibre and also by too forcible injections of fluid. In a number of these patients a stricture was present or the urethral wall was inflamed.

Pathology.—The rupture (*Fig. 58*) may be: (1) Interstitial; (2) Partial, internal or external; (3) Total; or (4) Complete. In the

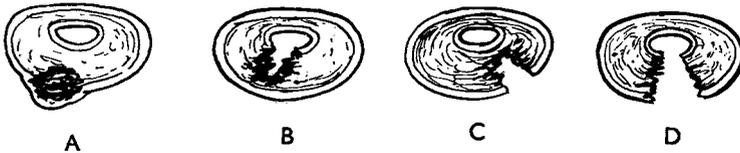


Fig. 58.—Incomplete rupture of the urethra. A, Interstitial rupture; B, Partial internal rupture; C, Partial external rupture; D, Total rupture.

interstitial variety the lesion is of the cavernous tissue of the corpus cavernosum urethræ, and the urethral mucosa escapes together with the coverings of the corpus. In partial internal rupture the damage is limited to a part of the circumference of the urethral mucosa and the cavernous tissue, including its inner sheath; partial external rupture connotes a lesion limited to a portion of the corpus and its external fibrous coat, whilst the urethral mucosa escapes. Total rupture implies that injury to the mucosa is associated with damage to the corpus cavernosum urethræ and its fibrous sheaths, but only involving a part of the circumference of the canal; when there is complete transverse division of these, the condition is spoken of as complete rupture. It is rare to find the damage limited to one or other of these layers, as is only to be expected when it is realized that a contusion is the primary cause.

Penile Rupture.—As this is usually the result of indirect violence, it is of either the interstitial or the partial type and the external

sheath escapes ; it is never total or complete, except in the very rare event of direct violence being the cause.

Perineal Rupture.—The rupture may be interstitial, partial, total, or complete. It is surprising with what regularity a complete division of the urethra and corpus cavernosum urethræ is found, and with this considerable retraction of the divided ends occurs ; Rutherford, however, states that it is only in the lithotomy position that there is retraction, and that the ends are approximated when the legs are extended. In addition to the local tear in the urethra



Fig. 59.—The appearances in a case of rupture of the bulbous urethra ; there is a large scrotal hæmatoma (Mr. Macalpine's case).

or other structures, there is commonly a pulping necrosis of the tissues in the neighbourhood. When the external sheath and the cavernous tissue are ruptured, hæmorrhage into the tissues is free, owing to the vascularity of the corpus, and a perineal and scrotal hæmatoma rapidly forms (*Fig. 59*) ; if the urethra is damaged in addition, hæmorrhage appears from the urinary meatus. It has been said that the extent of the hæmatoma bears a relationship to the amount of damage inflicted—for example, Legueu has noted that when the external sheath of the corpus cavernosum urethræ is intact hæmorrhage from the meatus is relatively profuse, but that

when it is severed hæmatoma formation is marked and meatal bleeding relatively less ; however, Bailey has shown that, though in general true, this is by no means invariable (*Fig. 6o*).

On micturition urine escapes into the tissues—extravasation of urine—but fortunately spasm of the sphincter urethræ membranaceæ is always present (Heitz-Boyer), and renders micturition impossible for some considerable time. An untreated case may, if infection

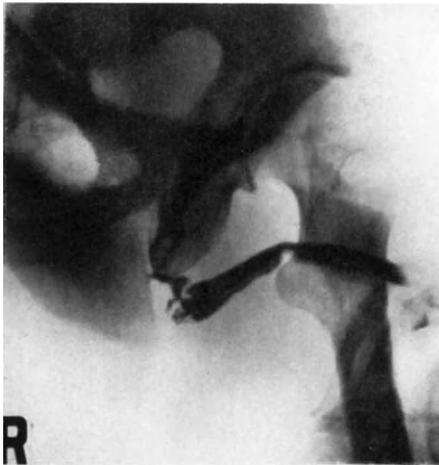


Fig. 6o.—Urethrogram in another case of rupture of the bulbous urethra. The rupture was total, but not complete : there was meatal bleeding, but no perineal hæmatoma.

occurs, develop an acute phlegmonous periurethritis ; rarely infection does not eventuate in such patients. Should recovery ensue there is invariably a marked fibrosis of all the structures involved and a urethral stricture develops. The extent and nature of the stricture depend on the extent of the lesion, the distance of separation of the extremities of the urethra, and the presence or absence of infection. Another late result which may follow the evacuation of abscesses is fistula formation.

Rupture of the Membranous Urethra.—When situated at the apex of the prostate the lesion is most often total and complete, and is associated with severe pelvic injury ; there is marked separation of the urethral extremities, and the bladder and prostate are displaced backwards as a whole, with rupture of the puboprostatic ligaments. Rupture between the layers of the urogenital diaphragm is followed

by less marked separation and consequently less fibrosis and less severe stricture formation. In the type of injury accompanied by great separation the urethra cannot re-form unaided, and the usual course of events, if the patient survives, is extravasation of urine, which is intrapelvic at first, and the later development of sinuses, suprapubic, inguinal, or perhaps perineal, through which the urine escapes; the urethral ends remain separated by a mass of dense fibrous tissue. Extravasation is an early event and occurs into the retropubic space (*cavum Retzii*) and the retroperitoneal tissues (*Fig. 61*). After some days perineal ecchymoses may appear, but a perineal hæmatoma is uncommon; nevertheless, with marked laceration of the urogenital diaphragm perineal hæmatomata may form and extravasation of urine occur in the perineoscrotal region. Ravenel has studied the various paths followed by extravasation according to the site of rupture of the urethra.

Diagnosis.—Urethrograms made after the injection of lipiodol can give valuable information (*see Fig. 60*), and intravenous urography should be employed if there is doubt as to whether there is rupture of the bladder or posterior urethra.

Rupture of the Penile Urethra.—Bleeding from the meatus may be the only sign of this injury, but sometimes a small swelling of the corpus cavernosum urethræ can be felt; pain, however, if present at all, is not marked. The hæmorrhage varies in degree and is sometimes profuse or, rarely, in the interstitial variety entirely absent. Micturition is not affected except that there may be some dysuria at the first.

Rupture of the Bulbous Urethra.—The bulbous urethra is the most usual site of an injury; there is a history of perineal contusion and the patient complains of severe localized pain and the escape of blood from the meatus; if the rupture is total he observes a

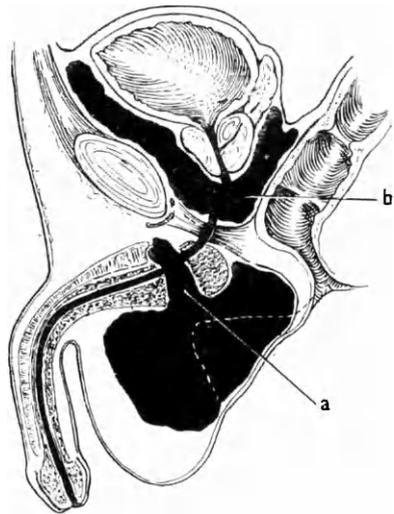


Fig. 61.—The sites of hæmatomata and extravasation in rupture of the urethra. *a*, In rupture of the bulbous urethra; *b*, In intrapelvic rupture.

swelling in the perineum and finds that in spite of an intense desire to micturate he is unable to do so. Meatal hæmorrhage is a constant sign, but varies considerably in quantity. Hæmatoma formation also varies and may be absent if the external sheath of the corpus cavernosum urethræ is intact; when present, it is limited as a rule by the fascial attachments, being localized therefore to the perineum and scrotum whilst any extension is upwards over the pubes; however, with severe damage these limitations do not exist. Urethral hæmorrhage, together with a perineal hæmatoma, is pathognomonic of urethral rupture (Legueu), and no instrumentation is permissible, but operation should be undertaken; in the absence of a perineal hæmatoma many surgeons permit instrumentation in order to diagnose the site of injury and to determine whether an instrument will enter the bladder. Should the patient have succeeded in his attempt to micturate, he may have noticed an increase of the perineal swelling, with little or no urine escaping from the meatus, and if untreated this extravasation of urine often becomes infected and numerous fistulæ eventually result. More rarely sepsis is avoided and, if the rupture is total but not complete, the urethra re-forms.

Rupture of the Membranous Urethra.—The patient has suffered a severe pelvic injury, often a crush or run-over accident, there is marked shock, and there are often signs of a fractured pelvis; frequently the urinary symptoms are at first overshadowed by the foregoing and may be overlooked. The patient may complain of retention, and this may lead to investigation, when it is found that there is some meatal hæmorrhage and that suprapubic rigidity and tenderness exist together with dullness, which perhaps extends into one or both inguinal regions, a symmetrical distribution being rare. Hæmorrhage arising proximal to the sphincter may escape into the bladder and fail to appear at the meatus; if it does it is slight. Hæmorrhage and retention indicate either urethral or vesical rupture, and the suprapubic dullness points to escape of urine and blood into the extraperitoneal tissues. It is frequently impossible before operation to differentiate between extraperitoneal rupture of the bladder and rupture of the posterior urethra, except by the use of intravenous urography or lipiodol per urethram; however, if a distended bladder can be palpated the rupture must be urethral; hæmaturia with ability to micturate tends to exclude urethral rupture and points to extraperitoneal rupture of the bladder. If on rectal examination the prostate can be identified, the rupture is probably

vesical, but if the landmarks are lost and replaced by a boggy swelling it is probably of the urethra. Catheterization is inadvisable, but circumstances may cause the surgeon to resort to it, and if an acorn-tipped bougie obviously fails to enter the bladder the diagnosis is made; usually the catheter passes and withdraws some blood or a little blood-stained urine, but the exact situation of its tip is unknown, except when it is possible to feel it per rectum. There is no perineal hæmatoma unless the injuries are very extensive, although an ecchymosis often appears later. Operative treatment is essential in either instance.

Treatment.—Various factors require consideration in determining the treatment: first, it must be recognized that stricture formation is inevitable, but that by careful and well-judged treatment it may be minimized; secondly, it must be understood that urine must not be permitted to escape from, or come in contact with, the injured area; and thirdly, if possible, infection should be prevented. These factors dominate the line of treatment whatever the area in which the rupture is situated. It is difficult to lay down hard-and-fast rules as to the manner and time of treatment of the rupture of the urethra. Considerable differences of opinion exist as to the correct methods of treatment of rupture at certain sites and under certain circumstances, and differing lines of treatment have produced equally good results. The ideal course of immediate repair is by no means always possible and sometimes when possible is inadvisable. It is the present-day tendency to defer treatment of the urethral lesion in the presence of considerable tissue damage until recovery has taken place and until infection has been eliminated. Immediate interference is limited to diversion of the urinary stream and to the evacuation of hæmatomata. As a general rule the catheter *en demeure* is to be avoided. The conclusion that a certain latitude is permissible is evident when the opinions and results of different surgeons are studied.

Penile Rupture.—The rupture is either partial or interstitial, therefore micturition is not impeded and extravasation does not occur. In a few men retention or difficulty may necessitate the insertion of a catheter *en demeure*. In some patients severe hæmorrhage necessitates compression by bandaging the penis about an instrument in the urethra to control the bleeding, if hot lavage and adrenaline or ice applied externally fail; otherwise instrumentation and operation are inadvisable; the risk of infection is thus lessened.

Perineal Rupture.—Several debatable questions arise in discussing the treatment of rupture at this site; in particular there is a choice between immediate and delayed repair of the urethra and also as to the method of diversion of urine. It is agreed that perineoscrotal hæmatomata of any size should be evacuated even though the patient is able to micturate satisfactorily (Lepoutre and Stobbaerts).

In considering treatment almost all surgeons agree that it is essential that the urine shall not come into contact with the damaged tissues or area of operation, but the manner in which this object is attained varies. Legueu, Marion, Haines, and also Lepoutre and Stobbaerts perform suprapubic cystostomy before countenancing operation on the urethra. Retrograde catheterization can then be utilized as an aid to suture or resection; suture was first performed by Birkett in 1866. Many surgeons employ the indwelling catheter, which is condemned by others as a source of infection and as ineffective since urine can trickle alongside it; nevertheless quite frequently excellent results are obtained by immediate suture of the urethra and diversion of the urine by catheter, and the instrument is an efficient splint. Nowadays few surgeons establish perineal drainage of the bladder by the introduction of a tube through a new opening in the urethra made proximally to the site of repair. The near relationship of the drainage tube to the operation field would seem to favour infection and embarrass subsequent procedures.

It is agreed that in the presence of shock, extravasation of urine, and infection, treatment should be directed primarily to these and repair of the urethra deferred. It is probable that in the past almost all surgeons practised immediate repair of the urethral injury whenever possible, and to-day the majority would continue this practice. When immediate repair is undertaken the method recommended as best securing diversion of urine, freedom from sepsis, and the minimum of stricture formation is suprapubic cystostomy followed by perineal section, with trimming of the urethral extremities, excision of necrotic tissues, and complete suture (Iselin). If trimming is necessarily extensive the urethra is mobilized in order to secure approximation. If union is impossible both extremities are brought to the surface (Pasteau and Iselin); alternatively, the roof alone is sutured (Morison) or Rutherford's sutureless method employed, when a catheter is passed into the bladder and the perineal wound left open.

In the presence of grossly traumatized tissues Lepoutre and Stobbaerts, Haines, and Marion regard a delayed resection of the urethra as the procedure of choice; the two first-named consider that this delayed repair is preferable in the majority of patients. However, if on the evacuation of a hæmatoma the urethral extremities present themselves and are found to be in a satisfactory condition and but little separated, immediate suture is permissible. When repair has been deferred, either of deliberate intent or because definitely contra-indicated at the time, the urethra is explored by sounds and urethrography in some four to five weeks' time, and further treatment determined. It may be that then treatment by dilatation or internal urethrotomy will suffice; however, Lepoutre and Stobbaerts confess that neither of these gives particularly good results. Resection of the affected area is to be aimed at, but it may be that approximation of the urethral ends is impossible even after mobilization, in which case either Stobbaerts' spiral resection is utilized or Morison's method of suture of the roof achieved; otherwise either the perineal wound is left widely open (Besley), or, preferably, both extremities of the urethra are brought to the surface for reconstitution of the channel at a later date by plastic methods (Pasteau and Iselin).

Some indications of the line of treatment to be adopted can be given as follows. Should the patient have micturated successfully before being encountered by the surgeon, and in the absence of a perineal hæmatoma, it is considered sufficient to maintain careful observation and abstain from all intervention. If hæmatomata are present they should be incised and evacuated. If there is retention of urine but no marked perineoscrotal swelling, many surgeons consider it justifiable to explore the urethra by means of sounds. Should a catheter pass it is left *en demeure*; if not, when obstruction is met, operation is recommended unless there are contra-indications to it. Some surgeons, however, do not countenance operation or indeed instrumentation, but perform suprapubic cystostomy or, if spasm is suspected, empty the bladder by suprapubic puncture, repeated if necessary, and proceed to cystostomy if micturition does not become re-established. Legueu writes that in spite of his own teaching he tends to operate upon all these patients.

If there is retention of urine and considerable swelling due to perineoscrotal hæmatomata, the consensus of opinion is that

instrumentation is unwise and that operation is required; a cystostomy is established, hæmatomata are incised, and if circumstances are favourable the urethra repaired. Even though a catheter will pass, operation is necessary (Marion).

It will be found that immediate repair is not possible in many of these men because of the grave condition of the patient, which limits the surgeon to the minimum of interference; it is inadvisable if tissue destruction is great and if the urethral extremities are widely separated (Lepoutre and Stobbaerts). Infection also necessitates postponement of repair. Haines prefers as a rule to temporize, performing cystostomy, which he regards as the only essential intervention, and noting that, whilst the urethral extremities may be widely separated when the patient is in the lithotomy position, they are not when the legs are extended, an observation also made by Rutherford.

Membranous Urethra.—With the ultimate welfare of the patient in view, it is probable that early operation is required for all ruptures of the membranous urethra (Young), and better results are attained by operation even in the presence of traumatized tissues than by operation delayed until the development of a stricture, which may have been preceded by urinary extravasation, perineal abscesses, and fistulæ. Lepoutre and Stobbaerts state that when the rupture is at the junction of the membranous with the bulbous urethra treatment is unsatisfactory because usually suture is impracticable. They consider, as does Haines, that as a first step diversion of the urine is essential, whilst, secondly, a procedure which may prove satisfactory is repair of the urethra over a catheter so far as possible; after repair the catheter remains *en demeure* for a long period.

When rupture has taken place at the apex of the prostate it has been a general rule to counsel immediate operation and repair whenever possible; this, however, is deprecated by Haines and also by Lepoutre and Stobbaerts, and it will be necessary to refer separately to the methods of immediate and delayed repair. The condition of the patient as the result of the severity of the injury often limits the surgeon to the minimum of interference—that is, to cystostomy alone. Haines remarks that every case requires to be judged on its own merits.

Immediate repair: Immediate repair, which is rarely feasible, is recommended by Young, and consists of exposure of the divided urethra by the perineal route and its suture over an indwelling

catheter ; very often it is necessary to employ suprapubic cystostomy as well in order to find the proximal end, and frequently approximation and suture are only partially effected. Afterwards the perineal wound is lightly packed and the catheter left in position for some three weeks. Otherwise suprapubic cystostomy is performed and a bougie passed in retrograde manner and cut down upon in the perineum, then being threaded through the distal urethra to the meatus. Alternatively, interlocking sounds passed from bladder and meatus may obviate perineal section, or catheters passed from the bladder and from the meatus may be retrieved in the retropublic space and used for guiding the insertion of a self-retaining catheter from the bladder (Davis). This may be fixed so that extension can be applied to it in order to depress the displaced prostate (Simpson-Smith). If the patient's condition is such that suprapubic drainage is alone justifiable, then the above procedures would be deferred, although only for the minimum period necessary.

Delayed repair : If the patient is micturating Lepoutre and Stobbaerts consider that treatment should be expectant, but if there is retention a suprapubic cystostomy is established whilst taking all precautions to avoid rendering a fracture of the pelvis compound. In about a month's time further measures are considered. It is to be remembered that displacement rather than stricture is the condition present. Later treatment may be by dilatation if this is practicable, by diathermic resection, or by suture of the surrounding tissues about a catheter *en demeure*. The ideal of urethral suture is not possible as a rule, even when aided by cystostomy and retrograde catheterization, together with perineal exposure of the apex of the prostate ; sometimes mobilization of the urogenital diaphragm is helpful. Fibrotic masses occasionally require excision, and although a stricture of the posterior urethra is said to be uncommon, this statement applies rather to inflammatory than to traumatic strictures. The after-treatment necessitates instrumentation at suitable intervals to control the traumatic stricture which is present to some degree no matter how successful the operative treatment may have been. Amongst points to be remembered are that the catheter *en demeure* is better tolerated by the posterior than by the anterior urethra, and that in a number of these patients impotence has been reported afterwards.

BURNS OF THE URETHRA

The subject of urethral burns either as the result of the injection of caustics or due to diathermy has been studied by Lepoutre; the accident is rare. In the milder forms the mucosa alone is affected and later is sloughed and passed as a cast of the urethra; in rather more advanced degree the cavernous tissue is involved, and then a dense and resistant stricture develops which is characterized as a rule by its considerable length; lastly, the most severe variety is that in which infection of the periurethral tissues leads to a suppurative periurethritis from which the gangrenous portion of urethra is eventually evacuated. The immediate symptom of a burn is intense pain; soon tumefaction appears and the swelling spreads to involve the whole penis, and micturition is obstructed and either becomes extremely difficult and painful or there is retention. A purulent urethral discharge develops, and perhaps a cast of the urethra is recovered. The immediate treatment consists of the relief of pain, whilst marked difficulty of micturition or evidence of perineal infection requires suprapubic cystostomy. Later treatment should be directed either to a stricture or to an actual loss of substance of the urethra.

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CHAPTER VI

ACUTE URETHRITIS AND ITS COMPLICATIONS

ALTHOUGH urethritis is commonly of gonorrhœal origin it is not necessarily so, and it is important to remember that a simple or non-gonococcal inflammation may occur. It is a matter for regret that many patients with a urethral discharge are labelled as venereal at sight, and it is still more regrettable that the term 'venereal disease' should so often result in the divorce of gonorrhœal urethritis from the sphere of urology.

Clinically and pathologically the male urethra is conveniently divided into two parts: the posterior urethra extending from the internal urinary meatus of the bladder to the sphincter urethræ membranaceæ; and the anterior urethra from this sphincter to the external urinary meatus.

SIMPLE ACUTE URETHRITIS

The posterior urethra is as a rule sterile, but various organisms can exist in the anterior urethra and cultures may be obtained from this region (Petit and Wassermann, Jungano). Simple urethritis is a rather uncommon condition, which, given suitable general or local factors predisposing to infection, may be caused by those organisms normally inhabiting the anterior urethra. It may be due to infection from without through the meatus, when frequently it is contracted during coitus, or it follows the introduction of chemicals used in prophylaxis against, or in the treatment of, an imaginary gonorrhœa; moreover the indwelling catheter invariably causes a urethritis. Shaw and Brunet state that a non-specific urethritis is found in from 5 to 10 per cent of male patients suffering from urological diseases. Various pyogenic organisms have been isolated in this disease—streptococci, staphylococci, the *B. coli*, and a short slender bacillus which is often found in chains—according to Lavenant the *Enterococcus protoformis* may cause either a primary urethritis or the infection may be post-gonococcal or arise

during an attack of gonorrhœa. Primary enterococcal urethritis is described as of slow evolution, painless, and resistant to treatment. In addition to these, typhoid urethritis has been reported (Sreenivasan) and also diphtheritic urethritis (Berry), whilst Riba and Jenkins have reported a number of cases of trichomonas urethritis in the male. Simple urethritis usually responds well to treatment, but is liable nevertheless to the same complications as gonorrhœal urethritis, and treatment is on similar lines in both conditions. Mombaerts has reviewed the subject of simple urethritis.

ACUTE GONOCOCCAL URETHRITIS (ACUTE GONORRHŒA)

Actiology.—The causal organism is the gonococcus (Neisser), a Gram-negative diplococcus of comparatively low powers of resistance which is difficult to cultivate and isolate; in smears of

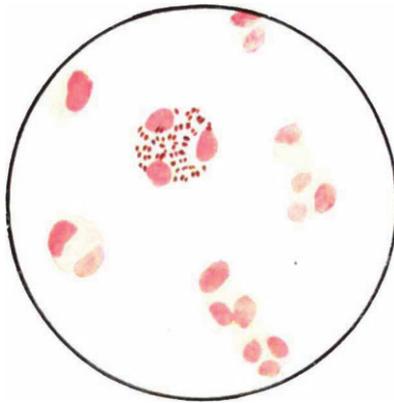


Fig. 62.—Gonococcal pus (Gram stain).

pus these cocci are characteristically intracellular (*Fig. 62*). Transmission occurs almost invariably by sexual intercourse, but in rare instances other forms of direct transmission may be responsible for urethral infection or for infection of other mucous surfaces such as the conjunctiva.

Pathology.—Infection of the mucosa first commences in the region of the fossa navicularis and extension proximally occurs from this point. The urethral mucosa becomes swollen and

hyperæmic, the urethral glands of Littré and the sinuses of Morgagni become infected, and at the same time the subepithelial tissues are involved and become infiltrated with polymorphonuclear leucocytes; simultaneously an exudation occurs which soon becomes purulent. In short the picture is typical of suppuration of a mucous surface. The inguinal glands are involved not infrequently, but only rarely do they suppurate. Extension may occur by two routes, either along the mucosa (Finger), or, as shown by Kenneth Walker, by the subepithelial lymphatics, which are invaded shortly after the disease becomes established. When the inflammation is limited to the anterior urethra it is termed 'acute anterior urethritis', and when the membranous and prostatic portions become acutely inflamed the condition is spoken of as 'acute posterior urethritis'; some degree of posterior infection occurs in approximately 80 per cent of patients. In fact the posterior urethra probably never completely escapes infection, some mild involvement of the prostatic urethra and prostate usually occurring even in those patients who escape an acute inflammation. The sphincter has no great action in limiting the process, an obvious fact if extension by the subepithelial lymphatics is granted. The mucosa of the bladder is infected at times, resulting in an acute gonococcal cystitis which on cystoscopic examination shows a peculiarly patchy distribution. Rarely gonorrhœal pyelitis, pyelonephritis, and renal abscess develop.

Various systemic infections may be referred to here, the more important being described again later. Buschke in 1898 described four gonorrhœal skin manifestations—erythema, urticaria and erythema nodosum, hæmorrhagic and bullous exanthemata, and hyperkeratosis or keratoderma blennorrhagica. The last-named is an extremely rare occurrence, in which an eruption appears on the palms, soles, glans penis, and buccal mucosa, from the pustules of which gonococci can be isolated (Strominger, Sullivan, Tobias). These cutaneous eruptions, of which the hæmorrhagic is the most serious, have been reviewed recently by Levin and Silvers. Other manifestations of blood-borne infection are gonococcal arthritis, bursitis (Strominger), myositis, iritis, endocarditis, meningitis (Branham et al.), pulmonary suppuration (Dupont), and phlebitis (Zégas).

At some period in the course of gonorrhœa a mixed infection always develops (Lavenant), and this is often responsible for a persistence of the inflammation in the chronic form. The result of suppuration of the mucosa is to produce some necrosis and

desquamation of the lining cells, which later, as recovery ensues, often are replaced by cells of a lower order, possibly squamous in type. Should the inflammation reach and persist in the subepithelial tissues a soft induration forms and subsequent fibrosis may give rise to stricture formation. Frequently the urethral glands are destroyed as a result of the inflammation, and they may form multiple small abscesses, *Littritis*, or *folliculitis*.

Symptoms of Uncomplicated Gonorrhœa.—After an average incubation period of from 5 to 7 days (1 to 21 days), the patient notices an itching or irritation of the penile urethra near the glans penis, followed shortly afterwards by a scalding discomfort on micturition associated with an initial glairy discharge from the meatus, which, however, frequently escapes the attention of the patient. Soon a definitely purulent discharge makes its appearance and there is considerable burning or scalding pain during micturition; on inspection the lips of the meatus are swollen and reddened and the purulent discharge is seen. Pain is not always severe and it may be absent; rarely it is so acute on micturition that voluntary inhibition of the act develops into retention. The penile urethra may be tender, appear swollen, and feel indurated along its whole length. These symptoms usually reach their height towards the end of the first ten days, and, in the ordinary course of events, commence to subside during the second month. At any period from the end of the second week onwards an acute posterior urethritis may appear; the discharge then as a rule diminishes, micturition is more frequent and painful, there is sometimes strangury and terminal hæmaturia, and painful erections occur which may become almost continuous (*chordee*) and prevent sleep. These are the symptoms of a severe posterior inflammation; in the less acute cases there is frequency and pain on micturition and perhaps pain on erection, and the second urine of the two-glass test is turbid. In from two to three months, if no complications have arisen and the disease has not become chronic, the inflammation subsides and cure follows.

Diagnosis.—The differential diagnosis from acute non-gonococcal urethritis depends upon the discovery of the organism in the films or on culture of the urethral discharge; the response to treatment is also very different, acute simple urethritis in the majority of patients yielding very rapidly to irrigation with mild antiseptics. Careful examination should prevent a meatal or intra-urethral chancre or chancroid being mistaken for urethritis. *Balanitis* and *balanoposthitis*

with a non-retractile prepuce from beneath which a purulent discharge appears should be treated by a dorsal slit of the prepuce, when the presence or absence of a urethritis can be determined; a clear second urine in the two-glass test (Thompson) may give some indication beforehand that the urethra is not inflamed. Rarely an intra-urethral venereal wart will complicate the diagnosis, or one of two other conditions, either herpes of the urethra or syphilis; the latter may appear in the form of mucosal manifestations of the secondary stage or as gummata which simulate periurethritis and abscess. The rare urethral discharge of genital tuberculosis must not be attributed hastily to gonorrhœa.

TREATMENT

Local treatment on the whole cannot be said to be satisfactory, and this is made evident by the variety of methods and preparations in use, and by the constant appearance of fresh ones. The reasons for this are: first, that the behaviour of the gonococcus *in vitro* and *in vivo* is not comparable and antiseptics do not readily penetrate the urethral glands and crypts or reach the subepithelial tissues; secondly, that the inflamed urethral mucosa is intolerant of irritant antiseptics in sufficient concentration to prove lethal to the infecting organism. Moreover local treatment improperly applied or carried to excess is prone to promote complications and chronicity, and therefore may be definitely harmful. Recently advances in chemotherapy have given very promising results. It is always well to bear in mind that acute urethritis tends to spontaneous cure.

Prophylactic Treatment.—If carefully carried out, prophylaxis is extremely successful, as has been shown by war-time statistics (Janet, Young). Careful washing of the glans penis and meatus with 1-1000 potassium permanganate solution is efficient if carried out immediately after exposure, as is the application of an ointment including calomel and phenol, or calomel and perchloride of mercury.

The following two ointments and jelly, usually supplied in collapsible tubes, are effective; moreover they also protect against syphilis:—

1. Lanolin	75	2. Lanolin	75
Calomel	25	Mercurio-salicyl Arsenate	25
3. Neutral Mercury Salicylate	10		
Irish Moss	5		
Water	85		
Jelly in collapsible tubes.			

Within 24 to 48 hours after exposure thorough irrigation of the anterior urethra with potassium permanganate lotion in a strength of 1-4000, or the instillation of 20 min. of 5 per cent protargol retained or sealed in with a portion of gauze soaked in collodion for at least 15 minutes will prevent urethritis. Janet utilized argyrol, washing the urethra with a solution of 1-500 and instilling a 20 per cent solution. The subject himself repeats the instillation, using 10 per cent argyrol after every micturition for three days; each instillation is retained for five minutes.

Abortive Treatment.—If carried out within twenty-four hours of the appearance of symptoms, treatment is often successful in aborting the disease. It may consist either of deep irrigation by the method of Janet, using potassium permanganate lotion 1-6000 twice daily for a week, or the sealing in with collodion of 20 min. of one of the silver preparations—for example, neoreargon 5 per cent, or argyrol 20 per cent—for three to four hours twice daily for from four to seven days. Acetone is employed to remove the collodion seal.

TREATMENT OF ACUTE GONORRHOEAL URETHRITIS

In the presence of an established urethritis both general and local measures must be undertaken. General instructions forbid sexual intercourse and sexual excitement of any kind, prohibit alcohol and also condiments and such accessories as pickles, curry, pepper, horseradish, etc.; they also limit exercise to a minimum during the acute stage. A large fluid intake is advised and warnings as to the risks of contagion are administered. It is usual to give an alkaline mixture of potassium bicarbonate or potassium citrate with the tinctures of hyoscyamus and belladonna and with infusion of buchu. An alkaline medium is unfavourable to the growth of the gonococcus, whilst hyoscyamus and belladonna aid in the relief of pain and spasm. Increased excretion by the kidneys results in frequent micturition, and the resultant lavage of the urethra prevents the accumulation of inflammatory products. These general measures are of great importance, and rest must, in particular, be emphasized because it is neglected so frequently. Vaccine treatment in the acute stage in the writer's opinion is of definite value, though perhaps not so valuable as in the chronic case; but it must be controlled with the greatest care, for if mechanically administered

it may promote those very complications which it is designed to prevent.

Chemotherapy.—For a number of years chemotherapy has been utilized as an adjuvant to local methods of treatment without aspirations of rivalry. French authors have extolled the intravenous injection of acriflavine both in acute and chronic gonorrhœa; 12 to 14 injections of a 2 per cent solution of acriflavine are given, the first of 5 c.c. being followed in twenty-four hours, if no contra-indications arise, by one of 10 c.c., and then by a similar dose every second day. It may or may not be supplemented by local treatment (Paradis). Abraham has advised the intramuscular injection of manganese butyrate, doses of 1 c.c. and 1.5 c.c. of a 1 per cent solution being administered on the first and fifth days of the discharge.

More recently chemotherapy by drugs of the sulphonamide group has emerged as a fully developed rival to the old-established and well-tried, though not spectacularly successful, routine. Important papers on the various compounds in use have been published in the English literature by Hanschell, Cokkinis and McElligott, Batchelor, Lees, Murrell and Braine, and also by Marinkovitch; the last-named obtained a permanent cure-rate of 46.3 per cent with prontosil album, of 56 per cent with uleron, and of 86 per cent with M & B 693 (sulphapyridine). At the present it is recommended that uleron be administered in three courses of treatment at intervals of from eight to ten days, each course lasting five days and the patient receiving 3 g. daily. M & B 693 has been given either for a period of five days, 3 g. daily, and then continued for a further period of five days at a dosage of 1.5 g. daily, or a dosage of 2 g. daily has been given continuously for as long as twenty-one days.

These drugs all possess toxic properties in varying degrees, which necessitate very careful supervision of the patient (Cokkinis, Buttle).

It would appear that with chemotherapy a more rapid cure of gonorrhœa is obtainable in a much greater percentage of patients than formerly; nevertheless a certain number of relapses, both early and late, are encountered (Cokkinis and McElligott). It is early as yet to determine whether the results claimed are unduly optimistic, and it is probable that the dosage remains to be standardized. Although successful results have been obtained by this new therapy alone, it would seem that a judicious combination of chemotherapy with local measures will produce better results than either alone.

Specific antigonococcal antitoxin (Anwyl-Davies) is of dubious value in treatment (Burke, Gabe, Harkness and King). Sherman states that good results have been obtained with gonococcal antiviral employed as a urethral injection, the duration of treatment being shortened and the incidence of complications markedly reduced.

Temperature Changes.—The gonococcus is susceptible to heat, and at various times attempts have been made to cure gonorrhœa either by artificial pyrexia or by the local application of heat. Hot baths embrace both measures, but are only of value in the relief of pain and spasm. Active methods of producing pyrexia include malarial therapy, vaccine therapy, and the injection of sulphur oils. The first-named is no longer employed; the remainder, however, are still in occasional use. For example, T.A.B. vaccine is administered intravenously, the first dose being 0.25 c.c. and subsequent doses 0.5 c.c. and 0.75 c.c. Streptobacillary vaccine also is given intravenously, the dose being 225 million organisms, or, if pyrexia is already present, 150 million organisms; two or three injections are given each week for a fortnight. Sulphur oils (Sulfosine and Huile Soufrie Brisson) are employed as intramuscular injections, 2 c.c. of a solution of from 1 to 2 per cent strength initially, which is increased to 5 c.c. later. These methods are used principally for chronic gonorrhœa with systemic complications. An interesting paper on fever therapy has been written by Ormond; the treatment necessitates a special cabinet and apparatus in which the patient's temperature is maintained at 107° F. for six hours at each session, and several sessions are required. The method is not free from risk and the results vary. However, Elkins and Krusen consider that fever therapy either alone or in conjunction with sulphanilamide will continue to be of value in the treatment of resistant cases.

It has been suggested that whatever beneficial effects vaccines possess are attributable to the results of pyrexia; certain rapid improvements in urethritis and even cures which have coincided with the development of epididymitis are also thus explained.

Local methods comprise the circulation of hot water through a double-channel catheter, and diathermy. Diathermy has been used in order to raise the temperature of the tissues of the parts to a level lethal to the gonococcus. Various special penile and rectal electrodes are needed and each application requires some considerable time. It would appear, however, from Schofield's experiments that

no temperature between 37° C. and 43° C. maintained for thirty minutes has any inhibitory effect on the organism.

Another suggestion is that the irrigating lotion should be used at a temperature of 10° C., as the gonococcus is peculiarly susceptible to cold (Moussali). It is improbable that anything more than anterior irrigation would be possible with fluids at this temperature.

Local Measures.—

Irrigation of the Anterior Urethra.—Irrigation may be carried out either by the method of Janet or by a syringe. In Janet's method

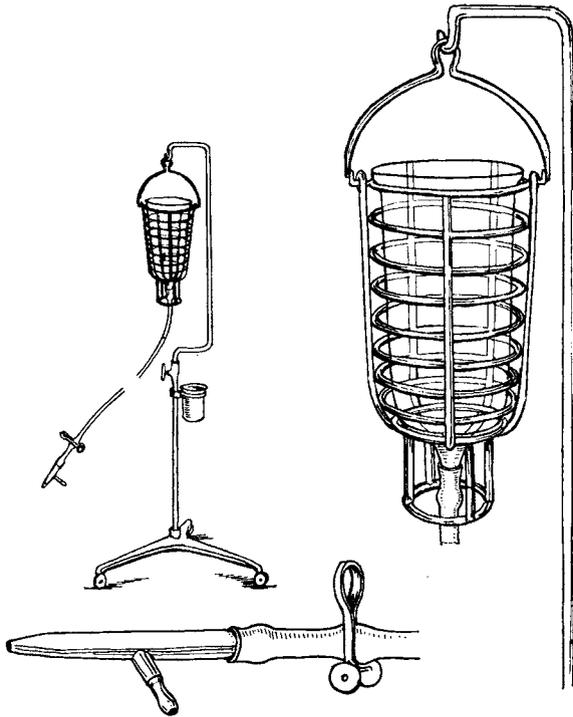


Fig. 63.—An outfit for *grand lavage* of the urethra and bladder—Anderson's double-channelled irrigation nozzle is shown.

a vessel containing the selected antiseptic solution is suspended some 3 ft. above the level of the patient's bladder and connected by rubber tubing to a urethral nozzle (Fig. 63). The solution in common use is potassium permanganate lotion in a strength of 1-8000 to 1-6000 and at a suitably warm temperature; it is essential that the whole outfit be sterilized. After carefully cleansing the

glans penis with antiseptics the nozzle is introduced into the urinary meatus and the lotion is permitted to flow in. It is important that the sphincter urethræ membranaceæ should not be forced, therefore the meatus is not tightly closed and the patient is not asked to relax the sphincter. The urethra is repeatedly and gently washed, in and out, until about a pint of the solution has been used. This procedure is repeated twice or thrice daily. In place of the potassium permanganate lotion, a solution of one of the silver preparations may be employed, for instance neoreargon, $\frac{1}{4}$ per cent, or argyrol in strengths of 1-1000 to 1-500. Alternatively a urethral syringe, fitted with a conical nozzle of metal or rubber, is used, and the anterior urethra similarly washed out with the antiseptic lotion, the solution at each filling being retained for two to three minutes by pinching the meatus. The process is repeated three or four times on each occasion, which should be as many times daily. Force must be avoided and the urethra only comfortably filled.

Instillations into the Anterior Urethra.—By means of a urethral syringe not more than 5 c.c. of one of the silver preparations is introduced into the urethra and retained for fifteen minutes. The solutions which are employed most commonly include argyrol 10-20 per cent, protargol 2-5 per cent, and neoreargon 3-5 per cent.

Grand Lavage (Janet) (Deep or Vesical Irrigation).—This method aims at lavage of the whole urethra, which is bathed both by the flow into the bladder and by the return flow. In technique it is very similar to Janet's method for the anterior urethra, and it is the rule that irrigation of that region is carried out first. Then the container is suspended from 4 ft. to 4 ft. 6 in. above the level of the patient's bladder, the meatus is tightly closed about the nozzle, and he is asked to relax the sphincter. When the patient has learnt to accomplish this voluntary relaxation, which may need several attempts, fluid freely enters and fills the bladder; when distension is appreciated the procedure is stopped and the bladder permitted to empty itself by micturition. The whole process is repeated two or three times, twice daily. The solutions employed are similar to those used for irrigation of the anterior urethra, and if preferred a large vesical syringe may replace the gravity method.

Comments on Treatment.—Little can be added to Janet's commentaries on local treatment made many years ago. His methods of irrigation have stood the test of time, as has the use of weak solutions of potassium permanganate, but damage to the inflamed

mucosa is easily inflicted if the pressure of irrigation is at all excessive ; therefore overdistension and unnecessary force, produced by raising the container to a greater height than that stated, must be avoided. The sphincter should be relaxed in *grand lavage*, not forced. It is obvious that, if gently and skilfully performed, irrigation is always of the anterior urethra alone for the first few days, and this is desirable. Anderson's two-way nozzle, which permits reflux and a certain control of pressure, is valuable in avoiding undue force and has given improved results in our hands (*see Fig. 63*). It is an undoubted fact that excessive treatment tends to prolong the disease and favours chronicity, and furthermore that anterior irrigation either by Janet's method or by a syringe may drive infected material past the sphincter and so bring about posterior urethritis. It is claimed that the method of instillation into the anterior urethra is free from these possible complications, and it is held further that the antiseptic permeates to the posterior urethra in small quantities sufficiently to prevent infection of this region.

The results of treatment are often disappointing, and as has been said above there is no doubt that excessive local treatment favours chronicity whilst over-vigorous measures may do harm. Treatment requires time, skill, and judgement, and, ideally, local treatment should be carried out by the medical attendant. Unfortunately in hospital patients, their very numbers and their occupations and hours make treatment difficult, and they have either to attend for treatment by, or under the supervision of, trained orderlies, or alternatively to carry it out themselves. The latter plan is to be condemned, and probably it is preferable that these patients should abstain from local measures, for it is quite impossible to train and educate every patient of hospital class to avoid making mistakes in technique. Treatment should be carried out in an institution where, if the patient is permitted to irrigate himself, he is under supervision and the solutions are properly prepared and the outfits sterilized. *Grand lavage* is preferred as the best method for these patients, as it would appear almost foolproof. Another valuable, though rarely practicable, line of treatment is rest in bed, a copious fluid intake, and the administration of drugs of the sulphonamide group, with abstention from all local measures. Chemotherapy affords a means of escape from local measures executed by the patient, for the disadvantages and risks of these are avoided.

Treatment of Acute Posterior Urethritis.—It is usual at the onset of acute posterior urethritis to suspend all local treatment and simply to insist rigorously on the general measures referred to previously, at the same time employing chemotherapy. There is, however, no objection to instillations into the anterior urethra or to anterior irrigation if these are carefully and gently carried out and not left to the patient. Hot sitz baths or hot rectal douches are valuable in the alleviation of pain and spasm. There is, however, no doubt that cessation of all local treatment in acute posterior urethritis is far preferable to excessive or ill-directed treatment, and although *grand lavage* may in skilled hands give good results, it not infrequently gives rise to posterior urethral complications. Painful and frequent erections are relieved best by cold sponging of the parts and by giving camphor monobromate, gr. 2, at night.

COMPLICATIONS OF ACUTE GONORRHOEA

The complications of acute gonorrhœa may be subdivided into those of acute anterior urethritis and those of acute posterior urethritis.

COMPLICATIONS OF ACUTE ANTERIOR URETHRITIS

Balanitis : Balanoposthitis.—In the presence of a long or tight prepuce, or if cleanliness is neglected, infection and inflammation of the preputial cavity may occur. Suppuration results and infiltration and œdema of the prepuce, further limiting retraction, enhance the acuteness of the condition and prevent proper cleansing. Mixed infection is invariable, and the process may be so acute that cellulitis, ulceration and at times sloughing, and perforation of the foreskin result; rarely sloughs of the glans penis may form. Treatment of the milder forms of inflammation consists of irrigation of the preputial cavity with potassium permanganate lotion, together with rest, fomentations, and support of the penis. The more severe types require a dorsal slit of the prepuce to allow of exposure of the glans and to permit free escape for the inflammatory products; following this operation frequent hot antiseptic bathing is necessary.

Acute Inflammation of the Para-urethral Ducts and Acute Tysonitis.—The para-urethral ducts open in the neighbourhood of the meatus on either side, sometimes within the meatus and sometimes externally: the ducts of Tyson's glands open on either side of the frænulum. Acute inflammation of these, and of other similar structures described by Janet, sometimes occurs and may proceed

to abscess formation; Rupel has reported several examples of infection of congenital canals of the raphé. Infected Tyson's glands appear as small red swellings on either side of the base of the frænulum and often the duct is visible and can be seen to exude pus; the infection may be unilateral or bilateral (*Fig. 64*). Should an abscess form, a swelling arises at the site of the gland and may burst either into the preputial cavity, externally on to the surface, or sometimes into the urethra. If in an advanced stage when it is first seen the condition is difficult to distinguish from a periurethral abscess. The treatment of acute inflammation is rest and hot antiseptic applications, and if an abscess is present, free incision and drainage.



Fig. 64.—Bilateral Tysonitis.

Periurethral Folliculitis and Periurethral

Abscess.—Blockage of the ducts of the inflamed urethral glands may lead to infiltration of the subepithelial tissue and to suppuration—folliculitis—and this may proceed to abscess formation. A periurethral



Fig. 65.—A penile periurethral abscess in gonorrhoea.

abscess appears at first as an indurated swelling in the course of the penile urethra and later as a rounded, tender, and fluctuant swelling on the under surface of the penis, which is thereby distorted (*Fig. 65*). Natural cure may result from rupture to the surface or into the urethra, as indicated by a sudden increase of discharge and by an

accompanying diminution of the swelling. The former is heralded by evident involvement of the overlying skin and sometimes results in the development of a penile urinary fistula. The treatment of periurethral abscess is by incision and drainage from the exterior.

Cowperitis.—Cowper's glands are situated deep to the inferior fascia of the urogenital diaphragm, but their ducts pierce the membrane to open into the bulbous urethra. Inflammation of these glands is to be suspected when perineal or low rectal pain is complained of during gonorrhœa, and diagnosed when the examiner discovers tenderness in the perineum on pressure and a tender swelling situated anteriorly and to one or other side of the middle line just within the anus. The examination is best made bidigitally, the fore-finger in the rectum and the thumb externally (*Fig. 66*). The duct may remain open or become blocked; in this latter event an abscess

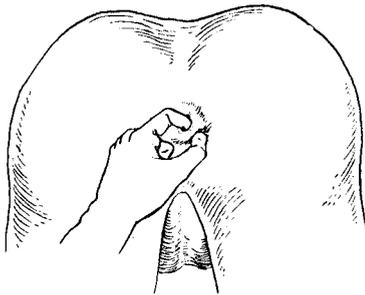


Fig. 66.—Palpation of an enlarged gland of Cowper.

sometimes forms, which tends to rupture into the urethra or, more rarely, develops as a perineal abscess to open on the surface. Treatment may be palliative by hot sitz baths and rectal douches in addition to the treatment of the urethritis; or radical by perineal exposure and drainage of the abscess.

COMPLICATIONS OF ACUTE POSTERIOR URETHRITIS

These complications include acute prostatitis and acute prostatic abscess, acute seminal vesiculitis and abscess, acute epididymitis, acute cystitis, and arthritis and myositis. Very rarely those other systemic complications which have already been noted arise.

Inflammation of the prostate and seminal vesicles require adequate description since these conditions possess such intimate connexions with urethritis; epididymitis also must be considered, although in somewhat lesser detail.

Acute Inflammation of the Prostate

It is probable that no acute infection of the posterior urethra can occur without some involvement of the prostate because of their intimate relationship. Gonococcal urethritis is the most frequent

precursor of inflammation of the prostate, which therefore is common in young adults (Oraison); it may, however, be the result of simple urethritis. The gonococcus itself is seldom isolated in inflammation of the prostate, 35 per cent (Séméniako), and to recover it in pure culture is extremely rare. The organisms ordinarily present are the *Staphylococcus aureus* or *Bacillus coli*, sometimes a streptococcus, and less often various anaerobes, whilst in addition trichomonas infection has been reported. In gonorrhœa secondary infection invariably occurs, and these other organisms either may initiate a prostatitis or be responsible for its persistence after the gonococcus has disappeared.

Pathology.—Anatomically two chief varieties of prostatitis exist, both of which are difficult to distinguish clinically from posterior urethritis (Fig. 67). The first is an inflammation of those glands and ducts which are in close relationship to the prostatic urethra; these either become choked with epithelium and debris—catarrhal prostatitis—or proceed to suppuration, when the condition has been likened to a periurethritis. The second type involves those glands lying remote from the urethra and is a parenchymatous prostatitis; in its mild form this is a follicular or glandular prostatitis, but in more severe types the inflammation extends to the interstitial tissue and becomes periglandular.

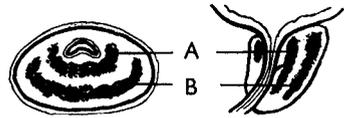


Fig. 67.—The figure illustrates the distinction in site between periurethral (A) and parenchymatous (B) inflammation of the prostate.

Acute Parenchymatous Prostatitis.—Acute parenchymatous prostatitis may be the precursor of either suppurative prostatitis or chronic prostatitis, but neither of these conditions is its inevitable sequel.

Symptoms.—In its typical form acute parenchymatous prostatitis often arises during gonococcal urethritis and not infrequently follows excessive treatment. It is associated always with symptoms of acute posterior urethritis, i.e., frequency of micturition, and sometimes terminal hæmaturia. A sudden retention of urine then occurs, or the patient complains of increasing difficulty of micturition, perhaps proceeding to retention. He feels and looks ill, fever is present, and rigors may occur, whilst pain is felt in the perineum, rectum, and along the penis or referred to the glans penis; it may radiate to the thighs, groins, or sacrum. This pain is increased by attempts

at micturition or defæcation, and the patient avoids movement and cannot sit in comfort. Tenesmus is present and frequency is marked if retention has not occurred.

Rectal Findings.—Rectal examination demonstrates a swollen prostate, either the whole organ or a part, perhaps one lateral lobe only, being enlarged (*Fig. 68*). The swelling is tender and feels tense and resistant.

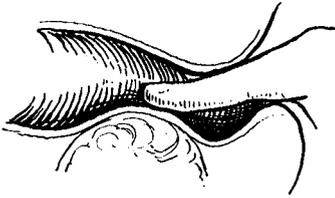


Fig. 68.—Palpation of the swollen prostate.

Diagnosis.—The diagnosis is made from the history and rectal findings; urethral instrumentation is not permissible except to relieve retention when other methods have failed. Acute vesiculitis is at times

difficult to differentiate, and may coexist (44 per cent of cases, according to Séméniako), but usually the site of the swelling will distinguish between the two conditions.

Course.—Resolution and subsequent complete cure is possible; alternatively, though infrequently, the condition may become chronic, chronic prostatitis, or more commonly abscess formation occurs. In certain instances resolution may be simulated by the rupture of an unsuspected abscess into the urethra. Suppuration is a not infrequent sequel, and then the rectal swelling increases in size, becomes more elastic, and, later, pitting followed by softening may be demonstrated.

Treatment.—All local treatment is best suspended except catheterization, if retention exists. For retention a soft rubber catheter should be used and, after emptying, the bladder should be washed out with silver nitrate 1-8000; sometimes suprapubic puncture may be required if catheterization fails. The patient should be confined to bed and given hot sitz baths and frequent hot (45°-55° C.) rectal douches by the recurrent tube. Belladonna is useful for the relief of spasm. Massage is not to be advised, although practised by certain authorities; it can be justified only in the absence of suppuration, and frequently the exclusion of this is very difficult.

Two uncommon forms of inflammation differing widely in their mode of onset remain to be described: they are, first, fulminating prostatitis and periprostatitis; and secondly, subacute prostatitis.

Fulminating or Phlegmonous Prostatitis and Periprostatitis.—

This extremely rare form develops with great rapidity, invariably proceeds to suppuration, and is comparable to acute phlegmonous periurethritis, which indeed it may produce by extension to the perineum.

Subacute Prostatitis (Mayet).—

Symptoms.—The onset of this condition is often insidious and may be without fever or tenesmus. The patient complains of some difficulty of micturition, perhaps of retention, and of rectal discomfort or pain.

Rectal Findings.—A large, firm, often enormous, prostatic swelling is found and sometimes small hard nodules may be distinguished in the mass. It is not tender, and bears a close resemblance to prostatic hypertrophy, or it may be mistaken for a neoplasm, but the age of the patient commonly is against such a diagnosis. This variety usually resolves and rarely terminates in suppuration, yet it may persist for long periods without symptoms.

**Suppurative Prostatitis, Periprostatitis
(Prostatic Abscess)**

In 390 cases of suppurative lesions of the prostate 53·6 per cent were associated with gonorrhœal prostatitis and 21 per cent were post-gonococcal; the cause therefore was gonorrhœa in 74·6 per cent (Séméniako). Suppuration, as has been already stated, is a common termination of acute prostatitis, but suppuration about the prostate may be due to extraprostatic causes. Clinically these varieties must be considered together.

Pathology.—Suppuration may be (1) Confined to the prostate or be (2) Periprostatic.

1. The prostatic abscess is limited by the capsule of the gland and as a rule follows acute prostatitis. Several varieties are described, depending on the stage that suppuration has reached. First there occurs a follicular suppuration which is almost indistinguishable clinically from acute prostatitis; a further stage of development is marked by the formation of miliary abscesses, and these later coalesce to form the larger prostatic abscesses. A fully developed prostatic abscess consists of at least two or three large and irregular cavities which are separated by delicate partitions. The abscess extends invariably towards the urethra, and in about 70 per cent

of patients ruptures into it. Séméniako found in his series that 22 per cent opened into the urethra; however, he speaks of 44 per cent as undergoing resolution. The extension of the process often destroys the ejaculatory ducts and may reach and involve the seminal vesicles.

2. Periprostatic suppuration is usually an advanced stage of the preceding variety, but it may originate in a vesiculitis or deferentitis, and sometimes accompanies urethritis in the absence of intraprostatic suppuration. Its site is variable; it is usually retroprostatic, but may be supraprostatic, between, or involving the seminal vesicles;

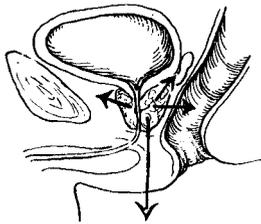


Fig. 69.—Illustrating four routes of extension of prostatic suppuration: towards the vesicles; towards the rectum; towards the perineum; towards the space of Retz.

occasionally it lies lateral to the prostate, when extension may occur towards the ischio-rectal fossa, and, very rarely, an anterior prostatic abscess invades the cavum Retzii (Fig. 69). In the absence of surgical intervention these abscesses open spontaneously in one of the following situations: the rectum, perineum, bladder, ischio-rectal fossa, or the peritoneum, or even through the inguinal canal or obturator foramen on to the surface. Cure usually follows rupture, but the prostate may remain atrophic.

Symptoms and Diagnosis of Prostatic Suppuration.—The subacute and acute abscesses vary in their symptoms.

Subacute Abscess (Desnos).—These abscesses are frequently latent, they may be associated with adenomata of the prostate (Saint-Cène) and then may be impossible to diagnose. In some patients an abscess forms painlessly and increases in size until rupture into the urethra occurs or is caused by instrumentation, the resultant purulent urethral discharge being the sole evidence of its existence.

Rectal findings: Latent abscesses as a rule are encapsulated in the prostate, and their diagnosis depends upon rectal examination, when softening may be felt or when pressure may cause pus to exude from the meatus. In chronic urethral infection the abscess may be discovered when an epididymitis leads to rectal examination, or when investigation is made to determine the cause of an unexplained rise of temperature; its presence may be anticipated more particularly when there is a catheter *en demeure*. Subacute abscesses are found much more commonly in the aged than in younger men.

Acute Abscess.—The symptoms are masked by those of the acute posterior urethritis and acute prostatitis which precede and accompany the condition. The diagnosis of small periurethral, follicular abscesses which open into the urethra may be impossible. As a rule the symptoms of acute prostatitis become intensified with suppuration, pain is severe, the temperature rises, and rigors occur.

Rectal findings: The diagnosis can be confirmed only by rectal examination, when the abscess may be evident as a prominent and very tender swelling, which is tense, elastic, and perhaps pulsating (*Fig. 70*). Palpation, however, may reveal merely a sense of deep resistance or an area of softening surrounded by firm margins situated

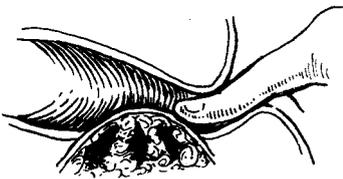


Fig. 70.—Palpation of the prominent swelling of a prostatic abscess.

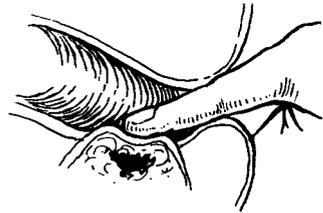


Fig. 71.—A figure to illustrate the rectal findings after discharge of a prostatic abscess per urethram.

in one of the lobes of the prostate (*Fig. 71*). When periprostatic, the foci of suppuration may be discovered laterally, or between or near the seminal vesicles. Diagnosis is particularly difficult when the prostatic outline is obliterated and replaced by an indurated, flat or concave mass stretching across the anterior rectal wall. In such a case of periprostatitis a central abscess cavity is usually present, but it is only demonstrable by the discovery of some small area of softening or by the expression of pus from the meatus, the latter being a point of considerable diagnostic value.

Course of Prostatic Suppuration.—

1. The abscess in rather more than half of the patients opens into the urethra; then pus is passed in quantity at the beginning and end of each act of micturition; the former representing the intra-urethral accumulation, whilst the latter represents the urethral reflux into the bladder itself. Rectal examination determines the disappearance of the swelling.

Many abscesses thus heal spontaneously, but the opening into the urethra may prove insufficient for drainage and various

complications then arise; in a number of patients the cavity persists, connected to the urethra by a fistula.

2. The abscess opens into the rectum, 4·4 per cent (Séméniako), or into both urethra and rectum, 2·9 per cent (Séméniako). The passage of pus on defæcation is as a rule the only sign; the abscess may heal or leave a sinus requiring operative treatment. Simple enlargement of the opening into the rectum may suffice to obtain cure.

3. The abscess reaches the perineum and forms a swelling simulating a urinary abscess or abscess of Cowper's gland, but it has, however, an impulse on coughing, and is reducible, when it may be felt on rectal examination to be a prostatic swelling. Rarely pelvic cellulitis or suppurative phlebitis occurs, and then death may result from pyæmia. Surgical treatment has greatly lessened the mortality, but a fistula is a not uncommon sequel of operation, 11 per cent according to Séméniako, and may be rectoperineal or urethroperineal, the last-named being the more usual variety.

Treatment of Suppurative Prostatitis.—The abscess should be drained and not permitted to discharge as it chooses; incision and drainage may be performed either through the anterior rectal wall or through the perineum. The latter is preferable on all counts as a surgical procedure (Minder, Sargent and Irwin) and the former route has been largely abandoned, although Routier in 1900 reported excellent results gained by making an extensive incision. Prostatectomy has been performed for latent and deep-seated abscesses (Loumeau, Marion), especially when they have been associated with repeated febrile attacks or with prostatic adenomata.

Indications for Treatment.—The acute abscess should always be drained once it becomes obvious that pus is present and also even if rupture into the urethra has occurred, unless complete subsidence follows within a few days; that is to say, operation is advisable if there are systemic symptoms (Séméniako). Palliative treatment until pus formation is evident is always necessary. For the subacute abscess operation may be delayed if retention is absent and the temperature does not rise, but it usually is advisable, again even although rupture into the urethra has taken place. Swan, however, believes that operation for prostatic abscess is needed only when systemic symptoms are marked, and employs frequent gentle massage and hot rectal irrigation. The operation of choice is by the perineal route, for thus it becomes a planned surgical procedure and can be

carried out with aseptic precautions, which are impossible by the rectal route; furthermore, should a urethroperineal fistula result, this is not comparable in gravity to a recto-urethral fistula.

Acute Inflammation of the Seminal Vesicles

The almost invariable involvement of neighbouring and related organs in seminal vesiculitis—for instance, the intimate associations of vesiculitis, prostatitis, posterior urethritis, and epididymitis—renders it extremely difficult to separate vesiculitis as a clinical entity. Our methods of investigation, which are largely limited to rectal palpation, do not lessen our difficulties. Gonorrhœa is undoubtedly the most frequent cause of vesiculitis, but it is equally certain that it is not the only one; staphylococcal and *Bacillus coli* infections are not uncommon, streptococci may be present, and, amongst a number of rare infections, trichomonas may be found (Riba and Perry). In a number of patients it is probable that the primary cause of disease was the gonococcus, but that this organism having died out, the mixed infection, invariable in chronic gonorrhœa, has persisted. Infection occurs by continuity, extension occurring from the posterior urethra and prostatic sinuses, more especially if any obstruction exists in the prostate or urethra. On rare occasions fluids injected per urethram have been observed to enter the vesicles. Infection is stated to occur as frequently in non-gonococcal as in gonorrhœal urethritis.

Acute Vesiculitis (Spermato-cystitis).—

Pathology.—The following varieties are described:—

1. Acute catarrhal vesiculitis.
2. Acute suppurative vesiculitis.
In these two forms the lining mucosa is principally affected, and the contents may or may not be mixed with blood.
3. Acute interstitial vesiculitis. The inflammation extends to and involves the vesicular walls.
4. Acute perivesiculitis. Spread of inflammation has occurred beyond the vesicles.
5. Pseudo-abscess formation. Partial obstruction of the lumen has developed and there is some degree of retention.
6. Abscess or acute empyema. There exists complete obstruction with retention; destruction of the mucosa and of the partitions

with the formation of a pus sac follows. Barney has demonstrated by means of X rays this development of a single cavity.

7. Acute gangrenous vesiculitis. This is a rare variety.

Symptoms.—These are associated with, and difficult to differentiate from, those of acute posterior urethritis. In subacute vesiculitis an increase of urethral discharge occurs, the urine becomes hazy, and micturition is frequent and painful. On rectal examination the vesicle is swollen and tender to pressure, its lumen is increased (Sargent). In acute vesiculitis there develop frequent and painful erections, with blood-stained emissions; frequent, painful, and difficult micturition occurs also, and is associated with tenesmus and terminal hæmaturia; pain and a sensation of weight is experienced in the perineum, and sometimes pain is complained of in the hypogastrium, inguinal regions, penis, rectum, or sacral region. On rectal examination a large distended vesicle, which may be boggy, is found, and this enlargement may be bilateral; often the signs of acute prostatitis are present. In some patients the symptoms of an associated cystitis and posterior urethritis are more apparent, and overshadow those of vesicular origin proper; the latter consist of frequent and painful erections and painful and blood-stained emissions. A rise of temperature is not seen unless the condition is one of acute empyema or perivesiculitis (Jordan Lloyd), or unless there is associated prostatitis or epididymitis, for fever does not appear so long as there is free exit to the inflammatory products. The cavity of the vesicle as outlined by a vesiculogram is diminished, probably because of inflammatory œdema (Sargent). Acute empyema is associated with symptoms of cystitis or sometimes with retention of urine. Swellings sufficiently large to cause rectal obstruction have been recorded (Ritch).

Rectal findings: Two factors are of importance in rectal palpation of the seminal vesicles: first, the length of the examining finger; and secondly, the position of the patient (*Fig. 72*). A short finger is useless either for palpation or massage of a vesicle. Three positions of the patient are of value in examination—first, the kneel-elbow position; secondly, the ‘bend-over’, when the patient stands with the legs straight and bends over a chair or couch; and thirdly, the squatting position, when, squatting over the edge of a couch, he sits upon the examining finger. The last is very valuable in obese patients. In pseudo-abscess the site of the vesicle is tender, and although one or more regular, soft, and small swellings are felt,

the outline of the gland is not distinguishable. The contents can be expressed. In interstitial vesiculitis palpation discovers a thickened and cord-like vesicle lying above the superior border of the prostate. With empyema a large, possibly enormous, and very tender swelling is felt, which may seem to be cystic; the condition is as a rule unilateral. In perivesiculitis a thick, indefinite swelling can be made out, and when more advanced an extensive, ill-defined, very tender, and deeply situated swelling is discovered; it bulges into the rectum and may present areas of softening due to supuration. When associated with periprostatitis the swelling has been felt through the abdominal wall. Jordan Lloyd compared perivesiculitis to peri-epididymitis.

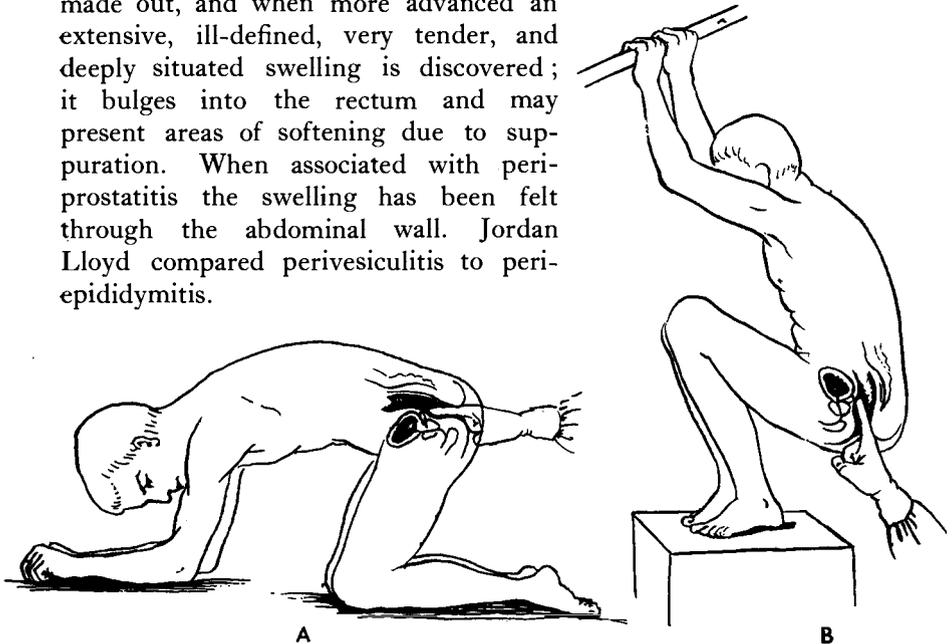


Fig. 72.—A, The knee-elbow position for palpation of the prostate and seminal vesicles; B, The squatting position, of value in a difficult case.

Course and Prognosis.—Subacute vesiculitis may resolve, but both it and the acute variety are frequently associated with deferentitis and epididymitis. Should obstruction occur perivesiculitis may result, and then the prostate also is often involved and fever is present; rarely pyæmia or septicæmia follow. An acute empyema may empty itself through the excretory duct or may rupture directly into the urethra or even the bladder. Chronic vesiculitis often succeeds the acute variety, and sometimes the functional disturbances disappear whilst the rectal findings remain as before.

Complications.—The local complications are cystitis, prostatitis, which is very common, and epididymitis, ampullitis, and deferentitis.

Rupture of the vesicle may take place and pelvirectal abscess (Morrissey), pelvic cellulitis, or peritonitis follow (Henry). Ureteral and renal infections—uretero-pyelo-renal infection (Kartal)—are possible and definite complications. The systemic complications which may arise are arthritis, iritis, osteomyelitis, and pyæmia.

Diagnosis.—Inflammation may be latent, and it is always necessary to examine the vesicles if epididymitis is discovered, or when pain in the spermatic cord or epididymis persists after the subsidence of all apparent signs of inflammation.

Treatment.—The treatment is similar for gonococcal and non-gonococcal infections. Prophylactic treatment consists of the routine treatment of urethritis, and especially of posterior urethritis. In acute posterior urethritis instrumentation must be avoided, as must all local treatment except possibly prostatic and vesicular massage which is practised by some authorities from the commencement of posterior urethritis in order to prevent infection of the vesicles. The treatment of acute vesiculitis itself consists of rest, dieting, and mild purging, with the administration of antipyretics and anti-spasmodics such as aspirin and belladonna. Chemotherapy should be employed and acriflavine or neosalvarsan may be used intravenously. Vaccines are best avoided in the acute stages, as also is massage. If subacute, warm vesical irrigation may be practised. Local treatment should be recommenced only gradually and carefully on subsidence of the inflammation. Acute empyema is dealt with best by early perineal vesiculotomy as first recommended by Jordan Lloyd. In pyæmia or septicæmia it is essential that surgical drainage of the vesicles should be combined with the general treatment.

Acute Epididymitis

That epididymitis in acute gonorrhœa is caused as a rule by the gonococcus itself is accepted by many writers, but a number hold that in chronic gonorrhœa it is rather the associated organisms which are the cause of the epididymitis. Lavenant, for example, finds that in only 25 per cent of cases is the gonococcus the causal organism.

Epididymitis has been noted in 12·4 per cent of 1000 patients with gonorrhœa (Lewin and Böhm), and Stone found a percentage of 4·8 in 900 patients. In a series of 3270 patients with gonococcal urethritis treated at St. Luke's Hospital, Manchester, there were

253 cases of epididymitis, or 7·7 per cent; 83 had developed prior to treatment, and 170 occurred during treatment. Bilateral involvement is found in 10 per cent or less of these patients.

The treatment of acute epididymitis is either palliative or operative. Palliative treatment is by rest, which is preferably in bed, with support and immobilization of the testis, hot sitz baths and hot applications, or, as an alternative to these last, the application of ice or evaporating lotions. Severe pain is relieved by morphia suppositories. Bier's hyperæmia has been employed and daily diathermy applications may be used (Corbus and O'Connor); Walker finds that these give relief. General measures include chemotherapy and vaccines. Additional methods which have been employed include the intravenous injection of sodium iodide (10 per cent) or of various antiseptics.

Operative treatment of epididymitis is indicated when suppuration is demonstrable and if pain is severe, for abscesses heal readily after incision. Many authors, moreover, advise operation for every patient, claiming that pain is lessened thereby and tension relieved, and so the risk of necrosis avoided, whilst resolution is hastened and convalescence shortened. The operations employed include decapsulation or decortication of the epididymis, puncture of the epididymis (Ernst), and the injection of antiseptics into the epididymis (Delbet, Doré, and Desvignes). Epididymotomy, however, would appear to be the method of choice if suppuration is expected.

Decapsulation or Decortication.—The whole epididymis and lower portion of the cord are exposed through a lateral scrotal incision. A cruciform incision is made in the capsule of the epididymis and the flaps outlined are raised by blunt dissection. The wound is closed with drainage. Bailey considers that this simple operation is to be preferred for acute gonorrhœal epididymitis.

Epididymotomy.—The modern operations are based on that of Hagner. Although some surgeons employ local anæsthesia, general or spinal anæsthesia is preferred because of the extreme tenderness of the parts. The scrotal incision is placed laterally at the site of junction of the swollen epididymis and testis, it varies in length with the swelling, from 5 to 10 cm., and may pass obliquely forwards in order to avoid the superficial vessels. The cavity of the tunica vaginalis is entered close to the epididymis. The epididymis is inspected and the testis and epididymis delivered from

the wound, but if the swelling is confined to the cauda, delivery is unnecessary. The epididymis is then probed and if pus is found the openings are enlarged; light pressure aids in emptying cavities, and any abscess cavities found are irrigated with corrosive sublimate solution 1-1000. Hagner closes the tunica vaginalis and leads a gauze drain down to it. The skin wound is closed with interrupted stitches.

Turner's operation possesses several modifications (*Fig. 73*): The incision exposes the epididymis and also some two inches of

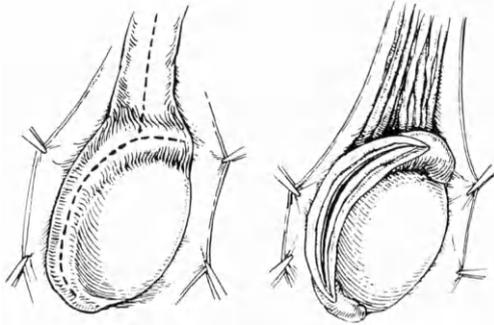


Fig. 73.—Epididymotomy. The exposure as effected by Turner.

the spermatic cord. The cord and epididymis are freed from adhesions and the ductus isolated a short distance above the testis; it is incised and probed with a silkworm-gut suture in the direction of the vesicle. If pus is present in its lumen or if it is not patent the suture is left in position and its end brought out through the

upper angle of the wound. Next the tunica vaginalis is opened; if there is an effusion it is further incised and treated by eversion as for hydrocele, the edges being left free to retract. The epididymis now is exposed and its sheath incised longitudinally and elevated by blunt dissection; this is an important step in the relief of tension. Finally the epididymis is probed with a sharp-pointed instrument over its whole extent. A drain is left within the sheath of the epididymis, which is closed about it. The silkworm-gut suture is removed on the third day.

It must be remembered that in this operation the duct of the epididymis may be divided, when sterility will follow if the opposite organ is already sterile.

Arthritis

Arthritis usually occurs as a hydrarthrosis of one of the larger joints, most commonly the knee-joint, but sometimes as an acute arthritis affecting more than one of the large joints, and, rarely, as a fulminating suppurative arthritis. A serofibrinous effusion is

met with occasionally in an intermediate type, whilst another form is described by Wanderer as gonorrhœal articular cellulitis. An uncommon variety is polyarthritis deformans in which the small joints of the fingers and toes are affected. When one of the large joints is involved it becomes swollen and tender and pain is complained of, especially on movement; on examination the skin may be reddened and an effusion is discovered—aspiration withdraws a cloudy fluid, but if suppuration is present pus of a greenish tinge is found, and from this the gonococcus may be isolated if care is taken. Such patients also give a positive complement-fixation test. There is a peculiar tendency for intra-articular adhesions to form and for ankylosis to result; when multiple small joints are involved permanent crippling effects are sometimes marked.

Strominger states that a gonococcal bursitis of the periarticular bursæ is relatively common and may be associated with arthritis. The bursæ most commonly affected are those of the wrist, foot, and about the great trochanter.

Treatment.—General treatment includes chemotherapy and also vaccines, which are of definite value. Local treatment of the affected joints comprises rest combined with carefully regulated active movement, whilst if a large effusion is present aspiration followed by elastic pressure may be required. As arthritis is almost invariably associated with vesiculitis or prostatitis, particular attention to these conditions is needed once the acute arthritis has subsided sufficiently to permit of active measures. Their treatment consists in massage per rectum together with *grand lavage* (Janet), or vasostomy and the injection of antiseptics (Belfield).

Gonococcal myositis has been discussed by Rubi. He describes, first, a mild form, sometimes a polymyositis which subsides satisfactorily; secondly, a phlegmonous type usually limited to one muscle; and, thirdly, a suppurative type which attacks several muscles. The treatment is symptomatic.

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*CHAPTER VII***CHRONIC URETHRITIS AND ITS COMPLICATIONS****CHRONIC URETHRITIS**

It is not possible to say definitely when an acute gonorrhœal urethritis becomes chronic, but it is usual to assume that the chronic state has been reached if after a lapse of three months cure has not resulted. This estimate is, however, probably too short, and when selecting an arbitrary figure six months is a more satisfactory period. Chronic gonorrhœa may be latent, the only sign being a small 'morning drop' or gleet, perhaps unnoticed by the patient, or a few shreds in the morning urine. It is almost certain that a chronic urethritis does not persist except in the presence of some complication or persistent focus of infection. The intimate relationship of the prostate and posterior urethra is the obvious reason why prostatitis is the commonest lesion associated with chronic urethritis, although another focus almost as common is chronic vesiculitis, which again frequently includes some degree of prostatitis; more rarely an infected colliculus seminalis and utriculus is the source of a chronic infection. The anterior urethra is overlooked at times when seeking such foci, but urethroscopy may demonstrate chronically inflamed glands, Littritis, or the infection may be latent in Cowper's glands. The findings in the anterior urethra have been described by Motz. A chronic infection of Tyson's glands or of a para-urethral duct is a fertile source of persistent reinfection. Evidence of these various complications must be searched for always, and when found thoroughly treated. In order to make the diagnosis, investigation must include microscopical and cultural examination of the contents of the prostate and vesicles after their expression by massage per rectum, but it is not sufficient to be content with a negative prostatic bead; instead or in addition a specimen of urine passed immediately after massage should be centrifugalized and examined, and pus cells, not previously evident, are then sometimes found in quantity. Rectal palpation by an educated finger can be most valuable, and indeed

may discover a closed vesicle when other methods fail. Sperm culture is advised by a number of authors who state that gonococci may be cultivated from a condom specimen of semen when undiscoverable by other means. The anterior and posterior urethroscopes must also be employed, and the former may reveal infected follicles or an early stricture (induration), whilst at times the swelling caused by a blocked and dilated duct of Cowper's gland is identified. The cysto- or posterior urethroscope (*Fig. 74*) may demonstrate a distorted colliculus and infected utricle, or pus may be seen to exude from the prostatic sinuses or ejaculatory ducts, especially on pressure per rectum. Wolbarst's glass tests are valuable in indicating the source

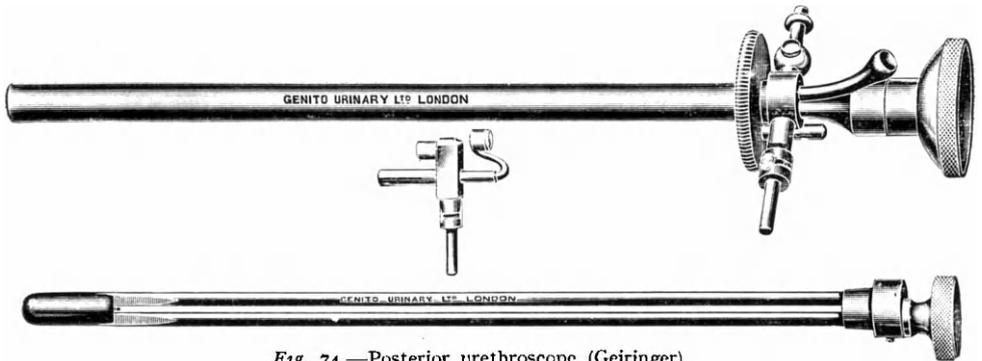


Fig. 74.—Posterior urethroscope (Geiringer).

of infection and as a preliminary to the foregoing examinations. His five-glass catheter test is performed as follows: "The patient comes with a full bladder. The anterior urethra is washed out carefully until the washings come clear (Glass 1); this gives us the debris from the anterior urethra. Further washing of the anterior urethra gives us a 'control' glass (Glass 2). A fine soft catheter now is introduced into the bladder and an ounce of the bladder urine drawn off into Glass 3; this gives us the bladder urine, uncontaminated by contact with any part of the urethra. If this urine is clear, we know positively that the bladder and upper urinary tract are normal. The catheter is withdrawn and the patient voids an ounce of urine into Glass 4; this gives us the debris washed from the posterior urethra. The prostate now is massaged and urine voided into Glass 5; this gives us any pus that may have been expressed from the prostate." The test may be elaborated further by endeavouring to express the contents of the prostate and vesicles separately.

Should the urine withdrawn by catheter not be clear, the bladder is washed clean and 5 or 6 oz. of fluid left in, and the test is then proceeded with.

When complications exist, symptoms arising from them are often present, but just as frequently there are apparently none. Chronic prostatitis and chronic vesiculitis are of the greatest importance and the value of a careful rectal examination must be emphasized again, for on this, together with the examination of the contents of these glands, diagnosis depends. Chronic Cowperitis, colliculitis, and infected urethral follicles can be diagnosed accurately only by



Fig. 75.—Inflammation of the posterior urethra. A view through the panendoscope. The verumontanum (colliculus) is distorted, there is adherent debris, and the mucosa is red and rough in appearance.

the use of the urethroscope. The colliculus seminalis when chronically inflamed may give a varied picture (*Fig. 75*): it may be merely hyperæmic, or erosions or polyps and granulations may be present; or it may have become fibrosed, pale, and shrunken. Tyson's glands should not escape investigation.

CHRONIC PROSTATITIS

Chronic inflammation of the prostate frequently develops insidiously after gonococcal urethritis, although at times it may follow acute prostatitis or prostatic abscess.

Ætiology and Pathology.—Invasion of the prostate occurs by direct spread of infection from the urethra. Marion describes three

varieties of chronic prostatitis which can be recognized on histological examination of the gland: In the first the glands are dilated and plugged with epithelium and leucocytes, whilst the interstitial tissue is œdematous and infiltrated by leucocytes; in the second a number of small abscesses surrounded by fibrotic tissue are present; and in the third there is marked fibrosis of the prostate, with cystic dilatation of the glandular acini.

Symptoms.—The symptoms of chronic prostatitis are often unobtrusive and usually lack distinguishing characteristics. The disease therefore, although common, may pass unnoticed or at least undiagnosed, and it may be impossible to differentiate from chronic vesiculitis; indeed, the two conditions often coexist.

The local symptoms can be separated into four groups: (1) Pain; (2) Symptoms of chronic urethritis; (3) Disturbances of micturition; and (4) Disturbances of the sexual function.

1. *Pain.*—The patient complains of various aches and pains which are felt in the perineum, rectum, urethra, or penis; frequently they are described as a vague sensation of tightness or weight in the perineum or rectum.

2. *Symptoms of Chronic Urethritis.*—A urethral discharge may be present, often seen as a 'morning drop' or stickiness of the meatus, but sometimes invisible and only appearing as threads or debris in the urine.

3. *Disturbances of Micturition.*—There may be frequency of micturition, especially diurnally, and the patient may suffer from a constant desire to micturate although cognizant that the call does not originate in a full bladder. Desire may be so sudden and intense that pain is experienced and the act becomes almost reflex; sometimes difficulty is experienced in initiation of the act, and the stream is feeble. Janet and also Goldberg have described complete or partial retention as an effect of chronic prostatitis.

4. *Disturbances of Sexual Function.*—There may be partial or complete impotence, erection may be incomplete, or sensation diminished. Ejaculation is often premature and occurs before erection is complete; perineal pain may be experienced during ejaculation. Nocturnal emissions are frequent.

None of these signs and symptoms are peculiar to chronic prostatitis, but may be present also in disease of the bladder, urethra, or seminal vesicles. A number of symptoms have been attributed, possibly justly, to disease of the verumontanum, although more

probably an exaggerated importance has been attached to this minute structure. It must be remembered that coincident chronic posterior urethritis and chronic vesiculitis are often present, and that recurrent attacks of urethritis may be the result of infection from the prostate. It is well to bear in mind that pyuria and albuminuria of apparently obscure origin may be due to chronic prostatitis.

Systemic manifestations are unusual and few, but a crippling arthritis may have its source in the prostate, and this focus may

remain undiscovered for many years. Another, unfortunately common, complication is neurasthenia, which is often extremely marked; the patient, even when cured of prostatitis, wastes his time and substance in seeking treatment for imaginary ailments. It has been stated that these neurasthenic symptoms are the result of lesions of the verumontanum (Wossidlo).

Rectal Findings.—It may be found: (1) That the prostatic outline is well defined; or (2) That its outline is obscured in part or as a whole.

1. The prostatic outline is well defined: The findings are most variable, for sometimes no abnormality can be detected by the examining finger or its existence is overlooked because too thick a finger-stall is employed. More often various abnormalities are discoverable; either one lobe or the whole prostate may be swollen, soft and boggy, or areas of vague

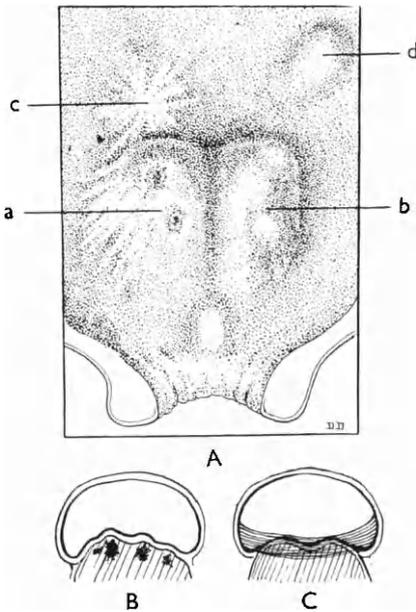


Fig. 76.—Representing the findings of palpation in chronic prostatitis. **A**, In the left lobe are areas of induration and the left lateral gutter and prostatic margin are obscured by scarring (a). The right lobe is irregular and nodular (b). The diagram shows also an indurated plaque at the site of the left vesicle (c), and a distended right vesicle (d). **B**, Nodular indurations of the prostate distort its normal outline. **C**, The prostatic contour is obscured by fibrosis and its surface is concave, the lateral gutters having been obliterated.

induration, few or many in number, may be present, and these are occasionally nodular and projecting; the gland itself may not be enlarged but be of normal size or small and irregular. (*Fig. 76.*)

2. The outlines of the prostate are obscured: This finding in chronic prostatitis most commonly indicates fibrosis the result of an acute suppurative prostatitis and periprostatitis. The normal prostatic projection may have disappeared and the gutters on either side become obliterated so that the anterior rectal wall feels flat or even concave (*Fig. 76, C*). When the organ is not affected as a whole indurated bands may be felt extending laterally from the prostate. In chronic periprostatitis induration is always present.

Diagnosis.—Attention having been directed to the urogenital system, the diagnosis of chronic prostatitis is made by:—

1. Rectal examination (described above).
2. Microscopical examination of the prostatic fluid expressed by massage in order to search for pus cells; the amount of fluid expressed is often grossly increased.
3. Exclusion of disease of other structures which may give rise to a similar train of symptoms.

Course and Complications.—Untreated the condition may persist unaltered for many years, but often it varies from time to time, the discharge alternately increasing and decreasing, with perhaps slight coincident disturbances of micturition. Sometimes severe exacerbations occur, infection spreads from the prostate, and acute urethritis, perhaps with epididymitis, results; these bouts are often initiated by coitus, indulgence in alcohol, or exposure. A patient may become crippled by an arthritis associated with a long-standing prostatitis. Retention of urine at times occurs, exposing the patient to its various risks. The condition has been accused of being a precursor of prostatic enlargement in later life, but this view is not accepted at all widely.

Treatment.—

General.—Treatment should include general as well as local measures. An open-air life with plenty of exercise is valuable both in improving the patient's general condition and in distracting him; riding and bicycling, however, are forbidden. The patient must be reassured if introspective, and attention directed from his trouble if possible; at the same time tonics are administered and constipation prevented; cold bathing is said to be useful. Chemotherapy and vaccines should be employed. Sexual intercourse is stated to be beneficial rather than harmful, but the risk of transmission of infection is a contra-indication to this.

Local.—As an essential principle it is first necessary to treat any causative condition or to carry out the treatment of this simultaneously with that of the prostate. Various methods of treatment directed to the local prostatitis are employed:—

1. *Prostatic massage*: Massage is performed best with the gloved finger, although various instruments have been devised for this purpose. The patient is preferably in the genupectoral position, but may stand and bend over a chair or couch. The right index finger suitably lubricated is inserted into the rectum and the prostate is palpated; massage is carried out by working from above downwards and from the periphery towards the central portion of the gland, so that the contents are expressed towards and along the urethra. At first pressure is light and the patient experiences a novel feeling, often translated as discomfort but not pain, at least in chronic prostatitis, and with but few exceptions massage should be restricted to chronic inflammation. At later sessions when custom has established tolerance, greater pressure may be exerted; opinions, however, differ as to whether full force should be exerted or not—probably not, save in exceptional instances. After massage the patient micturates in order to flush the urethra, and then instillations or lavage, which are referred to hereafter, should be carried out. Each massage lasts from two to five minutes and should not be done more than twice, or perhaps thrice, weekly, although some authorities recommend it daily. It is necessary to remember that in the neurasthenic, prostatic massage may become a habit.

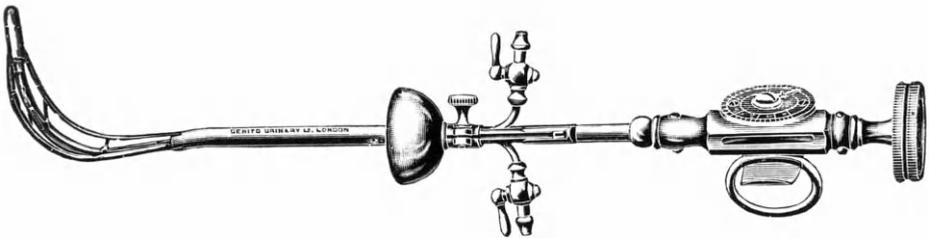


Fig. 77.—The curved Kollmann dilator for use in the posterior urethra.

2. *Massage by the urethra*: Extreme dilatation of the prostatic urethra compresses the gland and expresses the contents of its ducts; this may be accomplished by the passage of large sounds or by dilators such as that of Kollmann (*Fig. 77*); this latter instrument dilates the prostatic urethra principally and therefore allows of

greater dilatation than sounds, which cannot be larger than the narrow meatus through which they must pass. Dilatation should be gentle and gradual.

3. *Urethral applications*: These may be either by *grand lavage* or by instillation into the posterior urethra.

4. *Rectal applications*: Hot or cold applications to the prostate may be made by the recurrent rectal douche.

Electrolysis and also diathermy are used, but the results are not striking; Cumberbatch found for the most part that disappearance of pus cells could not be obtained by this method.

5. *Operative treatment*: This is reserved usually for chronic prostatitis associated with retention, and is, for choice, carried out either by perurethral methods or by the perineal route. Luys utilizes the urethroscope to lay open cavities when these are found.

CHRONIC VESICULITIS (SPERMATO-CYSTITIS)

Chronic vesiculitis may be described as either open or closed; in the former type drainage is free, in the latter there is retention because of obstruction of the lumen and duct. In both types the vesicles are enlarged, usually with infiltrated walls and thickened mucosa; nevertheless atrophy of the mucosa is sometimes encountered in association with the dilatation which results from retention. The contents of the inflamed vesicles consist of mucus containing organisms, epithelial debris, and dead spermatozoa.

Pathology.—The open type (*chronic suppurative vesiculitis*) is common in gonorrhœa and is often symptomless. Gonococci may disappear but leave a mixed infection, and spontaneous cure is slow. The quantity of pus present is as a rule small; nevertheless the condition apparently depends on inadequate drainage. The infected vesicle is often a source for reinfection of neighbouring organs, causing prostatitis, epididymitis, and urethritis; sometimes a perivesiculitis develops, which either may suppurate and rupture into the bladder or rectum on rare occasions or result in fibrosis with the formation of adhesions between the rectum, bladder, prostate, and vesicles, or even the peritoneum. Suppuration may terminate in cure should the abscess rupture and discharge freely.

The closed variety may take the form of either *chronic empyema*, in which the block is frequently incomplete, or *chronic fibrous vesiculitis*, in which the vesicle shrinks, atrophies, and hardens, even

becoming calcified (George). Additional foci of infection are as a rule present in the prostate, and there is sometimes an associated fibrous perivesiculitis with multiple adhesions and the formation of numerous hard plaques.

Symptoms.—The symptoms are most variable, and are rather those of infection than of inflammation. Slight urethral pain may be the complaint or a ‘morning drop’ is noticed, which becomes exaggerated with alcohol, fatigue, or coitus. Urinary symptoms which may be present are frequency, most marked at night, and pain, which may be experienced at any stage of the act of micturition. Not infrequently a small amount of residual urine is present. Painful ejaculation and intimately mixed hæmospermia are valuable as diagnostic points, but are not pathognomonic. Amongst other sexual disturbances which sometimes occur are premature ejaculation, delayed and slow emission, loss of sexual desire, partial impotence, and azoospermia. Frequent emissions, sometimes termed spermatorrhœa, are caused by excessive vesicular contractions and the vesicle sometimes ‘vomits’ its contents; more usually there is simply pyospermia. Vesicular colic (Reliquet) may occur; this is a painful spasm felt deeply in the perineum and rectum and radiating to the penis, inguinal canal, and testis; it follows sexual excitement unassociated with ejaculation. Testicular discomfort is not uncommon, and other vague pains, either deep or superficial, may be complained of; their distribution includes a wide area, for they may be experienced in any part of the external genitalia, urethra, perineum, groin, inner aspect of the thigh, hypogastrium, or sacroiliac region. Rarely inflammatory involvement of the ureter causes reno-ureteral pain and even colic. Systemic symptoms are rare and the general health is affected little if at all, but sometimes arthritis and rheumatism and, rarely, relapsing febrile attacks, or various neuroses, develop (Luys).

Rectal Findings.—On examination both sides should be carefully compared. The vesicles, which may be tender or not, may present any of the following characteristics or may appear as normal: (1) Large, not indurated, and emptying readily on massage; (2) Large, rounded, somewhat indurated, and emptying partially or not at all on pressure; (3) Indurated and cord-like, possibly with cystic enlargements or perhaps hard plaques, and often associated with areas of softening possibly indicating perivesiculitis (*Fig. 78*). In the presence of vesiculitis the mobility of the parts, including the

rectal wall, is diminished by the formation of adhesions. When there is prostato-vesicular obstruction the resultant mass, which may or may not suppurate eventually, is impossible of differentiation.

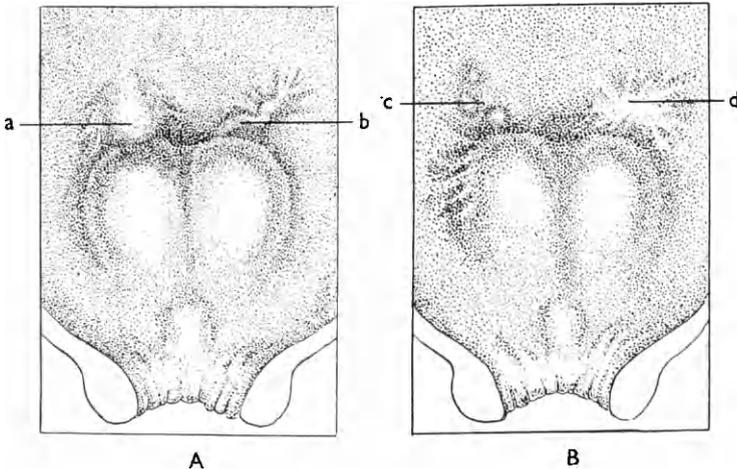


Fig. 78.—A representation of the findings on palpation in chronic seminal vesiculitis. **A**, At the site of the left vesicle is an ill-defined swelling (a), the right vesicle is felt as a fibrous cord (b). The prostate is normal. **B**, Some small nodules are palpable at the site of the left vesicle (c), on the right side an indurated plaque is felt (d). Scarring of the left lateral prostatic gutter is illustrated.

Diagnosis.—The expression of the vesicular contents and their microscopical examination or that of a condom specimen of semen aids in diagnosis. Posterior urethroscopy may afford a definite diagnosis if pus exudes or can be expressed from the ejaculatory ducts, but the 'mirror of the vesicles', the verumontanum, reflects the condition of the posterior urethra rather than that of the vesicles. Nevertheless Luys asserts that a tender verumontanum can be diagnostic of a concealed vesiculitis. He describes a sharp characteristic pain which is experienced by these patients when an acorn-tipped bougie impinges on the verumontanum.

Epididymitis, though often associated with vesiculitis, does not necessarily point to vesicular infection. Vesiculography, either by vas puncture (Belfield) or by catheterization of the ejaculatory ducts (Young and Waters), is more useful as a means of treatment than as an aid to diagnosis. In long-standing retention the vesicle, ampulla, and ejaculatory ducts show dilatation, but with fibrotic contraction there is marked decrease in, and even obliteration of,

the lumen (Sargent). Asymmetry of the two sides is of significance as evidence of disease (Yamamoto and Kojima).

Treatment.—Treatment of the vesiculitis must be both general and local. General treatment includes chemotherapy, the institution of a strict régime, and general hygienic measures; vaccines are of value, and French writers have claimed excellent results from the use of acriflavine injected intravenously.

Local treatment may be considered under the headings of conservative and operative measures. The former consist of massage of the vesicles together with *grand lavage*; massage empties the vesicles, stimulates them to contraction, and produces hyperæmia; possibly resorption occurs with the production of active immunity; *grand lavage* removes debris and prevents urethral and prostatic infection. Diathermy of the vesicles, employing a rectal electrode, may possibly be of some value. These local measures are embarrassed by the inaccessibility of the vesicles; complete emptying is not always obtained by massage, which moreover does not fully reach the ampullæ, and general measures are only accessories to treatment, although chemotherapy may be of great importance.

Operative treatment includes a number of procedures which may be practised under varying conditions: *Vasostomy* or *vas puncture* (Belfield) consists of the injection of antiseptics through the ductus deferens by means of a scrotal approach. The method is not always effective, and fails in the presence of a stricture of the ductus; complications of this procedure include leakage and infection of the wound, destruction of the mucosa with the subsequent formation of a stricture of the ductus, and fistula of the ductus deferens. The operation has a number of enthusiastic supporters and is worthy of trial in rebellious cases before proceeding to radical measures. The *injection of antiseptics through the ejaculatory ducts* (Young), utilizing the cysto-urethroscope, is technically difficult, can be impossible for anatomical reasons, and often fails; various complications such as epididymitis may result, and it is therefore a method to be attempted only by the skilled technician. It is true that fluids so injected reach the vesicles and not the ampullæ of the ductus alone (McCarthy, Ritter, and Klemperer).

Vesiculectomy is a final and radical treatment to be resorted to only when other procedures have failed after prolonged trial. It may be accomplished by the perineal (*Fig. 79*), the ischiorectal, the

transperitoneal (Wilhelm), or the suprapubic route ; when the last is selected prostatectomy is sometimes carried out in addition.

Vesiculotomy (Jordan Lloyd, Fuller) by the *perineal route* is reserved for either acute or chronic empyema of the vesicles, and the operation renders a subsequent vesiculectomy almost impossible.

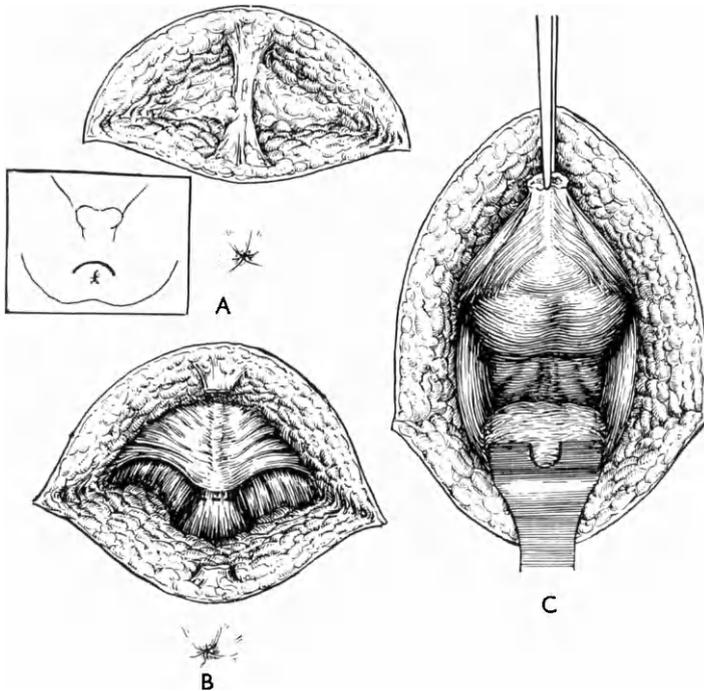


Fig. 79.—Perineal exposure of the prostate and seminal vesicles. **A**, The curved incision in front of the anus exposes the central tendon of the perineum. Inset is shown the skin incision. **B**, Division of the tendon and deepening of the wound exposes anteriorly the superficial transverse perineal muscles and bulbocavernosus, and, more deeply posteriorly, the recto-urethralis muscle. **C**, After division of the recto-urethralis and further blunt dissection the membranous urethra, prostate, and, deeply, the ampullæ and vesicles covered by fascia, are exposed. Posteriorly is the anterior rectal wall.

Operative measures should not be resorted to until, in the presence of definite local symptoms and findings, other methods have failed after reasonable trial.

Technique of Vasostomy (Belfield).—The following technique of vasostomy is based on the method recommended by Kidd (*Fig. 80*). Either local or general anæsthesia is utilized ; the ductus deferens is palpated within the cord as it leaves the scrotum, the cord is

gripped between the examining fingers, brought near to the surface, and cut down upon through a small incision; Hinman fixes the cord by passing a curved needle beneath it. The ductus is then isolated, carefully freed from the surrounding tissues, and delivered from the wound, an instrument being passed under it. It is cleared of all connective tissue and a minute longitudinal incision made into

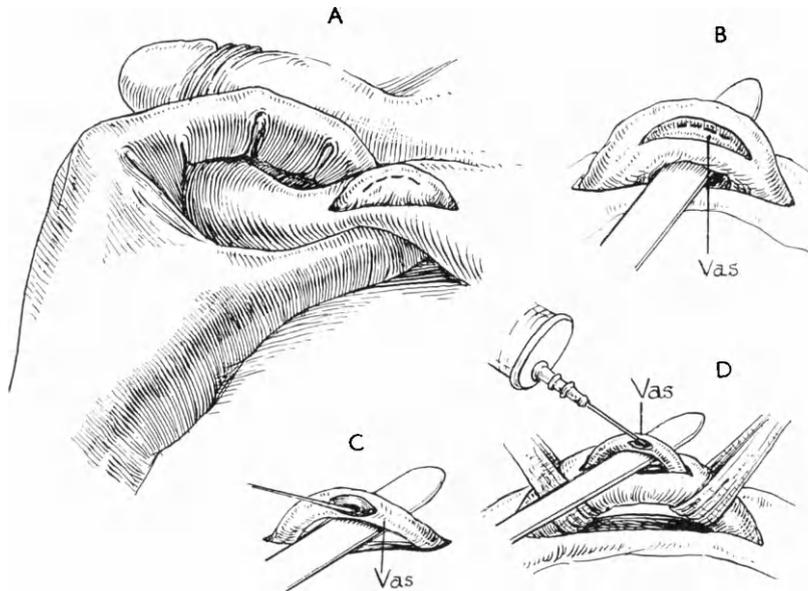


Fig. 80.—The operation of vasostomy. A, The cord, gripped by the fingers of the left hand, protrudes from the upper scrotal incision. The line of incision of its coverings is indicated. B, The ductus deferens has been exposed. C, The ductus has been isolated, incised, and is being probed with silk worm gut. D, The injection is being made.

the lumen with a small sharp-pointed knife; a piece of silk worm gut is passed along the ductus towards the vesicle as a probe in order to demonstrate its patency, for stricture makes failure certain and is a contra-indication to further proceedings. If patent, gauze is packed beneath the ductus and a blunted hypodermic needle introduced proximally into its lumen. The injection of some sterile water then will confirm the test of patency, but this step may well be omitted, and the slow injection of 10 c.c. of thymol iodide* (Belfield and Rolnick), or of the same amount of a 5 per cent solution

* Thymol iodide 10 g. stirred with 30 c.c. cod-liver oil.

of colloidal silver (protargol), or of 20 per cent silver protein (Thomas), is carried out; in the absence of obstruction this should flow easily. Two fine catgut sutures through the outer coats of the ductus close the incision, and it is then dropped back into the cord and the skin sutured. The patient should remain in bed for from three to four days in order to avoid a possible epididymitis. Cure, it is claimed, commonly follows a single injection, if the solution enters and remains in the vesicle as shown by its non-appearance in the urine for some days. A second injection may be necessary, and, if so, the operation is repeated, a new site for incision of the ductus deferens being selected.

Indications : The indication for this procedure is a chronic and obstinate vesiculitis.

Comments : It has been shown that as a rule fluid injected along the ductus enters the vesicle (Roper), and a successful injection of colloidal silver may be confirmed by X rays. Stricture of the ductus is a possible complication, but need not weigh against the operation when disease is unilateral; even bilateral injection is probably justifiable when the condition is of long standing and resists other forms of treatment, for a possible risk of sterility is to be preferred to its almost certain presence. The side of disease, if unilateral, is of course demonstrated by rectal examination.

CHRONIC EPIDIDYMITIS

An *acute* epididymitis may arise with the same facility in chronic as in acute urethritis. Its treatment has already been considered (*see* p. 105).

Chronic epididymitis is rare and almost always follows on an acute inflammation; nevertheless, very uncommonly, the process may commence and persist as a subacute or chronic process. The causal organism is sometimes the gonococcus, when small thick-walled abscesses are found, but more often it is due to one of the organisms of the mixed infection which is invariably present in chronic gonorrhœa. The fibrosis of gonococcal epididymitis tends to persist as a nodule near the cauda epididymis, and not infrequently obliteration and stenosis of the duct results. Other foci of infection are always present and equally require treatment. Treatment directed to the epididymis may be operative or non-operative; the latter includes rest and support and strapping of the testis and epididymis,

which affords pressure as well as additional rest; diathermy may be utilized. Chemotherapy and vaccines should again be employed. Surgical measures include epididymotomy, and vasostomy may be performed at the same time so that infection of the vesicle may be treated.

TREATMENT OF CHRONIC URETHRITIS

Routine treatment of the concomitant urethritis is essential, and must accompany those other measures which are directed against the persistent focus of infection, for otherwise reinfection and spread of infection will occur. This treatment consists either of Janet's *grand lavage* or of instillations into the posterior urethra through the Ultzmann catheter and syringe. The former method has been described already; various lotions can be employed, and amongst

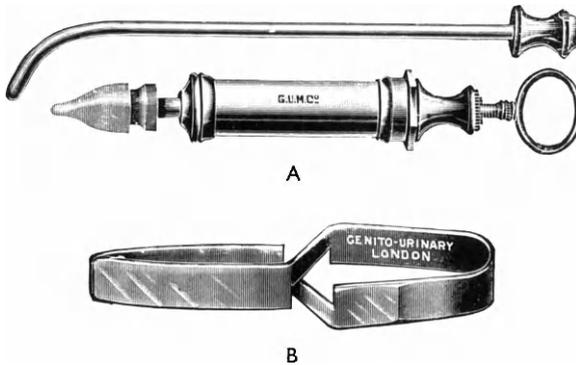


Fig. 81.—A, The Ultzmann syringe and catheter.

B, Penile clamp (Thomson-Walker), useful for retaining intra-urethral instillations.

the more serviceable are potassium permanganate 1-6000, silver nitrate 1-10,000, and oxycyanide of mercury 1-4000. Irrigation should be performed daily and should always follow such procedures as prostatic and vesicular massage. The latter method is effected by the passage of the Ultzmann catheter nozzle (Fig. 81, A), the point of which just enters the posterior urethra, and the introduction of 2 to 4 c.c. of silver nitrate $\frac{1}{4}$ per cent, $\frac{1}{2}$ per cent, or $\frac{3}{4}$ per cent, or of neoreargon or other silver preparation into the posterior urethra. Instillation may be practised every third day and is best preceded by prostatic massage. Wolbarst holds that daily instillations into the anterior urethra are of value in that, in addition to preventing

infection of this region, they also medicate the posterior urethra. It is evident that urethral treatment, however long continued, will fail unless the associated foci of infection are discovered and treated at the same time. The general régime is similar to that described for the acute form of the disease, and must be adhered to in spite of the difficulties which often arise from the prohibition of alcohol and sexual intercourse. Chemotherapy should be utilized, and mixed vaccines of the detoxicated variety are of value in supplementing local treatment, whilst fever therapy must not be forgotten (Elkins and Krusen).

TREATMENT OF OTHER COMPLICATIONS

The treatment of chronic prostatitis, chronic vesiculitis, and chronic epididymitis has been considered. It remains to call attention to that of some other complications.

Chronic Tysonitis.—A chronically inflamed Tyson's gland is best dissected out in its entirety; alternatively silver nitrate fused on to a fine needle or probe may be directly applied and the infected tissues destroyed, or the electric cautery or diathermy needle can be used instead. Similarly the para-urethral ducts are excised, laid open, or cauterized.

Littritis.—Infected urethral follicles are treated by the direct application of 10 per cent silver nitrate through the anterior urethroscope. Minute abscesses and retention cysts may be emptied or ruptured by massage of the urethra over a large metal sound introduced into the urethra.

Cowperitis.—Cystic dilatations of the ducts which protrude into the urethra may be incised through the urethroscope. Massage is useful when the duct is pervious, but sometimes it proves necessary to dissect out the infected gland through the perineum.

Colliculitis.—The treatment of colliculitis is by the application of 5 per cent silver nitrate through the cysto-urethroscope, together with prostatic massage and treatment of the associated prostatitis and posterior urethritis.

STANDARD OF CURE OF URETHRITIS

There is no rapid method of determining cure; time is the best test. Cure therefore is not accepted unless satisfactory tests are obtainable throughout a period of six months after the cessation

of treatment; and before the final test a return to alcohol may be permitted. The following modification of the two-glass test has proved satisfactory: The patient holds water for three hours prior to examination; he then passes the first specimen, and after prostatic and vesicular massage the second; both urines are at once centrifugalized and examined microscopically, the average number of pus cells in a field being reported. To establish a cure the number of pus cells to a microscopic field in the second glass should not be above 3, in a few patients 4 or 5 are permissible, but the ideal is nil in both specimens. The test should prove satisfactory on at least four occasions during the six months' probation. The value of the complement-fixation test for gonorrhœa has not been determined accurately as yet (Price). A positive test is found to be of considerable value in an established gonorrhœa and in its complications; a single negative test is worthless alone as a test of cure because an 'open' infection may give a negative result.

Some authorities advocate a provocative dose of vaccine before final discharge, others a routine urethroscopic examination, and yet others the use of a Kollmann's dilator; however, such partial investigations are not advised here, for if embarked upon there would seem to be no point in not continuing them and making as complete an examination as possible on the lines described under the diagnosis of chronic gonorrhœa. Dilatation of a possibly normal urethra with the Kollmann instrument is to be condemned as a brutal, if not actually harmful, procedure. The test described above, repeated over a period of time and combined with a careful rectal examination, is quite sufficient to indicate whether further investigation is necessary. It is rare indeed to find that cure as thus determined is not confirmed by the stern test of sexual intercourse.

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CHAPTER VIII

STRICTURE OF THE URETHRA

AN acquired stricture of the urethra is a narrowing of the urethral canal as the result of changes in its walls caused either by inflammation or by trauma.

The result of such injury, whether inflammatory or traumatic, is scarring, and the fibrous tissue which develops exhibits the contraction which is the inherent property of all scar tissue, and thereby produces a narrowing of the urethral lumen. This narrowing is a slowly progressive change which, as it increases, causes a series of phenomena in the urinary tract as the result of the obstruction to micturition and of the infection with which it is so often associated. A urethritis is a factor in the production of an inflammatory stricture, and later it coexists with the stricture as a chronic condition; frequently traumatic strictures are free initially from sepsis, but in the later stages sepsis is invariable and indeed freedom from infection is rare in any injury of the urethra.

Actiology.—Traumatic rupture of the urethra is followed inevitably by stricture development, and, if neglected, leads to a most intractable variety. Sometimes in these neglected cases the continuity of the urethral canal is completely obstructed from the moment of injury and can only be restored by operation, the urine meantime escaping through fistulæ which are either the result of urinary extravasation or of the operative treatment of the injury.

Inflammatory fibrosis causing stricture is in the great majority of patients of gonorrhœal origin, and Campbell states that its formation depends rather on the severity of the original urethritis than on its duration. It also may be the result of syphilitic ulceration of the meatus (Casoli) or, rarely, of simple urethritis. Campbell, studying 1224 cases of stricture, found that more than 90 per cent were of inflammatory origin; Thompson found that of 220 cases about 75 per cent were gonorrhœal in origin, 12·7 per cent traumatic, and 1·4 per cent syphilitic. Of 103 patients with urethral stricture who attended the Salford Royal Hospital, 16 were of traumatic and 87 of venereal

origin; of these 87 inflammatory strictures 2 were meatal strictures due to syphilitic chancres, and the remaining 85 were almost certainly the result of gonorrhœa.

The production of a stricture is a process demanding not merely months but years, and of 126 men questioned at the Salford Royal Hospital as to the dates of their gonorrhœal infection and of symptoms, the minimum intervening period was 2 years, whilst the most remote case required 35 years to develop symptoms; an average for this series was 12 years. Thompson found that symptoms developed rather earlier than this in most of his patients, and Keyes finds that symptoms arise in a very much shorter period, but his early symptoms are those of catarrh, not of obstruction, and, while such symptoms are present in all strictures of inflammatory origin, all patients with chronic urethritis do not develop stricture.

Pathology.—

Traumatic Stricture.—The formation of a traumatic stricture is easily understood as the natural sequence of a wound healing by the formation of scar tissue. The area of the resultant fibrosis depends partly on the extent of the urethral injury—partial, total, or complete rupture—and partly on the presence or absence of sepsis, but it is largely influenced by the treatment adopted or by the lack of it. A complete rupture with separation of the urethral extremities must, if not repaired, result in a long tunnel of fibrous tissue when the lumen re-forms, whilst a rather less marked fibrosis follows a total rupture without separation, and less again in the partial varieties of rupture. Successful suture of a urethral wound, if uncomplicated by sepsis, results in a circular scar of minimal width or length. Complete, total, and interstitial ruptures of the urethra must result in fibrosis of the surrounding cavernous tissue, which in the first two varieties named is additional to that of the mucosa.

The site of a traumatic stricture is most often in the perineal urethra, and next in frequency in the membranous urethra, whilst the penile urethra is involved the least commonly. A traumatic stricture is single, and some 10 of every 100 strictures are due to trauma (Campbell).

Inflammatory Stricture.—It has been accepted generally (Wassermann and Hallé) that the sequence of events in the formation of a stricture is as follows: gonococcal urethritis; chronic inflammation; soft infiltration; and then hard infiltration with irregular spread of fibrosis into the tissues, leaving the urethral channel at first of

wide bore but later with contraction giving rise to symptoms. Campbell's statement that stricture formation would seem to depend chiefly on the severity of the gonorrhœa casts doubt on this sequence, and would suggest that the persistence of the chronic urethritis is a result rather than a cause of soft and hard infiltrations of the urethral wall, or, as Keyes notes, chronic urethritis and stricture are related in possessing a similar cause. No doubt the first step in the formation of a stricture is the production of a soft infiltration, which is a deep urethritis or interstitial inflammation of the mucosa and submucosa, gradually spreading to involve the corpus cavernosum urethræ. As

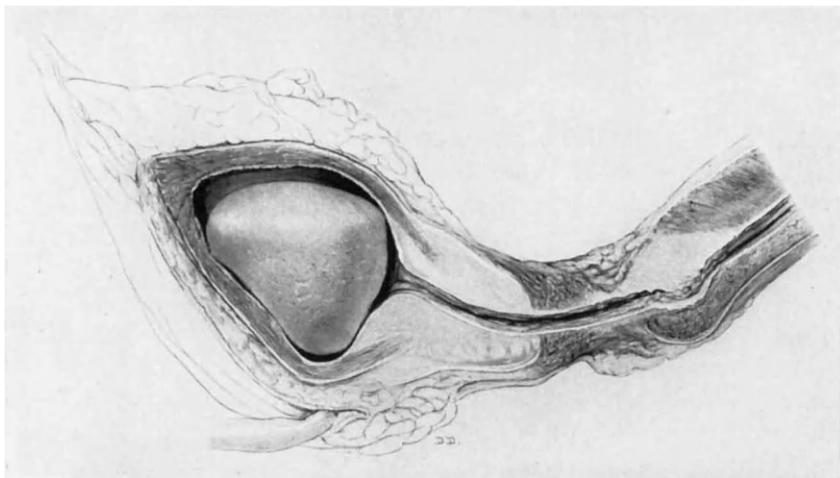


Fig. 82.—A stricture of the bulbous urethra seen in a sagittal section of the bladder, prostate, and urethra. A large vesical calculus is present. The fibrous tissue of the stricture is almost confined to the roof of the urethra.

the inflammation subsides the tissues are invaded by fibroblasts, desquamated epithelium is replaced usually by cells of a lower order, perhaps leukoplakia occurs, and finally with the formation of fibres contraction begins and a wide-bore stricture is established; eventually further contraction causes symptoms of stricture. Gouley compares the development of a stricture to the scarring of a burn, implying that it follows severe loss of epithelium; it would then, as suggested by Campbell, be more likely to follow on acute than on chronic inflammation. The lesion tends to spread because the associated infection, particularly of Littre's glands, favours the production of

further infiltration and fibrosis. Pfister classifies strictures of rapid development under the title of "primary stenosing periurethritis".

Gonorrhœal strictures are, according to some authorities, usually multiple; Keyes, however, denies this. The most frequent site at which the lesion is found is in the region of the bulb (John Hunter, Thompson, Walsh), and if there are multiple strictures this will be the site of the narrowest (*Fig. 82*); as the meatus is approached their frequency diminishes. Rarely almost the whole penile and perineal urethra is one long stricture, and very rarely indeed a stricture of the posterior urethra is encountered. The figures of the location of stricture appear in the accompanying table:—

LOCATION OF URETHRAL STRICTURE

Campbell's 794 Cases

Pendulous urethra	242
Bulbous urethra	206
Bulbomembranous urethra	247
Membranous urethra	99
Prostatic urethra	0

Thompson's 320 Cases

Within 2½ in. of the external meatus ..	54	17 per cent
Anterior to the bulbous urethra, but not including the above	51	16 " "
At and in the neighbourhood of the junction of the membranous and bulbous parts	215	67 " "

Any narrowing of the urethra will favour the production of a stricture if gonorrhœal infection should occur; such a diminution of the urethral lumen may be of congenital origin—for example, a small meatus. Similarly lesions of the mucosa, produced for example by the caustic action of too strong an antiseptic or by too early or forcible instrumentation, predispose especially in the presence of infection to stricture formation. It is to be noted that such conditions all tend to enhance the severity of a urethritis.

Strictures vary greatly in extent and form, and three chief types may be described: (1) The circular stricture of minimal extent, which is in the form of a diaphragm with central or eccentrically placed opening; (2) The tunnel stricture, which involves some considerable length of the urethra; and (3) Intermediate between these two, the annular stricture of varying length. The so-called bridle stricture is a diaphragm which has a second perforation near its periphery, usually produced by instrumentation, so that a bridge crossing the urethral lumen has resulted; the tortuous stricture is a development of the

tunnel stricture and is exemplified best by certain traumatic strictures, but it may be of inflammatory origin if fibrosis has proceeded irregularly. The annular stricture is often demonstrable in the penile urethra as a ring-like band which is easily palpable.

Strictures are sometimes described in terms indicative of their response to dilatation ; an elastic or resilient stricture is one which rapidly contracts to its former size—it is encountered especially in the region of the bulb ; a hard or cartilaginous stricture is one which is only very slightly, if at all, susceptible to dilatation—this type is often penile in situation. Spasmodic stricture is a misnomer and does not occur, and although at times the sphincter urethræ membranaceæ may offer more than the usual resistance to the passage of a sound, this is either reflex from neighbouring inflammation or due to psychic causes, and is in no sense a stricture.

The effects of a stricture of long standing are of major importance, for they are in the main those of urinary obstruction and complicated as a rule by infection. The urethra proximal to the site of obstruction is dilated and there is always some degree of sepsis present, which favours the development of periurethritis and may lead to either periurethral abscess or acute phlegmonous periurethritis, both of which are frequently followed by urinary fistulæ. The bladder responds to the obstruction by hypertrophy, often there is cystitis, and then as the bladder musculature fails stagnation occurs, with the appearance of residual urine, until finally dilatation results, perhaps with vesical diverticula. The bladder is a safety-valve and compensates well for a long period ; in fact Keyes states that in the stricture patient, unlike the prostatic, the bladder so long as it empties at all does so completely ; however, with its failure the ureters may become involved and then unilateral or bilateral hydronephrosis with mega-ureter develops, the renal function suffers, and if infection is present pyelitis or pyelonephritis ushers in the final stage of uræmia.

Symptoms.—During the slow evolution of a stricture, a process occupying years, the patient often is unconscious of anything amiss ; a gleet may be observed as the outward sign of a chronic urethral infection, but usually the soft induration and the succeeding hard infiltration or wide-bore stricture attract no attention, and it is only when contraction has advanced that the patient becomes conscious of urinary obstruction. Indeed, some patients first realize their plight when complete retention develops, often as the result of a chill or of alcoholic or sexual excess. Commonly the first signs of obstruction

which attract attention are an initial delay and a prolongation of the act of micturition which become associated with straining; attention is then directed to the stream of urine, and this is found to lack projectile force, often falling almost vertically, and sometimes being filiform or a mere series of drops.

The symptoms of stricture are, therefore: straining over the act of micturition, the abdominal muscles and diaphragm being brought into play; prolongation of the act due to the slow passage of the urine through the narrow bore of the urethral stricture; diminution in the calibre of the stream on the same score; and, for a similar reason, a lack of projectile force, until the urine falls out of the meatus drop by drop. Twisting and forking of the stream may be observed, but are of little value in diagnosis, for a rotatory motion is normal and presumably accounted for by the varying calibre of the normal urethra and the sudden change from the vertically compressed penile urethra to the glandular urethra, which is flattened from side to side. The calibre of the stream suffers before the force of projection is affected, and some stricture patients with good vesical compensation are well able to project a thin stream.

Other symptoms include complete retention of urine, continual dribbling after the act, intermittency of micturition, and incontinence. The first is usually a late occurrence, whilst dribbling after the act is caused by the escape of urine which has been retained in the dilated urethra. However, dribbling incontinence may be an overflow from a distended bladder (*Fig. 83*) or a true incontinence; the latter is caused by extension of the stricture to the sphincter urethræ membranaceæ, so diminishing its efficiency that involuntary escape occurs on movement. Either of these varieties may simulate frequency of micturition. An associated infection is responsible for the addition of symptoms of cystitis, epididymitis, periurethritis, or, later, of pyelitis and pyelonephritis. Ejaculation is always interfered with by a urethral stricture, and is either delayed, or the semen regurgitates into the bladder and is voided later.

The differential diagnosis is of importance, for any or all of the symptoms may be completely unassociated with stricture. Prostatic hypertrophy or neoplasm may mimic urethral stricture, or vice versa, but the urine of a stricture patient is never without shreds, whilst that of the prostatic may be. The stricture patient strains throughout the act, the prostatic often only at its commencement. Nervous lesions may simulate stricture formation, especially tabes dorsalis or atony of

the bladder of obscure aetiology (McCrea). Again, congenital urethral obstruction may duplicate exactly the symptoms of acquired stricture, since both are obstructions of the urethral lumen. However, the diagnosis can be reached by complete investigation.

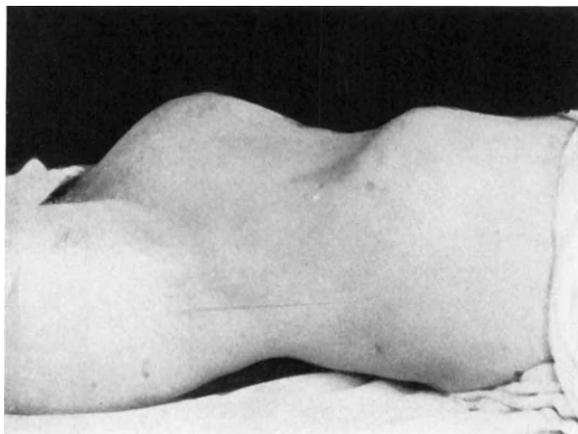


Fig. 83.—A visibly distended bladder in retention of urine.

Diagnosis.—It is unnecessary to refer here to the diagnosis of the enlarged prostate, for to determine the presence of a stricture it is only necessary to demonstrate a narrowing of the urethral calibre. A negative history of urethritis is often for various reasons unreliable; a positive history of gonorrhœa or injury may point to the diagnosis, but the essential measure is exploration of the urethra. Two methods of investigation should be adopted; the first is the passage of olivary-tipped bougies, and the second the use of the urethroscope. It must



Fig. 84.—The acorn-tipped bougie.

be understood that exploration of the urethra does not imply merely the exclusion of soft or hard infiltrations of narrow bore, for, as Legueu observes, the patient may have come for examination because of a persistent morning drop and not with any symptoms of obstruction. Therefore the passage of an instrument of moderate size is insufficient, and a series of acorn-tipped bougies of varying size (*Fig. 84*) must be utilized, and perhaps supplemented by the use of such an instrument

as the Otis urethrometer (*Fig. 85*) if the meatus is small. A bougie of No. 18 size on the Charrière scale should be introduced first, and if obstruction is encountered replaced by a smaller one; but should it pass freely a No. 24 is substituted, and if no resistance is appreciable either entering or returning, it is probable that not even a wide-bore stricture exists. In the presence of a small meatus the Otis urethrometer is useful; closed this corresponds to size No. 15 on

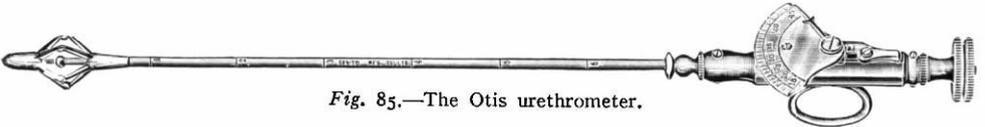


Fig. 85.—The Otis urethrometer.

the Charrière scale, open it expands to size No. 45; alternatively, to permit of the passage of large instruments the meatus may be temporarily stretched with Kelly's dilator or by the passage of a series of bougies of graded size, or meatotomy may be performed under local anæsthesia.

When one or more strictures are discovered the olivary bougies will give information as to their bore and also as to their extent or

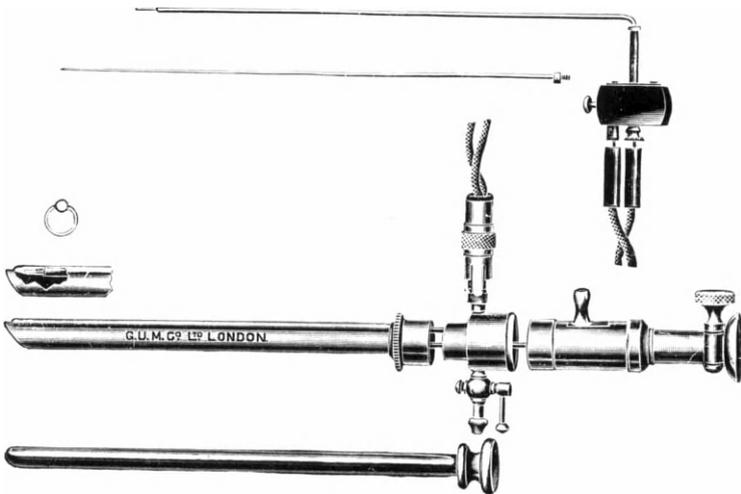


Fig. 86.—Anterior urethroscope (Harrison).

length, which is determined by subtracting the distance from the meatus when first met with from the distance when met with on return; similar information is supplied by the Otis urethrometer.

Should the stricture not admit an olivary bougie then filiform bougies are employed, and if necessary a filiform may be guided through under direct vision with the urethroscope.

The urethroscope (*Fig. 86*) supplies information as to the presence or absence of soft and hard infiltrations and as to their site, for a soft infiltration may escape diagnosis if the acorn-tipped bougie only is used; the urethroscope, however, can give no information as to the length of the stricture. As viewed by the urethroscope a soft infiltration appears as an irregular patch of swollen, hyperæmic mucosa, and one or more of varying size may be present; the mucosa of these patches may retain its lustre or may be dull, perhaps showing granulations. Although permitting the passage of the tube the lumen does not appear to open freely before it and closes again immediately on its withdrawal; the glands of Littre are seen as small injected areas and are often swollen and appear as seed-like projections.



Fig. 87.—A urethroscopic view of a urethral stricture. The lumen is irregular, it is rigid, failing to dilate before the instrument, and its pale margins indicate fibrosis.

The hard infiltration always renders the passage of the urethroscope difficult and sometimes impossible; the lumen of the urethra is decreased and the orifice of the narrowest region may be eccentric owing to an uneven distribution of the fibrosis (*Fig. 87*). The mucosa varies from a yellowish to a greyish colour because of the contraction of the fibrous tissue which has impaired its blood-supply; the epithelium may be hypertrophied and appear as if covered by a dull whitish, translucent membrane, or if leukoplakia exists appear white and opaque. The appearance seen in hard infiltration has been compared to that of a rigid tube with cardboard-like walls.

It is possible to demonstrate the site and extent of urethral narrowing by X rays after the injection of lipiodol (Parker, Ledoux-Lebard, Garcia-Calderon, and Petetin) (*Figs. 88, 89*), or by a urethrogram during micturition if the bladder is filled with lipiodol (Luque). A stricture is sometimes palpable, especially if penile, and is more easily felt when an instrument lies in the urethra; inspection should disclose any meatal narrowing. As already noted, shreds are

almost invariably present in the urine when an inflammatory stricture exists.



Fig. 88.—Urethrogram in a case of stricture of the perineal urethra. The arrow indicates the site of stricture, which extends for a short distance only. Behind it the urethra is somewhat dilated and the ducts of the bulbo-urethral glands are outlined. Prostatic diverticula are present.

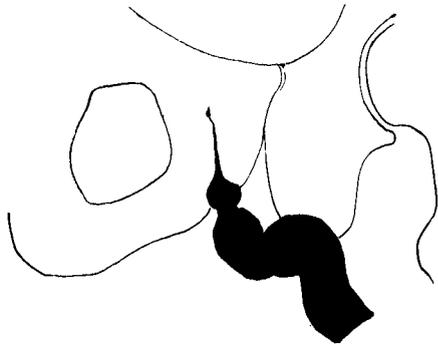


Fig. 89.—A tracing from a urethrogram showing two bulbular strictures—the first of wide bore, the second of narrow bore, through which lipiodol passed with difficulty.

Prognosis.—Urethral stricture is a progressive disease and nothing save the death of the patient will arrest its progress. No treatment can be described as really curative, and at best operative measures only replace a tight tunnel stricture by a wide-bore narrowing of minimal extent; this in time will itself contract, though symptoms may be anticipated by death from extraneous causes. Cure is therefore clinical or symptomatic only.

The prognosis at the institution of treatment depends on a number of factors; the type, situation, and bore of the stricture, as well as the extent to which obstruction has affected the urinary tract and the presence and degree of infection. During treatment by dilatation—

and dilatation is essential even after operation—the prognosis increases in gravity if infection cannot be controlled, or if fresh sepsis is introduced. If there are contra-indications to operation in patients with strictures of the cartilaginous or contractile type in which the response to dilatation has been unsatisfactory, as it almost always is, the prognosis becomes more grave. Several observers have noted that the fibrosis which follows traumatism responds more readily to dilatation than the inflammatory cicatrix does, and this is also our experience.

TREATMENT

Prophylaxis.—The nature of the stricture which follows on such trauma as a rupture of the urethra can be greatly modified for the better if treatment is prompt and successful (*see* RUPTURE OF THE URETHRA). Operation at the earliest possible moment, with diversion of the urine and repair of the urethra, is the ideal, and if successful, avoids sepsis and reduces the subsequent fibrosis to a minimum; but, unfortunately, immediate repair is under certain circumstances neither possible nor desirable. Operation does not, however, prevent stricture development, and no patient should leave hospital after the treatment of a ruptured urethra without a clear understanding that if instrumentation is neglected a stricture will develop.

The stricture which results from a urethritis should in theory never develop in a patient treated from an early stage, for if every patient with gonorrhœa is treated and cured, stricture will not be found. Unfortunately the patient himself too often determines the standard of cure, and there must be at all times a very great number of men suffering from an untreated chronic urethritis. Nevertheless chronic gonorrhœa is more often a posterior urethritis, prostatitis, etc., than an anterior infection, and so long as infection is not of the anterior urethra stricture is not to be feared. If cure of gonorrhœa is pronounced only when there is absence of microscopical pus from the urine both before and after prostatic and vesicular massage, then stricture formation will be avoided. Anterior urethroscopy is another safeguard, but it must not be forgotten that a posterior focus may be in existence and subsequently cause reinfection of the anterior urethra.

GENERAL TREATMENT

Once a stricture, always a stricture; the few exceptions prove this rule. Symptomatic cure may and does take place, but only because the lifetime of that particular patient has been too short for the

inevitable symptoms of contraction to develop. Either the urethral lumen is kept open or even increased at the site of the stricture by the passage of instruments, or, if the obstruction is great, the narrowing may be dealt with by operative measures and subsequently treated by instrumentation. Operation is not cure, but, like instrumentation, a palliative measure which may be indicated in a variety of circumstances.

Treatment therefore consists either of dilatation by instruments or of operation followed by instrumentation. The operative treatment is dealt with in Chapter IX.

INSTRUMENTATION

Amongst the most useful instruments of the armamentarium are : of the metal sounds, Clutton's, Lister's, and Bénéiqué's (*Fig. 90*) ;

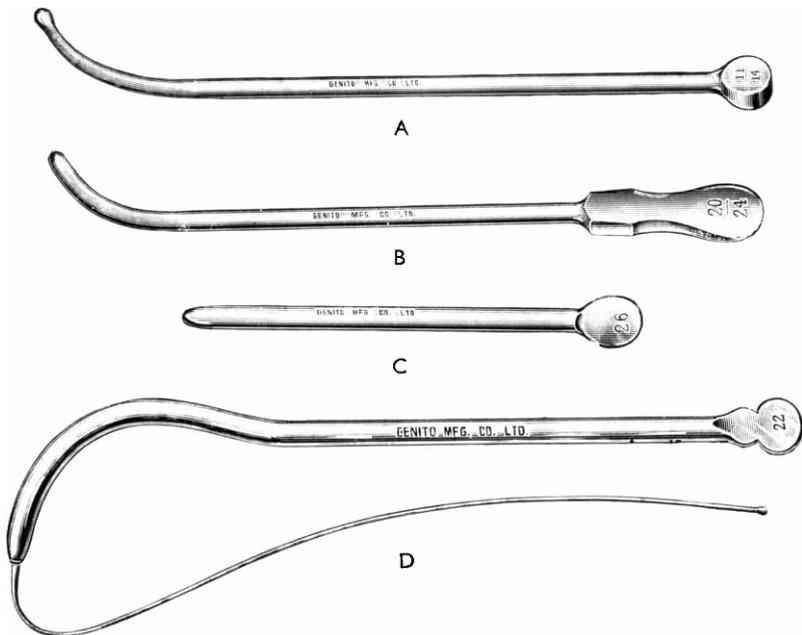


Fig. 90.—Metal sounds. A, Lister's sound ; B, Clutton's sound ; C, Sound for the anterior urethra ; D, Bénéiqué's sound, shown here with a filiform guide attached.

and of the soft bougies, the silk-web gum-elastic bougies (*Fig. 91*). In addition, it is advisable to possess a number of filiform bougies, both silk-web and whalebone, and some whip bougies, and to be

prepared to utilize the urethroscope to aid in their passage when a troublesome stricture is encountered.



Fig. 91.—Olivary silk-web gum-elastic bougie.

Gradual Dilatation.—The stricture is very gradually and gently dilated by the passage of instruments at regular and carefully judged intervals; more correctly speaking, inflammatory infiltrations may be dilated but the old fibrous stricture can only be prevented from further contraction, for if dilated it is torn, and, as Keyes puts it, the urethra is splinted whilst a larger-bore stricture forms—a result which is better secured by operation. Treatment must be based on three main points; first, avoidance of infection of the urinary tract; secondly, avoidance of overdilatation; and thirdly, regulation of the interval between attendances so that the degree of contraction is not permitted to increase.

Urinary infection is very common in these men and is most difficult to avoid. In a stricture clinic the following routine precautions are adopted: gloves are worn and the gloved hands are rinsed

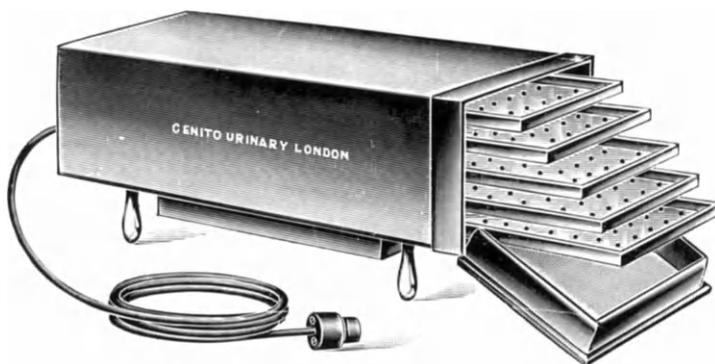


Fig. 92.—Formalin sterilizer for bougies and catheters.

thoroughly in an antiseptic solution as a preliminary to each dilatation; the glans penis and meatus are carefully cleansed and disinfected, the penis is surrounded by sterile towels, and the anterior urethra

irrigated. After instrumentation every patient takes a urinary anti-septic for some days. Metal instruments are sterilized by boiling and bougies by formalin vapour (*Fig. 92*).

Overdilatation consists of the too rapid and too forcible dilatation of a stricture and is harmful in every way ; damage is done and bleeding occurs, whilst more scar tissue forms with rapid additional contraction. Furthermore the patient usually decides against further treatment until compelled to it. Dilatation therefore must be gentle and gradual.

As regards the contraction of a stricture, personal experience of each individual patient alone permits of the correct spacing of the dilatations. No definite rules can be formulated, but every stricture must be judged on its own merits. In general, every new patient should attend once a week at first and then once a fortnight until some knowledge of the stricture and its behaviour has been obtained ; again, in general a stricture which is easily dilatable to the size 12-15 (English) should not be allowed to diminish to a figure below 10-13 (English), or, in a few patients, 9-12 (English).

No metal instrument of a size smaller than 7-10 (English) or a No. 14 Bénéiqué sound should be used, and below this size soft bougies alone are allowable, for thus the possibility of damage (false passage, etc.) is markedly reduced. The use of Kollmann's dilators (*Fig. 93*) when a stricture has reached a suitable size,

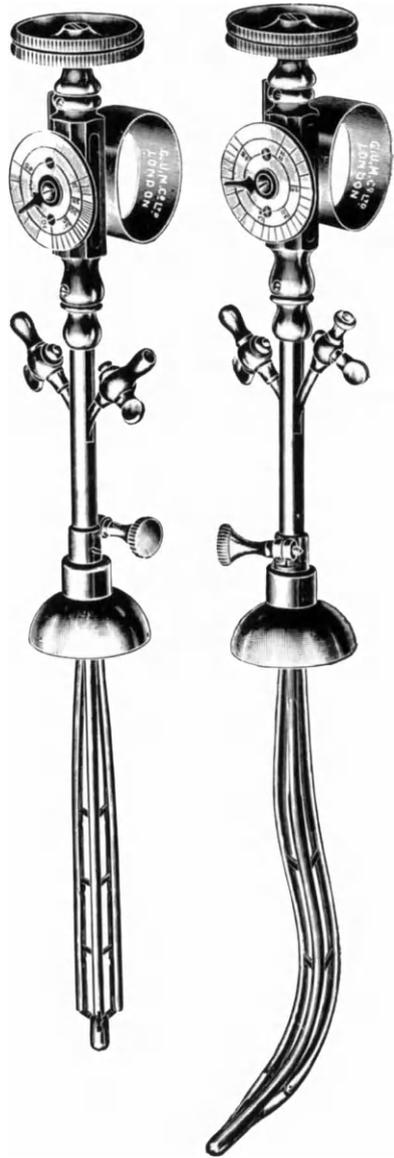


Fig. 93.—Kollmann dilators, straight and curved.

and especially if the meatus is not large, gives excellent results, but experience in their use is necessary and the temptation to overdilate must be resisted.

The importance of regular attendance at the advised times, and personal treatment by the same medical attendant, is shown by the following figures taken from 87 patients with inflammatory strictures who regularly attended the Salford Royal Hospital over a long period. Forty-one patients had had no operative treatment, 46 patients had undergone operation. Figures are also given for 14 traumatic stricture patients who were attending the hospital, all of whom had been operated upon.

INFLAMMATORY STRICTURE (87 CASES)

	<i>Average Interval at Time of Investigation</i>
1. <i>No operation (41 cases)</i> —	
<i>a. Treated at the Salford Royal Hospital only (32 cases)</i>	4½ mths.
<i>b. Previously treated elsewhere at irregular intervals (9 cases)</i> ..	2 ,,
2. <i>Operation patients (46 cases)</i> —	
<i>a. Operation and all treatment at Salford Royal Hospital (26 cases)</i> ..	5½ mths.
<i>b. Operation elsewhere, subsequent dilatation nil or irregular (20 cases)</i> ..	2½ ,,

TRAUMATIC STRICTURE (14 CASES)

Immediate operation after receipt of injury (8 cases)	7 mths.
Operation delayed until symptoms of stricture (6 cases)	4 ,,

It is probable that the best results will be obtained always in traumatic cases in which immediate repair has succeeded, because a minimal amount of scar tissue then forms, whilst the long-continued inflammation of chronic urethritis results in a gross production of more resistant scar tissue; however, the worst strictures are the result of unoperated ruptures of the urethra in which healing by granulation has occurred.

The difficulties of and the response to dilatation vary greatly: multiple narrow strictures perhaps provide the most troublesome problem, and instruments may fail to pass at all; similarly, a long and tortuous stricture hampers manipulation. A small opening, often eccentrically placed, and with surrounding pockets of false passages and urethral sinuses, is sometimes very troublesome, but with care an instrument usually can be introduced. A filiform bougie (*Fig. 94, A*) with bent tip may search the stricture face, or several may be

inserted, some to occupy the neighbouring recesses whilst one enters the true opening (*Fig. 95*); alternatively the urethroscope is used,

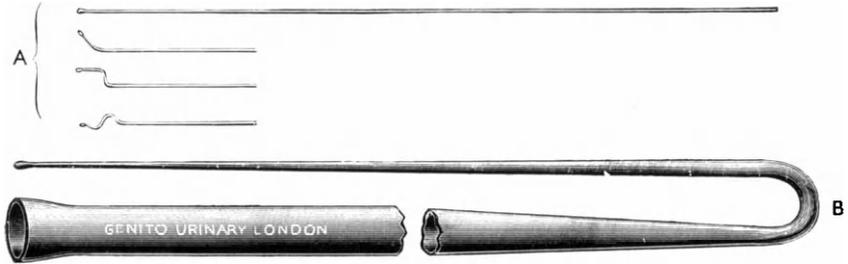


Fig. 94.—A, Filiform bougies—straight, coudé, bayonet-ended, and corkscrew-ended; B, Whip bougie.

the stricture inspected, and a filiform bougie passed under direct vision. The whip bougie (*Fig. 94, B*) and railroad sound find their greatest use in dilating such narrow openings to a size suitable for other instruments.

The response to dilatation varies enormously and appears to depend largely on the age of the scar tissue; a 'young' stricture or infiltration which has developed and contracted rapidly often dilates rapidly and is easily maintained open, whilst an 'old' stricture of narrow bore resists dilatation, or, when stretched, rapidly contracts and is 'resilient' or 'elastic'. The object, therefore, of dilatation is to maintain a stricture fully dilated, so that the adult scar reaches its mature condition as a large-bore ring.

Rapid Dilatation. —

Rapid dilatation consists of the forcible dilatation of a stricture under anæsthesia either by the passage of a

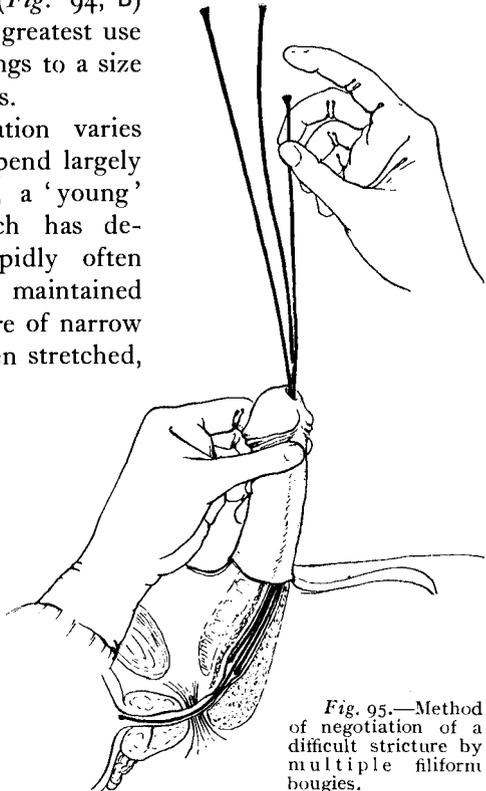


Fig. 95.—Method of negotiation of a difficult stricture by multiple filiform bougies.

series of instruments until a large size is attained, or by the use of a dilator of the Kollmann type. It is to be condemned as leading to rupture of the stricture rather than to dilatation and to the formation of further fibrous tissue which will surely contract. Operation is preferable, but the procedure is conceivably permissible if operation is impossible by reason of isolation and lack of facilities.

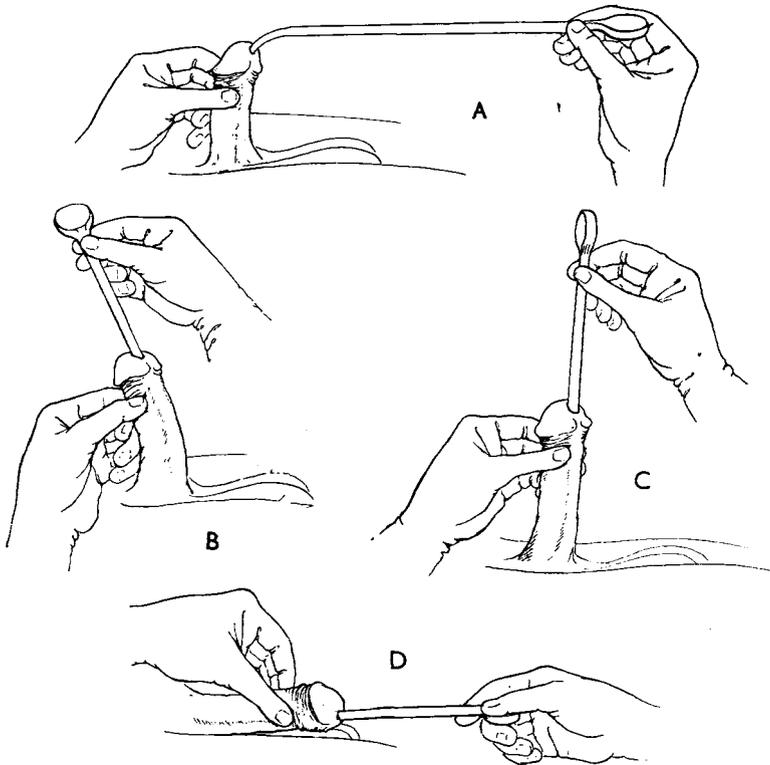


Fig. 96.—Illustrating the technique of the metal sound. A, Introduction of the sound; B, The sound, having been rotated to the left, occupies the line of the left inguinal ligament and is being elevated; C, The advancing sound is now vertical and occupies the middle line; D, The sound having been depressed between the thighs, has entered the bladder.

Technique.—

1. *Metal Sound* (*Fig. 96*).—The patient is recumbent upon a couch and the surgeon stands at his right side, the penis and instruments having been prepared in the manner described. The penis is grasped immediately proximally to the corona between the forefinger

and thumb of the left hand, whilst the instrument, held by its extremity between the forefinger and thumb of the right hand, is dipped into the lubricant and the point then inserted into the meatus, the shaft at this moment pointing towards the patient's left foot. As the point advances through the terminal urethra the shaft of the sound is rotated horizontally to the left of the patient, the surgeon's right hand holding it as it describes an arc of 90° to the patient's left; the shaft is then directed along the line of the left inguinal ligament. The point meanwhile has been slowly advancing along the penile urethra and it continues to do so merely under its own weight, the shaft being gradually elevated and at the same time approximated to the middle line so that when the point reaches the penoscrotal junction it is in this line and at an angle of some 45° to 60° to it; it is then elevated still further and when vertical the point is passing through the region of the bulb. A slight depression of the shaft, still in the sagittal plane, towards the patient's feet brings the point against the sphincter urethræ membranacæ, when a gentle continual pressure together with depression will overcome its slight resistance, and a further depression of the shaft until it is almost in the axis of the trunk will guide the advancing point through the prostatic urethra into the bladder. In withdrawal these movements are reversed. It will be observed that a stricture 'grasps' the sound, and that at times a distinct effort is needed to withdraw the instrument.

2. *Flexible Bougie*.—Gum-elastic bougies depend upon their flexibility to follow the normal curves of the urethra, therefore sizes larger than 24 on the Charrière scale should not be used as they are bulky and consequently stiff. The penis is grasped as before and extended to its full length in order to straighten the mobile portion of the urethra, whilst the bougie, lubricated with oil, is held between middle finger and thumb in the manner of a dart and introduced into the meatus in the penile axis and gently pushed along until the bladder is entered. At the stricture and at the sphincter the forefinger placed upon the end of the instrument may add just sufficient force to guide it through. It may be necessary to alter the axis of the penis and bougie in order to negotiate a stricture, the handle of the bougie describing circles of varying radii, the centres of which all lie theoretically at the stricture, though often actually at the penoscrotal junction where the free penile urethra loses its mobility. Preliminary flexion of the bougie tip often aids in the avoidance of an obstruction or pocket of the urethral floor.

When strictures are penile it is not necessary that instruments should enter the prostatic urethra or bladder, and it is preferable that they should not.

Dilatation aided by Electrolysis.—In this method the technique of Desnos may be adopted. Desnos introduces a Bénéqué sound to fit the stricture and connects the handle to the negative pole, whilst a saline pad on the belly or thigh is connected to the positive pole; he then passes a continuous current of from 3 to 5 milliamperes for from ten to fifteen minutes. This method has been utilized to obtain rapid dilatation. Excellent results are claimed for the procedure, which is said to give more rapid and durable effects than the ordinary sound; however, the method has never become popular, and in the author's hands, with certain rebellious, elastic or cartilaginous strictures, gave no better results than the usual sounds.

Diathermy.—Recently the high-frequency current of diathermy has been employed in a similar manner, the current being passed through a metal sound and the stricture then rapidly dilated.

Continuous Dilatation.—Strictures are often met through which nothing larger than a filiform bougie can be passed, and these patients often have retention; it will be found that if the filiform is left *en demeure* urine will escape alongside it, and in a day or two a larger instrument will enter easily.

Complications of Treatment by Dilatation.—

Urethral Shock.—On several occasions fatal collapse has been reported to have followed the passage of a sound. Probably local anæsthesia of the urethra as a preliminary to the first instrumentation would minimize the possibility of this occurrence.

Urethral Fever.—It is not very unusual for rigors to follow instrumentation, and in all probability they result from the absorption of toxins, for in most patients who experience them evident sepsis is present. It is advisable to attempt to control the urinary infection in these patients, and after particularly gentle instrumentation the patient should retire to bed with warmth externally and internally.

Urogenital Infection.—The repeated passage of instruments leads almost inevitably to infection, which, however, may be deferred, minimized, or even avoided by a scrupulously aseptic technique on the lines previously indicated. Infective complications which occur include urethritis, prostatitis, epididymitis, cystitis, and, through the latter, ureteral and renal infection.

False Passage.—A false passage occurs when the advancing point of the instrument does not enter the lumen of the stricture but tears its way through the mucosa to one side of the opening (*Fig. 97*); when this happens a peculiar grating is felt by the guiding hand, sometimes suggestive of contact with a stone, and hæmorrhage results. Excessive force is the usual causal factor and gentleness should avoid it, but if it occurs instrumentation must cease for the time being and further attempts be deferred for some days.

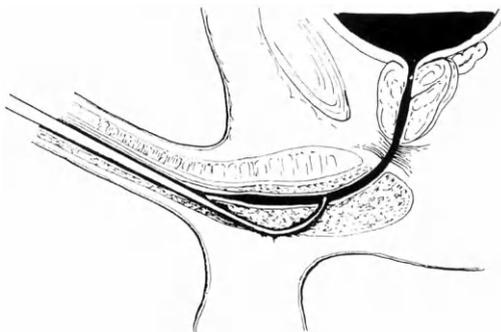


Fig. 97.—Illustrating the mechanism of a false passage.

Periurethritis and Periurethral Abscess.—

False passages and over-dilatation may allow of the spread of infection to the periurethral tissues; again, gentleness and skill are the best means of prophylaxis.

Hæmorrhage.—Certain strictures bleed readily and freely on the passage of an instrument even with gentle manipulation, but it is rare to meet with so marked a degree of hæmorrhage that dilatation is contra-indicated; indeed, in such patients tumour should be suspected. On the other hand gross false passages may bleed alarmingly and necessitate adrenaline per urethram, with ice packs and pressure to the perineum or penis. In the presence of hæmorrhage further instrumentation should be deferred for the time being.

Retention of Urine.—Retention of urine sometimes follows the passage of an instrument, and is due as a rule to spasm produced by over-dilatation, but it may be inflammatory in origin and the result of congestion and œdema of the mucosa. It can be avoided subsequently by anæsthetizing the urethra and avoiding over-dilatation.

Foreign Body.—Very rarely a perished or defective instrument breaks and one is faced with a foreign body in the urethra or bladder (*see p. 218*).

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CHAPTER IX

**STRICTURE OF THE URETHRA:
OPERATIVE TREATMENT**

Operative Measures.—Operation is needed when a stricture proves impassable to the surgeon; if it is very irritable and tender; if rigors, retention, or hæmorrhage constantly follow instrumentation; and if it contracts rapidly and does not improve with dilatation. Operation is indicated also by complications such as periurethritis and fistulæ, or by vesical and renal disease, either primary or secondary to the stricture and requiring perurethral investigation and treatment. Operation is again necessary if the patient refuses dilatation or if regular dilatation is unobtainable. The operations include: (1) Meatotomy; (2) Internal urethrotomy; (3) Open operation: (a) External urethrotomy; (b) Excision of stricture.

Choice of Operation.—The choice of operation is guided by the site and nature of the stricture.

Meatotomy is the best means of overcoming a stricture of the meatus. Penile strictures are suitable for internal but not for external urethrotomy, because a fistula may result; excision, however, may be attempted. Strictures elsewhere are suitable for either internal or external urethrotomy, or for a combination of these methods, especially when multiple strictures, some penile and some bulbar, exist. Excision is to be preferred to external urethrotomy when possible, and, since the operation is an elaboration of external urethrotomy, it is not usually necessary to make the decision beforehand. A stricture of diaphragmatic nature is eminently suitable for internal urethrotomy, a long tunnel stricture for external urethrotomy, whilst a ring or annular stricture lends itself to resection. Internal urethrotomy, however, is of value in all types and at all sites.

Internal urethrotomy is a comparatively minor procedure, easily and quickly executed under local anæsthesia; it deals with any stricture which may be present, and may be of great service in permitting drainage of the bladder; yet, on the other hand, it is a blind method sometimes accompanied by severe hæmorrhage.

External urethrotomy or excision is a more severe operation requiring a general or spinal anæsthetic, and in the presence of sepsis is more likely to lead to infective complications. It deals with one stricture only, but hæmorrhage is visually controlled. External urethrotomy is necessary when internal urethrotomy cannot be performed—that is, when the urethrotome guide cannot be introduced. It is indicated also in the presence of fistulæ and periurethritis.

The mortality-rates of the two procedures are not strictly comparable, but admittedly the figures for open operation must be somewhat higher, especially in view of the type of patient on whom it is of necessity performed. Nevertheless if a patient will not or cannot attend for subsequent dilatation, then the open operation is by far the better, for internal urethrotomy, although giving good results if followed by regular and careful dilatation, certainly relapses more rapidly if dilatation is neglected, and then frequently the stricture becomes more difficult than before. In these patients, if subsequent sterility is not of importance, Russell's operation of artificial hypospadias is a valuable alternative procedure (p. 168).

MEATOTOMY

Local anæsthesia is used, a small quantity of 2 per cent procaine or other suitable preparation being injected by means of a fine needle into the meatal margin and in the direction of the proposed incision. It is usual to make the incision towards the frænulum, for as a rule the thickness of tissue to be divided is less. In order to avoid bleeding a piece of rubber tubing can be tied round the penis as a tourniquet. A blunt-pointed and narrow bistoury is inserted into the meatus, and by cutting outwards and inferiorly the orifice is enlarged so that a No. 32 bougie of the Charrière scale enters easily; on rare occasions it will be found preferable to make the incision towards the apex of the glans. If it is possible the mucosa and surface epithelium are sutured together by means of fine catgut sutures. The small wound requires careful dressing until healed, so that adhesion of the raw surfaces may be prevented; the insertion of a strip of gauze spread with lanocyllin ointment usually achieves this end.

Comments.—Colles practised this operation with very satisfactory results; he raised a flap of epithelium on either side and, if necessary,

excised strips of corpus cavernosum urethræ so that the raw areas might be covered satisfactorily. The resultant glandular hypospadias is not to be feared, for it is far preferable to a stenosed meatus and causes little disability.

INTERNAL URETHROTOMY

The stricture is divided by a guarded knife which is passed through it along the urethra; it follows therefore that the stricture must permit the passage of an instrument. The stricture may be cut from before backwards or from behind forwards, or in both

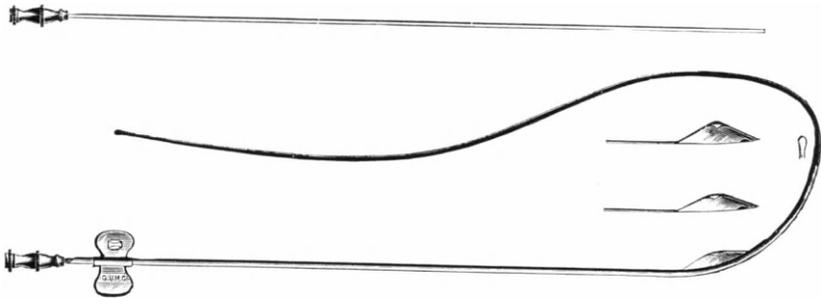


Fig. 98.—Internal urethrotome (Thomson-Walker).

directions. The instrument which will be described is Thomson-Walker's modification of Maisonneuve's urethrotome (*Fig. 98*), and the stricture is cut, on the superior aspect of the urethral canal, from before backwards and again from behind forwards.

Thomson-Walker's urethrotome consists of a fine curved metal staff which has a deep groove on its concave surface extending from the handle to a point immediately beyond the commencement of the curve. At the point of this sound is a male screw on to which a bulbous tip fits or to which a filiform guide may be screwed. The metal end of the guide is tapered so that it gradually expands to the thickness of the staff. A triangular knife is fixed at one end of a steel rod which is fitted for insertion into the groove of the staff, and at the other end of the rod is a metal button on which the size to which the knife cuts (French scale) is engraved. The apex of this triangular knife is broad and blunt, not cutting, but its anterior and posterior edges are sharp, and a small flange on either side of the base of the knife prevents its escaping from the deep groove in the staff as it runs along. Two large

flat transverse wings are fixed on either side of the handle of the staff and provide a grip for the fingers and thumbs of the assistant. A steel rod occupies the groove until the knife is about to be inserted. Anæsthesia is necessary, either general, local, or spinal; satisfactory effects are obtained by employing sacral anæsthesia.

The penis and pubic region undergo the usual preparation for operation, and immediately before operation the urethra is irrigated. The patient lies in the dorsal position with the surgeon on his right hand and an assistant on the left side. The filiform guide is passed

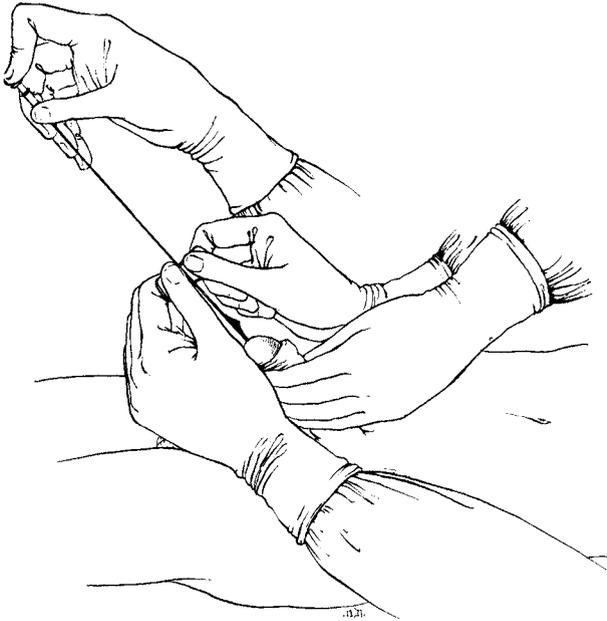


Fig. 99.—The position for the operation of internal urethrotomy.

through the stricture or, if this is of large enough calibre, the staff with its bulbous tip is passed through. The curve of the staff occupies the posterior urethra, and the filiform guide coils up in the bladder. The assistant, with a forearm or elbow on each iliac crest of the patient, leans over and grasps the wings on the staff handle between each forefinger and thumb. The staff occupies the sagittal plane pointing in the direction of the feet, but at an angle of 45° to the long axis of the patient, and is held firmly in this position by the assistant (*Fig. 99*). The steel rod is then withdrawn and the surgeon slips the knife, lubricated with sterile oil, into the groove; the surgeon's left hand

now raises the glans penis and the knife is insinuated through the meatus and passed gently along the urethra until the stricture is reached. Evident obstruction is encountered at the stricture and now the knife is pushed onwards with sudden firmness, cutting through the stricture or strictures. Withdrawal, especially if the staff is rotated through a few degrees, allows the strictures to be cut again in the reverse direction by a sharp pull on the knife, and it may be used again to cut in two more situations. A forceful rapid movement is essential in order to cut cleanly and definitely.

The instrument is now withdrawn and a large metal sound introduced (11-14 or 12-15 English), in order to ascertain the success of the procedure. A catheter of a size about 22 of the Charrière scale is then passed into the bladder, the urine is withdrawn, and the bladder washed out with a solution of silver nitrate 1-10,000. This catheter is tied in with its eye just within the bladder and, some 2 oz. of lotion having been introduced, it is plugged.

After-treatment.—The bladder is either emptied two-hourly by removal of the plug or drained continuously, but if retention has been present decompression should be gradual. After 48 hours the catheter is removed; the patient is allowed up at the end of a week, and on the tenth day a metal sound (12-15 English) is gently passed. This procedure is repeated a fortnight later and then at gradually increasing intervals which are determined by the behaviour of the stricture.

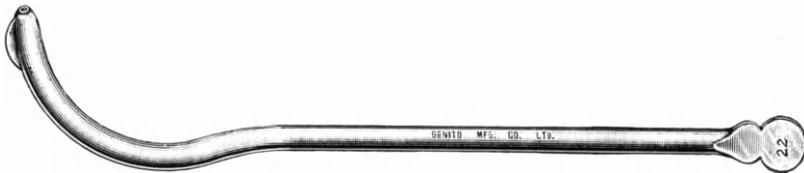


Fig. 100.—The cutting Béniqué sound.

Comments.—An interesting account of the history of this procedure, with descriptions of instruments now obsolete, is to be found in Thompson's work. The Thomson-Walker instrument is preferable to the Maisonneuve, which allows the knife to enter the posterior urethra with possible injury there and subsequent concealed hæmorrhage. The cutting Béniqué sound (*Fig. 100*) is an instrument of value if obstructions on the urethral floor are to be divided. The catheter *en demeure* serves as a urethral splint and minimizes hæmorrhage; it should not be retained longer than two days or a urethritis

will result. The complications which may arise are : fracture of the guide when the filiform remains in the bladder—it must be extracted then with a lithotrite after division of the stricture ; hæmorrhage, which may be severe and is sometimes concealed if it escapes back into the bladder—too large a knife, therefore, should be avoided lest in addition to the stricture the urethra itself be wounded. The local treatment of hæmorrhage is by the insertion of a large catheter, splinting and bandaging of the penis, or the application of a firm pad and ice-bag to the perineum ; general measures include elevation of the end of the bed, morphia, calcium lactate, and serum. Irrigation with a hot solution of silver nitrate can be tried ; as a final step, external urethrotomy may be performed, when the vessels are ligatured, if this is possible, but if it is not a large tube is inserted and surrounded by packing. This hæmorrhage may be primary or occur on removal of the catheter. When sepsis is marked urethral fever may occur after removal of the catheter as the result of toxic absorption ; it is best treated by gentle irrigation, but at times the catheter must be replaced. More rarely anuria occurs, and in these patients there has been as a rule a pre-existent and gross renal infection, though very uncommonly patients are encountered in whom no evidence of such infection is to be found (Walker). In anuria with infection nephrostomy is valuable in treatment, but without infection it is not advised and diuretics should be employed. It is probable that preliminary treatment by suprapubic cystostomy should precede section of the stricture when renal infection and damaged function are known to exist beforehand.

Mortality.—The mortality-rate is small, certainly not greater than 1·5 per cent.

Results.—The result with strictures of diaphragmatic and of narrow annular type are excellent, and instrumentation is eventually only necessary at intervals of from 12 to 18 months : that is, if the post-operative instrumentation has been scrupulously executed and the calibre maintained for a sufficiently long period. Hard tunnel strictures are enlarged but must be kept open by regular dilatation.

OPEN OPERATION

EXTERNAL URETHROTOMY

A brief but clear description of external urethrotomy is given by Read (1687) in his account of Hildanus' lithotomy. John Hunter practised external urethrotomy with division of the stricture.

In the past two operations by the perineal route for the treatment of stricture have attained considerable popularity; they are the operation of external urethrotomy with a guide (Syme), and external urethrotomy without a guide (Wheelhouse). The first of these is to-day in disuse and in the majority of patients in whom a guide can be passed internal urethrotomy is preferable to Syme's operation. It will not be further considered. The Wheelhouse operation is still of importance since modern operative procedures for stricture of the bulbous urethra are based upon it, whilst the results obtained with a stricture of the hard tunnel variety are often very good, and this in spite of criticisms directed against its soundness as a surgical procedure.

The following description is that originally given by its author: "The staff (*Fig. 101*) is to be introduced with the groove looking



Fig. 101.—The Wheelhouse staff.

towards the surface, and brought gently into contact with the stricture. It should not be pressed much against the stricture, for fear of tearing the tissues of the urethra and causing it to leave the canal, which would mar the whole after-proceedings which depend upon the urethra being opened a *quarter of an inch in front of the stricture*. Whilst an assistant holds the staff in this position, an incision is made into the perineum, extending from opposite the point of reflection of the superficial perineal fascia to the outer edge of the sphincter ani. The tissues of the perineum are to be steadily divided until the urethra is reached; this is now to be opened, *in the groove* of the staff, *not upon its point*, so as certainly to secure a quarter of an inch of healthy tube immediately in front of the stricture (*Fig. 102*). As soon as the urethra is opened, and the groove in the staff fully exposed, the edges of the healthy urethra are to be seized on each side by the straight-bladed nibbed forceps, and held apart. The staff is then to be gently withdrawn until the button-point appears in the wound. It is then to be turned round, so that the groove may look to the pubes, and the button may be hooked into the upper angle of the open urethra, which is then held stretched open at three points thus (*Fig. 102, B*), and the operator looks into it immediately in front of the stricture. Whilst thus held open, the probe-pointed director is inserted into the urethra;

and the operator, if he cannot see the opening of the stricture, which is often possible, generally succeeds in very quickly finding it, and

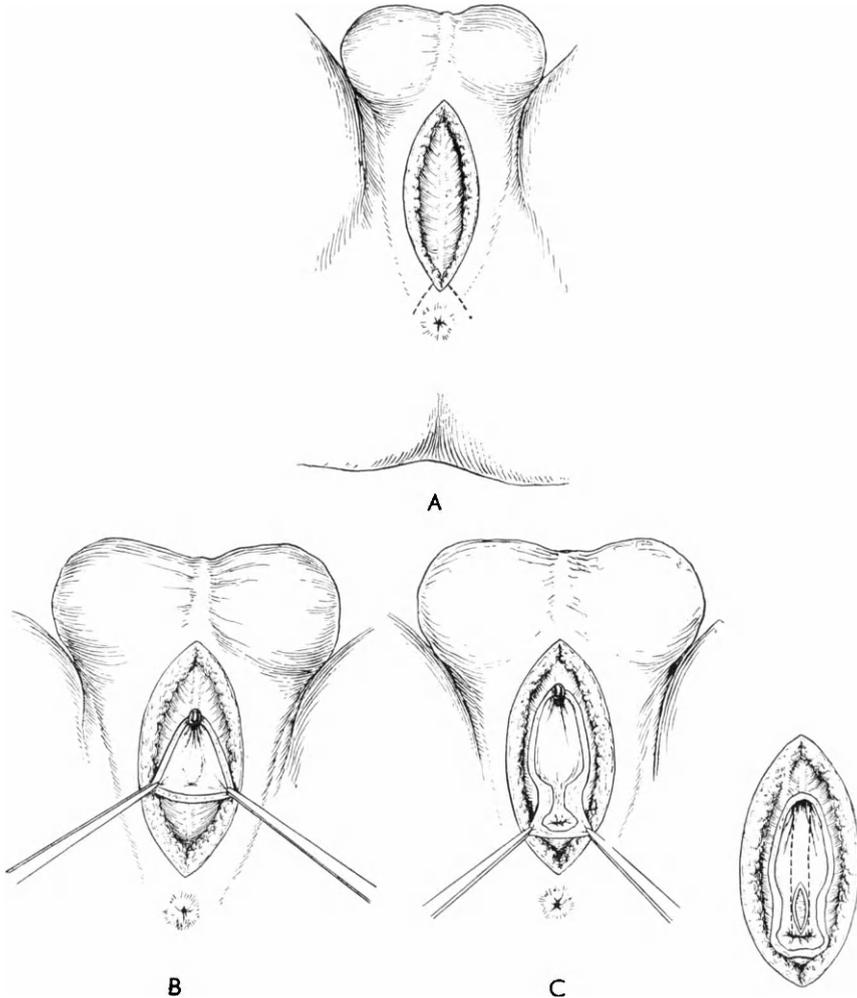


Fig. 102.—The operation of external urethrotomy. A, The incision exposes the bulbocavernosus muscle. B, The urethra has been opened in front of the stricture; the Wheelhouse staff is hooked in the anterior angle of the urethral incision. C, The stricture has been laid open; the inset shows how the roof may be incised longitudinally so that a catheter (dotted lines) may be bed in.

passes the point onwards *through* the stricture towards the bladder. The stricture is sometimes hidden amongst a crop of granulations

or warty growths, in the midst of which the probe-point easily finds the true passage. The director having been passed on into the bladder (its entrance into which is clearly demonstrated by the freedom of its movements), its groove is turned *downwards*, the whole length of the stricture is carefully and deliberately divided on its under-surface, and the passage is thus cleared. The director is still held in the same position, and a straight probe-pointed bistoury is run along the groove to insure complete division of all bands or other obstructions. These being thoroughly cleared, the old difficulty of directing the point of a catheter through the divided stricture and onwards into the bladder is to be overcome. To effect this, the point of the probe-gorget (*Fig. 103*) is introduced into the groove in the director, and, guided by it, is passed onwards into the bladder, dilating the divided

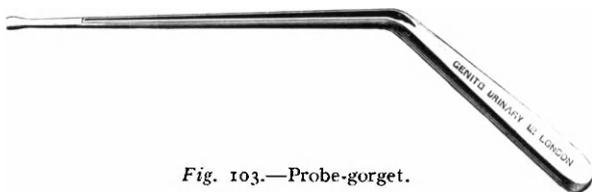


Fig. 103.—Probe-gorget.

stricture, and forming a metallic floor, along which the point of the catheter cannot fail to pass securely into the bladder." The corpus cavernosum urethræ and subcutaneous tissue are then sutured whilst the skin wound remains open.

Comments.—The point to be emphasized in the performance of this operation is that the urethra is opened distal to the stricture in the groove of the staff and not upon its point, and that therefore there is left a portion of urethral wall distal to the narrowing which may be held so that a funnel leading to the stricture face is left. Even then the orifice of the stricture may be extremely difficult to discover and numerous ingenious aids have been devised. A number of these are noted by Bailey, and of those most useful the indigo-carmin or methylene-blue method is perhaps the best (Cecil). Half an hour before operation 10 or 12 c.c. of the dye are injected through the meatus and held in for some ten minutes before being allowed to escape, then at operation the stricture track is stained blue and so is the urethra behind the stricture, the discovery of which is essential. A soft catheter is preferable to the silver instrument used in the original technique, and irrigation should be performed afterwards.

EXCISION OF STRICTURE

In the Wheelhouse operation and its modifications the fibrous tissue of the stricture is divided but not removed, and therefore the operation of excision is to be preferred. The aim of this operation is to resect the scar of the urethral wall completely and to restore the continuity of the canal so that a minimal operation scar results. The operation of excision is applicable to that portion of the urethra which is enclosed in the corpus cavernosum urethræ, but not to the posterior urethra proximal to the inferior fascia of the urogenital diaphragm; in this region complete resection is not feasible, although a partial resection of the membranous urethra can be valuable. Strictures of the annular type are most suitable for complete resection or excision, but those which more particularly demand this operation are the impassable cartilaginous tunnel strictures.

Diversion of Urine.—Before entering upon a description of the operative technique it is necessary to discuss the chief obstacles which in the past have prevented the attainment of satisfactory results. Urinary infection almost invariably coexists with strictures of inflammatory origin and usually it has been acquired in those of traumatic origin. Failure to obtain primary union of the urethral extremities is the result of sepsis which is difficult to avoid, first because the wound is perineal in site, secondly because urinary sepsis exists and contact of the suture line with urine leads to infection, and thirdly because the catheter *en demeure* results in urethritis. Urinary sepsis can be controlled to a certain extent and the indwelling catheter avoided by a preliminary drainage of the bladder, as a rule by the suprapubic route, though sometimes by the perineal. The suprapubic route is always to be preferred when the stricture is of the perineal urethra, for the proximity of the suture line to a perineal urethrostomy endangers the former. Perineal drainage may be employed when penile strictures are resected, but nowadays this method is employed infrequently. Preliminary drainage is more easily performed by the suprapubic route, but a perineal urethrostomy is simple to establish at the time of operation. A catheter may be dispensed with in complete resection and suture, if diversion of the urine has been achieved, but in partial resections, especially if of the membranous urethra, it will be seen that it is still at times a necessity. Notwithstanding what has been said, the catheter *en demeure* may give excellent results, for it serves as an efficient splint. Sometimes after drainage of the bladder the

induration about the stricture improves, and treatment by dilatation proves feasible and sufficient.

Position of the Patient.—The most satisfactory position is one which combines the lithotomy with the Trendelenburg, and in order to maintain this and to prevent undue weight being borne by the shoulders it is essential to employ a pelvic rest which grips the loins immediately above the iliac crests (Macalpine) (*Fig. 104*). The patient having been placed in the customary lithotomy position with the addition of this pelvic rest, an exaggerated Trendelenburg position can be obtained so that the perineum is presented as an almost horizontal surface, and a great number of the inconveniences of the usual lithotomy position are avoided (congestion, access, etc.).

Technique.—The preliminary steps of the operation are similar to those of external urethrotomy, but in strictures situated far back in the bulb it is advisable, and in traumatic strictures involving the membranous urethra essential, to prolong the incision backwards by two diverging cuts on either side of the anus. An inverted Y-shaped incision is the result, and posteriorly the central tendon, transversus perinæi superficialis, and ischiocavernosus muscles are exposed as well as the bulbocavernosus.

The stricture having been exposed, it is laid open exactly as in external urethrotomy, except in those rare instances in which an annular band can be defined before opening the urethra, when it may be possible to proceed immediately to the excision of a complete

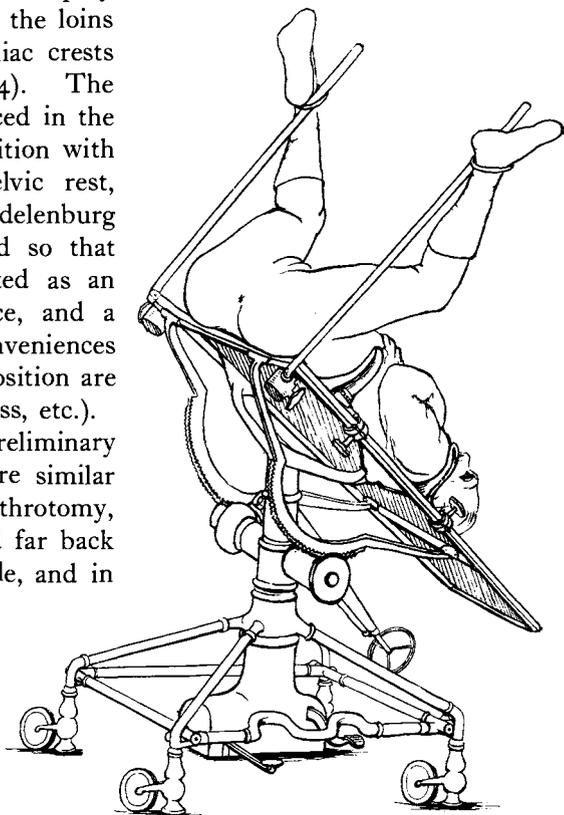


Fig. 104.—The combined lithotomy-Trendelenburg position for operations on the perineum.

segment with end-to-end suture (*Fig. 105*). Otherwise one of three procedures may be adopted: (1) The French method; (2) Russell's method; (3) MacGowan's method.

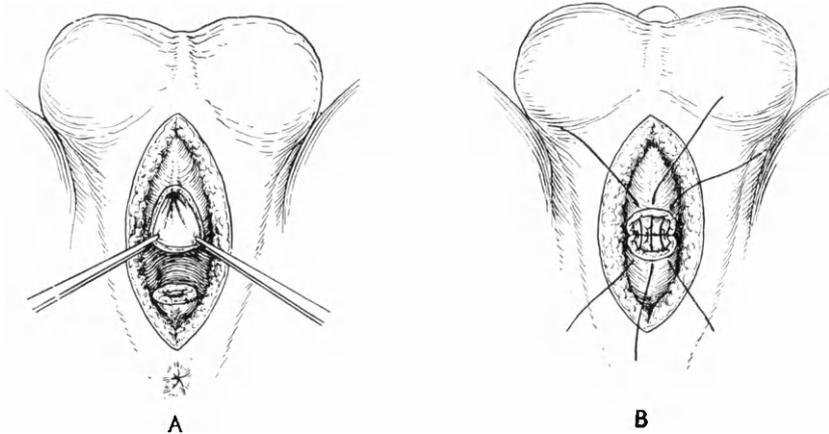


Fig. 105.—Annular resection of stricture. **A**, A short segment of the urethra and stricture has been resected; **B**, Suture of the urethra.

1. In the first of these, a method developed by French surgeons, the stricture having been incised, all the scar tissue is excised except for a narrow strip of the roof, which is preserved and maintains continuity (*Fig. 106*). This is a partial excision, and Milligan considers it unsatisfactory in that as the glands and crypts which harbour infection occupy the roof rather than the sides and floor, any resection omitting the roof will be useless. The method is said to permit of the removal of some 2.5 to 3 cm. of the urethral wall.

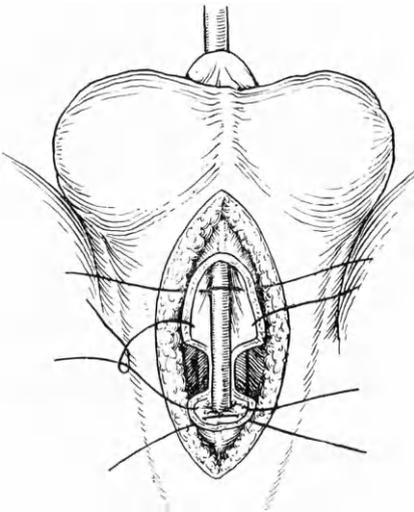


Fig. 106.—Partial resection of the urethra, leaving a strip of roof (after Leguen).

2. The second method is that of Russell and is a development of his operation of artificial hypospadias for intractable stricture (p. 168). The stricture is laid open as before and also the urethra in front and behind

it for some distance, a total excision of the affected area is performed, and then the ribbon-like ends remaining are mobilized both proximally and distally and sutured together still in ribbon form, the knots being placed on the mucosa (*Fig. 107*). The wound is left open or may be lightly packed, for in the recumbent position the parts come together naturally. Russell observed that

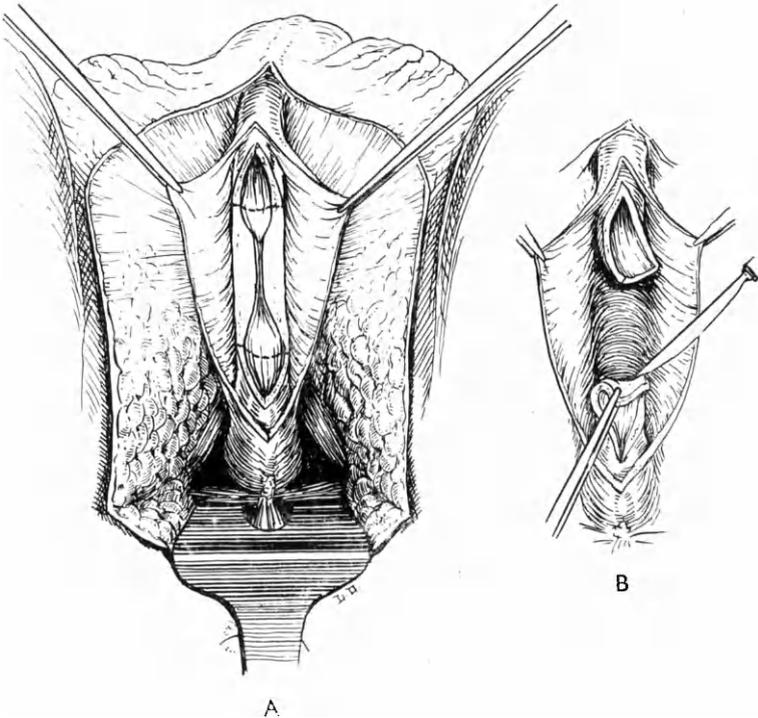


Fig. 107.—Excision of stricture by Russell's technique. **A**, Exposure and incision of the urethra and stricture; **B**, Mobilization of the ribbon-like ends remaining after resection of the stricture as a preliminary to suture.

the flat ribbon of urethra re-forms as a tube partly because of the proliferative properties of the urethral mucosa and partly because as the overlying parts come together the flat strip is rolled into a tube. As much as 8 to 9 cm. of urethra has been removed by this method. In his description perineal drainage of the bladder is provided, but to-day a suprapubic cystostomy would be preferred.

3. The third method is that of MacGowan and will be described in rather greater detail. The incision used is the inverted Y, and it

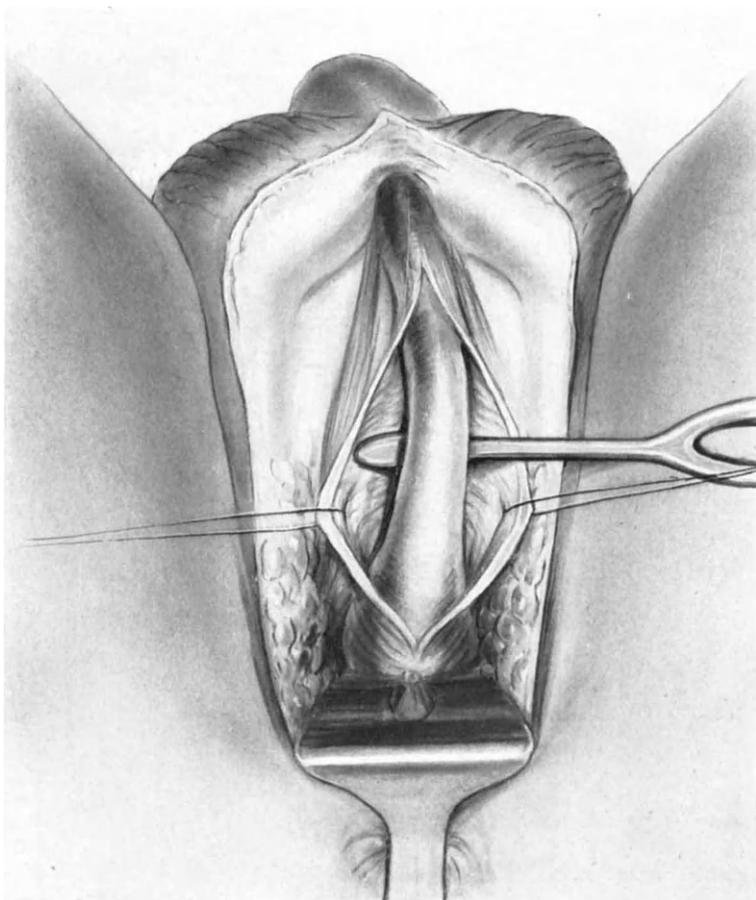


Fig. 108, A.—MacGowan's technique for the excision of stricture. Exposure and liberation of the corpus cavernosum urethrae.

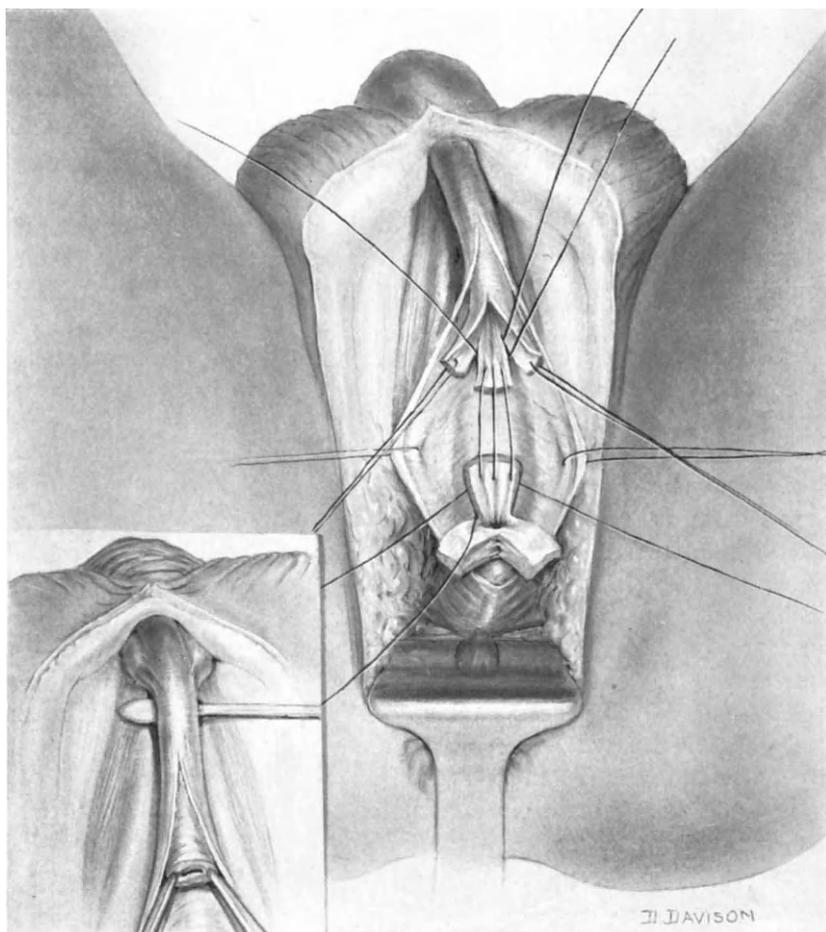


Fig. 108, B.—MacGowan's technique for the excision of stricture. After resection: division of the extremities into three flaps; insertion of the first sutures. The inset shows extensive freeing of the anterior extremity in progress, with knuckling of the corpora cavernosa penis as the result of traction.

may prove necessary to bare the corpus cavernosum urethræ from the inferior fascia of the urogenital diaphragm to the frænulum in order to obtain sufficient mobilization to avoid tension. The incision having been made, the central tendon is divided, the inferior fascia exposed, and the ischiocavernosi are pushed aside; then the bulbo-cavernosus is split along its raphé and the transversus perinæi superficialis muscles are clamped and divided close to the bulb. The urethra is freed from its bed, chiefly by blunt dissection, to points well behind and in front of the stricture, and the stricture is incised in its whole length with the aid of a filiform guide in the urethra, but if one cannot be inserted the track is found usually from in front, or if necessary from behind as well as by retrograde catheterization. The stricture is completely excised, care being necessary at the point where the dorsal vein perforates the inferior fascia; then the two extremities are slit so that three strips are formed from each, one being placed postero-superiorly and two laterally. The first must be of sufficient size for the insertion of three chromic-gut sutures which are inserted 1 cm. from each cut end and left to be tied later. Next the cut ends of the corpus cavernosum urethræ are approximated by traction sutures of silk placed in the midline at points just beyond the terminations of the slits. The chromic-gut sutures are now tied, the central first, the knots lying external to the lumen. As the tube when re-formed must not be under any tension, it may be necessary to prise the urethra from its bed as far as the frænulum in front and posteriorly back to the inferior fascia. When drawn into its new position the urethra is anchored to its bed by as many sutures of chromic gut as may be necessary. (*Figs. 108 A, 108 B.*)

A soft rubber catheter is inserted from meatus to urogenital diaphragm and anchored to the inferior fascia by a suture of plain catgut; it serves to prevent adhesion of granulations and acts as a splint. The lateral strips are then sewn together, using No. 00 chromic gut, and finally united side to side similarly. The bulbo-cavernosus and ischiocavernosi are replaced, a few interrupted sutures being used, and the transversus perinæi superficialis muscles are repaired. The superficial wound is partially closed, a cigarette drain having been inserted. The wound must not be closed entirely because of the dangers of hæmatoma formation and sepsis; drainage is favoured by loose suturing. MacGowan points out the necessity of suitable instruments for this delicate work and recommends the kit of an eye surgeon.

After operation the bowels are confined for from four to five days, by which time granulations will have formed sufficiently to guard against sepsis of the depths of the wound. Gentle instrumentation may be begun on the fifth day; MacGowan himself commences about the fourteenth day with bougies not larger than 18 or 20 Charrière and gradually increases the size used at weekly intervals.

Comments.—The ideal procedure is therefore preliminary suprapubic cystostomy followed later by total resection of the stricture and repair of the urethra by suture according to the method of either Russell or MacGowan. Even though marked flexion and deformity of the penis may be the immediate result of an extensive excision, it is stated that this is only a temporary condition. Total resection of the urethra and its corpus cavernosum is never endangered by loss of blood-supply, so efficient are its anastomoses; neither is erection hindered later. Mobilization of the inferior fascia of the urogenital diaphragm is a further aid to approximation

of the urethral ends, but should it prove impossible to unite the extremities it is inadvisable to attempt further restoration of the canal at the time of operation and either a catheter *en demeure* will permit the urethra to re-form at the expense of a stricture, perhaps more troublesome than its predecessor, or, and preferably, the technique of Pasteau and Iselin is adopted. This was designed primarily as a two-stage excision of stricture with the object of avoiding any development of a fresh narrowing at the line of suture—a possibility of the single-stage procedure. Through a long incision a wide and extensive excision of the stricture and any surrounding fibrosis is practised. The urethral extremities are then sutured together if this is possible, but the longitudinal incision of the urethra is left unclosed and instead its lateral margins are sutured to the skin edges on either side in

their whole extent (*Fig. 109*). The result is a long and gaping urethral gutter forming an artificial hypospadias which has been

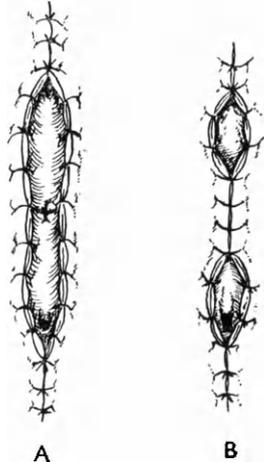


Fig. 109.—The final stage of the operation of Pasteau and Iselin. **A**, After resection the ribbon-like urethra has been brought to the surface, its margins being sutured to the skin edges; **B**, Approximation having proved impossible, both ends of the urethra have been brought to the surface separately.

described as resembling a vulva. At a later date the gutter is closed using the superimposed skin-flap method of Guyon (p. 201). Should the urethral ends fail to come together they are approximated as nearly as possible and fixed to the skin in the manner described; the union of the two openings and the re-establishment of a urethra is achieved subsequently by Guyon's method in exactly the same way.

When suprapubic cystostomy has been employed retrograde catheterization (*Fig. 110*) simplifies the finding of the urethra proximal

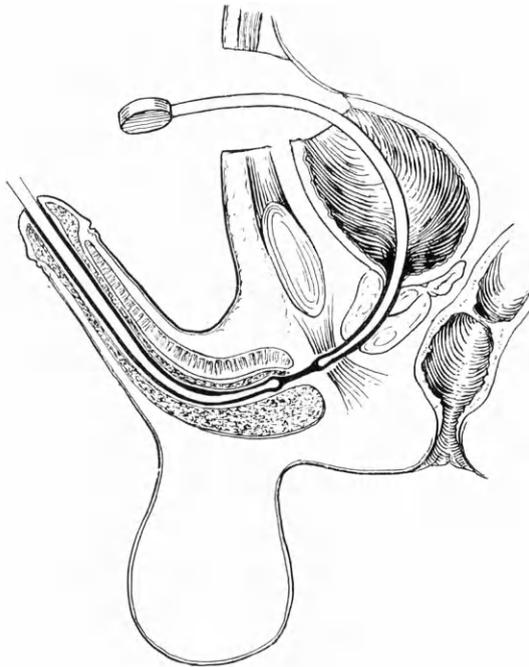


Fig. 110.—Retrograde catheterization.

to the stricture; otherwise the same difficulties are met with as in external urethrotomy, and similar methods may be necessary to overcome them. When the stricture is situated far back in the bulb two devices are of help in finding the proximal urethra. In the first a backward prolongation of the incision is utilized and, after division of the central tendon, the apex of the prostate and the membranous urethra are found and the latter is opened to allow of retrograde

catheterization (Russell) (*Fig. III*)—this would seem to be an elaboration of Cock's operation. In the second the bulb is fully exposed and then partially separated from its attachments to the inferior fascia of the urogenital diaphragm so that the urethra may be discovered as it pierces this membrane. The latter method avoids all risk of damage to the sphincter urethræ membranaceæ or to its nerve-supply.

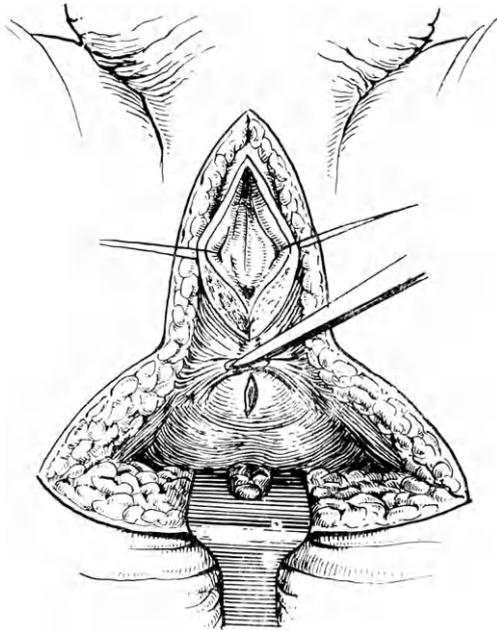


Fig. III.—Exposure of the membranous urethra to allow of retrograde approach to a stricture.

Stricture of the Membranous Urethra.—Backward prolongations of the incision on either side of the anus, or a curved incision anterior to it, are utilized to expose the membranous urethra. The central tendon of the perineum is divided and the apex of the prostate with the emerging urethra exposed (*see Fig. III*). Complete excision of these traumatic strictures is inadvisable if not impossible, and it is best to excise as much scar tissue as possible whilst preserving a strip of urethral mucosa on the roof which may as a final step be split longitudinally (Russell), thus leaving a groove for the catheter to sink into and aiding in the prevention of spur formation. Epithelialization then proceeds from four edges in place of two. A catheter *en demeure* cannot be avoided.

Complete excision of all scar tissue, fistulæ, and the stricture itself is the method of choice when treating strictures complicated by chronic periurethritis; operation is of course preceded by cystostomy.

RESULTS

Both external urethrotomy and resection of a stricture are more severe procedures than internal urethrotomy, and the patient is in hospital for a longer period. The mortality-rate of external urethrotomy is stated to be in the neighbourhood of 5 per cent; for resection a sufficient quota of figures has not been accumulated as yet. The results of external urethrotomy are in general as good as, if not better than, those of internal urethrotomy provided that care is taken that subsequently instrumentation is maintained, and there is still a place for this operation in treating strictures which refuse to admit an instrument. Resection is undoubtedly preferable to external urethrotomy, but is not always feasible. It is claimed, at least for Russell's method, that a certain percentage of absolute cures result, adhesions to the surrounding parts holding open the urethral lumen at the site of union; however, with a number of patients relapse occurs unless dilatation is carried out subsequently. For a few patients, particularly if elderly, a permanent perineoscrotal urethrostomy or artificial hypospadias (Russell) must be considered.

ARTIFICIAL HYPOSPADIAS (RUSSELL)

This operation closely resembles that described by Pasteau and Iselin. The scrotum is split longitudinally along the whole length of its median raphé until the corpus cavernosum urethræ is exposed. When drawn laterally the wound assumes a diamond shape; it is partially sutured, commencing laterally at the outer angles of the diamond on each side until each testis is enclosed in its own separated half of the scrotum; the corpus cavernosum urethræ, however, remains exposed in the middle line. A sound is introduced into the urethral lumen and the urethra is incised along its under aspect from a point immediately anterior to the scrotum to a point in the perineum which must be proximal to the stricture. The edges of the urethral opening on either side are sutured in their whole length to the skin margins. A rubber catheter is tied in through the perineal wound. The sutures are removed in ten days.

Comments.—A perineoscrotal hypospadias is established which necessitates a squatting posture for micturition and results in sterility, but the penis remains free and the effects of the stricture are abolished. The operation does not require the after-care of external urethrotomy, and is to be preferred to permanent suprapubic drainage.

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CHAPTER X

PERIURETHRITIS, TUBERCULOSIS, SYPHILIS, AND
SCHISTOSOMIASIS OF THE URETHRA

PERIURETHRITIS

PERIURETHRAL inflammation may be either acute or chronic. The former may be gangrenous or suppurative, whilst the latter is characterized by a marked fibrosis.

Aetiology.—Periurethritis can only occur in the presence of two essentials—a lesion of the mucosa and infection. The former may result from inflammation, as for example an acute urethritis or the chronic inflammation of stricture, or from instrumentation (false passage) or traumatic rupture: rarely a neoplasm or the indwelling catheter is responsible. Infection occurs either simultaneously with, or subsequently to, the injury and spreads into the surrounding tissues.

In the great majority of patients periurethritis is associated with a stricture, for proximal to such an obstruction there always exists infection together with dilatation and sometimes ulceration. Occasionally in these patients straining at micturition may cause perforation and initiate suppuration, but as a rule the spread of infection is a gradual process.

Bacteriology.—Many organisms can cause periurethritis, the *B. coli*, streptococci, staphylococci, and a number of anaerobes having been found; usually, however, the infection is a mixed one.

Pathology.—Infection may be introduced from without, but more commonly originates from within. Introduction from without may occur by instrumentation, by foreign bodies, or through external injuries. Infection from within spreads through the damaged mucosa behind a stricture or arises from infected Littre's glands (Motz and Bartrina), or from an ulcerative balanitis, whilst sometimes a Cowperitis or prostatitis is its starting-point. On occasions the infective focus is a phlebitis and thrombosis of the cavernous tissue

which has been caused by direct spread from the urethra. The type and course of the inflammation is frequently determined by the general bodily health of the patient.

ACUTE PHLEGMONOUS PERIURETHRITIS (EXTRAVASATION OF URINE)

There are two conditions which can be described under this heading and these are clinically similar but of different origin; both forms are characterized by an acute and rapidly spreading cellulitis of the periurethral tissues, and their mortality-rate is stated by Campbell to be in the neighbourhood of 50 per cent. One of these may be truly classified as acute phlegmonous periurethritis and is more particularly considered here; the other is more correctly termed fulminating scrotal and penile gangrene.

Actiology.—Acute penile and scrotal gangrene is a rapidly developing diffuse cellulitis which is the result of anaerobic or streptococcal infection, presumably originating from an infection through the skin. Phlegmonous periurethritis is caused by an infection originating in the urethra, and may be associated either with trauma of the urethra or with stricture. The onset is sometimes sudden and overwhelming, but may be gradual and follow on abscess formation.

The urethral injury either results from external violence applied to a previously normal urethra, namely rupture of the urethra, or the urethra is already the site of a stricture and instrumentation is then commonly the traumatizing agent. Infection of the urethral wall proximal to a stricture may lead either directly to periurethritis or to abscess formation which may subsequently result in periurethritis.

Pathology.—The urine of a patient suffering from traumatic rupture of a normal urethra may be, and usually is, aseptic, whilst that of a stricture patient invariably is infected, and the course of events differs greatly in consequence. A neglected rupture of the urethra results in a true extravasation of urine, the physical properties of which cause necrosis, and subsequent infection then leads to periurethritis. Periurethritis when associated with stricture is an inflammation extending from the urethra and rarely, if ever, is accompanied by extravasation of urine; its site of origin is the bulbous urethra or a point distal to this. In traumatic rupture of the normal urethra the site is either at the bulbous urethra or, with fracture of the pelvis, in the membranous urethra. Rupture of the

membranous urethra is intrapelvic and escape of urine occurs into the retropubic space (cavum Retzii) and spreads in the retroperitoneal tissues of the pelvis, perhaps appearing at the subcutaneous inguinal rings on one or both sides. Extravasation from a ruptured bulbous urethra is extrapelvic and its spread is therefore guided by the fascial attachments in the perineum so that it involves the perineum, scrotum, and penis, causing periurethritis, and spreading upwards and laterally over the anterior abdominal wall. The distinction due to site is not always clearly cut, because with severe traumatism the damage to the pelvic floor may be so extensive as to allow of the appearance of an intrapelvic extravasation in the perineum or to permit an extrapelvic collection to gain the retroperitoneal tissues. Rarely with a stricture the inflammation originates proximally to the inferior fascia of the urogenital diaphragm and is therefore intrapelvic; in fact, however, the pelvic diaphragm proves a very poor barrier to the inflammatory process. Sometimes intrapelvic extravasation may be an indirect result of urethral stricture, the sequence of events being stricture, retention, suprapubic puncture, reaccumulation of urine, and its escape into the perivesical tissues.

If the urine is aseptic it is possible for an extravasation to remain latent for many days or even weeks, but necrosis and subsequent infection inevitably occur and then acute symptoms associated with grave toxæmia develop. With an infected urine the symptoms follow shortly on the extravasation, and often the process is fulminating. Infection having supervened or being already present, the picture is one of an extremely acute, sloughing cellulitis, indistinguishable in extrapelvic extravasation from acute penile and scrotal gangrene and only to be differentiated when the history points to rupture or an instrument discovers a stricture. (*Fig. 112.*)

Diagnosis.—The symptoms of an established extrapelvic phlegmonous periurethritis are both general and local. The patient is profoundly ill with toxæmia, the temperature is high and rigors occur, delirium is often present, the skin is pale and moist and the tongue dry and furred, whilst little or no urine is passed. On examination there is a brawny red indurated area in the perineum, and the scrotum and penis show considerable swelling and are red and œdematous; areas of gangrene soon develop at the more dependent parts and the lower abdominal wall becomes involved to a varying extent. Crepitation due to the presence of gas from gas-producing organisms may be discovered.

The early symptoms of extravasation due to rupture of a healthy bulbous urethra are those of rupture of the urethra ; later, if this is neglected and the patient attempts to urinate, extravasation takes



Fig. 112.—Acute phlegmonous periurethritis in a case of stricture. Gross inflammatory swelling of the perineum and scrotum is present together with patches of superficial gangrene.

place, and on examination a soft, painless œdema of the perineum is found. The skin is red, pits on pressure, and may crepitate, but soon the swelling becomes painful, hard, and tense. Later, gangrene occurs with sloughing and the formation of fistulæ, which produce

fœtid serous fluid and possibly gas ; and finally there is great loss of tissue and denudation of the urethra, testes, etc. If a sequel to urethral stricture the acute periurethritis is preceded by prodromal symptoms of urethral obstruction, and usually also of periurethral abscess with fever and rigors. In such cases the patient complains of severe pain in the perineum and sometimes of "something giving way". Symptoms of retention develop and the temperature falls while the pulse-rate rises and a rapidly increasing œdema of the penis and scrotum occurs, which soon emerges into the fully developed picture described above.

Traumatic intrapelvic extravasation of urethral origin cannot be differentiated from extraperitoneal rupture of the bladder unless a distended bladder can be palpated, or outlined by intravenous urography, or a catheter definitely fails to enter the viscus ; this last procedure should not be resorted to if it can be avoided. In both conditions there is a history of injury and often the pelvis is fractured, in neither can the patient micturate, whilst in both strangury is present and a catheter withdraws blood-stained urine. In each dullness appears above the pubes, commonly more to one side than the other, and tenderness and rigidity of the lower abdomen are present. Extension may occur through the ischiatic foramina, obturator foramina, or inguinal canals, and become evident. Sooner or later necrosis and infection ensue, with subsequent cellulitis and abscess formation, whilst sometimes septicæmia or pyæmia due to venous thrombosis and infection develops.

Rarely, a train of events similar in type but of more rapid evolution follows on suprapubic puncture of the bladder or on forcible instrumentation of a urethral stricture.

It must be noted that a severe injury may permit of both intrapelvic and extrapelvic extravasation of urine, and also that periurethritis, arising from the membranous urethra, may result in both intrapelvic and extrapelvic suppuration.

Prognosis.—The mortality-rate of all cases is approximately 50 per cent ; nevertheless the prognosis is much more favourable when the condition results from traumatic rupture of the urethra than when it follows on urethral stricture. The former patients are for the most part in robust health, but the latter have for years suffered from urinary infection which is often associated with renal impairment. The factors governing prognosis in the latter group are the virulence of the infection, the varying physical properties o

the urine, and the duration and extent of renal damage. In both groups the general condition of the patient and the promptitude of treatment largely influence the result; when death occurs it is usually the outcome of systemic infection.

Treatment.—The immediate treatment is the provision of free drainage for the infiltrated and infected tissues, and this is effected by multiple free incisions made with the diathermy needle, cautery, or knife and left widely open.

Extrapelvic Extravasation following on Traumatic Rupture of the Urethra.—Multiple incisions are made in the perineum, scrotum, penis, and abdominal wall according to the area affected by the

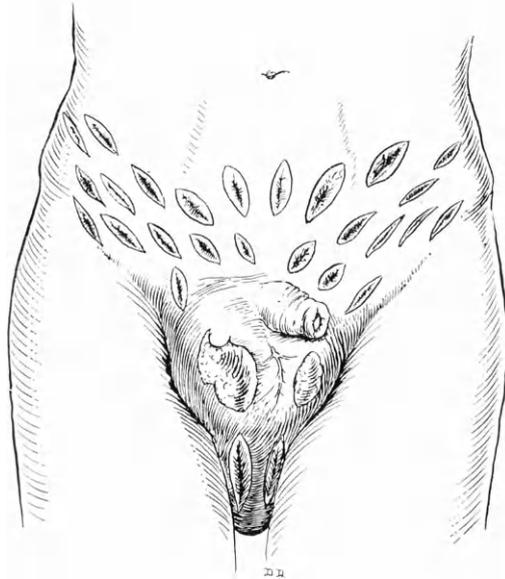


Fig. 113.—The treatment of acute phlegmonous periurethritis. The drawing was made from a rapidly recovering case.

extravasation; these incisions must be of sufficient depth to reach the level of the deep fascia. At the same time if facilities for immediate treatment are available repair of the urethra sometimes can be carried out, and suprapubic cystostomy may be performed as the first step of this repair (*see RUPTURE OF THE URETHRA*).

Extrapelvic Phlegmonous Suppuration following on Urethral Stricture.—Multiple incisions are required as described above (Fig. 113), and at the same time it may be possible to perform an external

urethrotomy for the relief of the stricture; Guyon, however, stated that this should never be done, and moreover it is often contra-indicated by the critical condition of the patient and the state of the tissues. Drainage of the bladder, however, should be established in order to divert the infected urine and to relieve the probably damaged kidneys; it may be provided either by suprapubic cystostomy or by the perineal route; the former appears preferable, as the latter interferes with subsequent manipulation of the urethra and may develop into a fistula (Wolfer).

Intrapelvic Extravasation of Urine.—Drainage of the pelvic tissues is always difficult and to some extent unsatisfactory, but it must be carried out so far as possible through inguinal and suprapubic incisions. In addition suprapubic cystostomy is essential in order to ensure diversion of the urine and to permit treatment of a ruptured posterior urethra (*see RUPTURE OF THE URETHRA*). All areas affected by the extending extravasation must be located and freely drained, and in certain patients both extrapelvic and intrapelvic drainage should be provided. After operation antiseptic dressings must be frequently renewed, and irrigation of the wounds with hydrogen peroxide or eusol is of value. General measures to combat toxæmia are adopted, in particular a copious fluid intake. Drugs of the sulphonamide group are used and sera are employed with advantage, whilst intravenous injections of antitoxins or of antiseptics such as mercurochrome or acriflavine have been recommended for pyæmia and septicæmia.

SUPPURATIVE PERIURETHRITIS (URINARY ABSCESS)

Periurethritis originating from the posterior urethra has been described together with prostatic abscess and periprostatitis, therefore suppurative periurethritis of the anterior urethra alone will be considered here. It may be defined as a localized periurethral abscess arising from the urethra. Three anatomical varieties are described: Penile; Scrotal; and Perineal.

Penile periurethritis occurs most often during the acute stage of gonorrhœa (*Fig. 114*). An induration is felt along the course of the urethra and this soon develops into a swelling which has the ordinary characteristics of an abscess and which finally ruptures, sometimes into the urethra but more often externally. It is rare for a fistula to result.

Scrotal periurethritis is perhaps most often associated with the presence of an indwelling catheter. Its development is insidious, for the periurethral swelling is concealed by the scrotum, but sometimes it is discovered by palpation in a patient with unexplained fever, although more often attention is directed to the area by a complaint of pain in this region or when the skin has become involved with evident œdema and redness. The abscess is situated as a rule to one side of the middle line, and not infrequently points in the direction of the pubic spine. A fistula is an infrequent result of such an abscess.



Fig. 114.—A penile periurethral abscess (gonorrhœal).

Perineal periurethritis is the variety most frequently observed. Its onset may be abrupt with rigors and perineal pain or it



Fig. 115.—Suppurative periurethritis (urinary abscess).

may be insidious with some frequency of micturition, perineal discomfort, and rectal tenesmus, accompanied by a slowly increasing swelling which renders sitting impossible. On examination there is a rounded, symmetrical swelling in the midline of the perineum with its long axis corresponding to that of the urethra (Fig. 115). Anteriorly the swelling merges indefinitely in the scrotal tissues, which are œdematous, but posteriorly it is well defined in the region of the bulb, where any further extension is limited by the attachment of the fascia of Colles. The overlying skin becomes red, glossy, and adherent to the deeper structures,

and on palpation the swelling is indurated and movable from side to side, though not in the anteroposterior direction. The passage of a bougie may demonstrate a stricture.

During this stage the patient complains of a perineal tenseness and is unable to sit without pain, micturition is painful and difficult or there is retention of urine; pyrexia is present.

A perianal abscess is distinguished easily by its site, superficial situation, and limitation anteriorly. An abscess of Cowper's gland is at first lateral to the urethra, and a prostatic abscess pointing in the perineum may be lateral to the urethra, but in any event can be differentiated by rectal examination.

Course and Complications.—Suppurative periurethritis may give rise to acute phlegmonous periurethritis; on rare occasions it may resolve, particularly if an indwelling catheter is removed, but usually abscess formation follows. The abscess cavity may communicate with the urethra, either *ab initio* or as a late phenomenon developing after some seven to ten days; more rarely there is no urethral connexion, and in these patients the prognosis as regards rapid cure is favourable. The formation of a fistula is unfortunately a common termination, and there often result multiple sinuses with surrounding chronic periurethritis and fibrosis. The prognosis has always a certain gravity owing to the latent infective possibilities and their sequelæ.

Treatment.—In the early stages before abscess formation has developed treatment consists of frequent perineal fomentations or two-hourly sitz baths, with cessation of all urethral instrumentation. When a penile abscess has formed this should be incised, either per urethram in an early stage or, later, externally. Fistula rarely follows a timely external incision. A perineal or scrotal abscess should be opened freely and drained. The incision occupies the middle line and is long and deep, the cavity is explored, any recesses are opened up, and septa are broken down with the finger; drains are then inserted and the wounds frequently irrigated and, at a later stage, packed.

Subsequently treatment of the urethra is essential, especially if a fistula remains. When inflammation has subsided, which usually takes some ten days, internal urethrotomy is performed and a large catheter left in the urethra until the fistula closes or becomes minute in size. Large instruments should then be passed at regular intervals in order to prevent relapse. In the presence of retention and cystitis

due to a stricture of small calibre, either external urethrotomy may be done at the time of the original operation and perineal drainage instituted, or a cystostomy established.

CHRONIC INDURATIVE PERIURETHRITIS

Aetiology.—Chronic indurative periurethritis is, as its name implies, characterized by a great production of fibrous tissue. At times the condition is primary and the inflammation is chronic from its commencement, and develops gradually for weeks or months about a chronically inflamed urethra; there may or may not be a small central abscess cavity and the organisms present are similar to those isolated in the more acute forms. At other times the condition is secondary and follows on one or more urinary abscesses. It perhaps most commonly occurs after an abscess has discharged and left one or several fistulæ, in which event the stagnant and infected urine favours the further formation of fibrous tissue. A stricture of the urethra is always present either as the cause of, or as a sequel to, the condition.

Pathology.—The swellings which are present are usually perineoscrotal in site, median or just to one side of the middle line, and often irregular in shape. They are composed of dense fibrous tissue, and, surprisingly, may be easily separable from the adjacent structures—"énucléable" (Legueu).

A central cavity frequently exists, perhaps containing pus, and often possessing communicating fistulæ and sinuses. The fistulæ are either primary or secondary, more commonly the former, and then the fibrosis has succeeded them; they are irregular in their distribution and open in every possible situation. Sometimes they contain calculi, and as they are often lined by squamous epithelium, epitheliomata may arise, although rarely. The urethra is always involved in a chronic periurethritis, and is scarred by partial destruction of its wall, with resultant severe stricture formation. The damage present is largely of the inferior wall of the canal. The fibrous masses themselves may merely compress the urethra and be easily separable from its wall, or they may be attached to it at those points where fistulæ arise. Nevertheless the fibrosis sometimes involves the urethral wall, and the canal then becomes lost in the tumour mass; this is almost always so when the penile urethra is affected. The urethra then may open directly into the central cavity, or possess

a communication with the cavity. On other rare occasions the distal urethra is obliterated and all urine escapes through the fistulæ.

Symptoms.—The onset of the disease is always slow and insidious and the condition may take months to develop, whether as a primary event or as the sequel to a neglected abscess. A hard



Fig. 116.—Chronic periurethritis. Swellings formed by fibrotic masses and the orifices of numerous fistulæ are visible. Bilateral epididymal cysts exaggerate the scrotal swelling.

swelling of varying size and adherent to the deeper parts gradually forms in the perineal region (*Fig. 116*). It is covered by an adherent, rugose, and thickened skin which is neither red nor œdematous. One or more fistulæ traverse the mass to reach the surface, and a varying amount of urine escapes through them; usually a certain quantity passes by the natural channel, but the whole may escape

through the fistulæ. There is always some purulent discharge, or small abscesses arise, burst, and discharge repeatedly. A chronic lymphangitis of the neighbouring skin frequently produces a false elephantiasis. The general health may be little if at all affected, and it is rare for the patient to complain of pain, although some discomfort may be mentioned.

Diagnosis.—Tuberculous periurethritis is the only condition which may give rise to doubt in diagnosis, but in tuberculous disease destructive rather than productive changes predominate, and suppuration and fistulæ are accompanied as a rule by a minimum of fibrosis. Identification of the bacillus may determine the question. In chronic periurethritis instrumentation usually reveals an impassable stricture, although rarely one or more obstructions which are easily surmounted are found; a stricture on the other hand is said to be a rarity in tuberculous periurethritis.

Prognosis.—The prognosis is serious owing to the difficult and lengthy treatment and because of the permanence of the urethral damage.

Treatment.—The essentials of treatment are the excision of all fibrotic masses and the restoration of the urethral lumen. Operative treatment of the urethra should be the primary measure; nevertheless if stricture formation is negligible this first step may be omitted. Internal urethrotomy is considered preferable to external if an instrument can be passed, but the floor rather than the roof requires section, and for this the cutting Béniqué sound is best, whilst more than one cut is necessary. A catheter *en demeure* follows urethrotomy, and the second perineal stage is usually deferred for some weeks, although it is sometimes possible to proceed with it at once.

At the second stage a sound is introduced, and through a median perineal incision which reaches the corpus cavernosum urethræ, all fibrous tissue and all fistulæ are completely and cleanly excised, including if necessary a varying extent of urethra, but preserving with care the sphincter urethræ membranaceæ. Rarely the urethra is so little involved that it remains almost intact, and then external urethrotomy is unnecessary.

Should all attempts to introduce an instrument at the primary operation fail, the best procedure is probably that described by Kidd: a cystostomy is performed and retrograde catheterization carried out; then with sounds in the anterior and posterior urethræ, a perineal excision of the fibrotic mass and involved urethra is undertaken, the sphincter being carefully preserved. Afterwards if

practicable the urethral ends are mobilized, particularly the anterior extremity, and then sutured together and the wound partially closed; sometimes the roof only can be sutured. Alternatively to cystostomy the membranous urethra may be exposed from the perineum as the preliminary step and retrograde catheterization thus performed, perineal drainage being established at the completion of the operation; the risk of damage to the sphincter urethræ membranaceæ is, however, greater than when cystostomy is performed.

Should suture of the urethral ends be impossible, the choice probably lies between bringing each extremity to the surface, and at a later date reconstituting a urethra by plastic operations (Pasteau and Iselin), or establishing a perineal urethra (Poncet). Sometimes a catheter is placed *en demeure* and the wound left open, the urethra

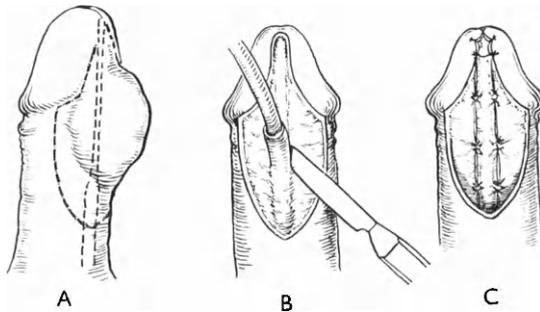


Fig. 117.—Cathelin's operation for chronic indurative periurethritis of the terminal urethra (after Legueu). A, Outline of the incision for removal of the fibrotic mass; B, Liberation of the uninvolved urethra; C, Advancement and suture of the freed urethra.

being left to re-form about the catheter, but by this method a severe degree of stricture formation is almost inevitable. In those patients in whom the penile urethra is involved, resection of the urethra is usually unavoidable, and Legueu counsels a two-stage operation rather than immediate mobilization and suture; the result of this procedure is that after the first stage a large fistula is left which requires secondary repair. If the site is near the meatus a condition of acquired hypospadias follows excision, and Legueu advises Cathelin's operation, which he terms urethral advancement, to repair this (Fig. 117); a length of urethra is dissected free and, together with its overlying skin, stretched to reach the original meatus, where it is sutured. As an alternative to this, Mathieu's procedure for hypospadias may be utilized (p. 55).

TUBERCULOSIS OF THE URETHRA AND TUBERCULOUS PERIURETHRITIS

Tuberculosis of the urethra is stated to be rare, but this is true only as regards the anterior urethra, for the posterior urethra is not at all uncommonly affected in conjunction with tuberculous prostatitis (Hallé and Motz). The age incidence of the disease is from 25 to 40 years of age.

Aetiology.—Its occurrence is said to be favoured by the length of the male urethra and also by the presence of old or chronic gonorrhœal lesions such as urethral stricture. G. Walker could not find any unimpeachable record of an example of isolated tuberculosis of the urethra, and whether infection ever is truly primary is doubtful, with the exception that direct inoculation of the glandular urethra is known to have occurred during ritual circumcision. As a rule infection is by secondary involvement, and this may originate from either a urinary or genital descending infection, or be of hæmatogenous origin. In the former event bacilli become implanted in the urethral glands and lacunæ, whilst in the latter the cavernous tissue, not the mucosa, is primarily involved. Tuberculous periurethritis develops by lymphatic and tissue spread.

Pathology.—

Posterior Urethra.—Infection of the prostatic urethra is commonly secondary to tuberculous prostatitis, but rarely the urethral infection may precede prostatic involvement and then it is as a rule the result of tuberculous cystitis; very exceptionally the infection may seem to be primary. Ulceration is the predominant occurrence, and the lesions are most marked on the floor and on the verumontanum. Disease of the membranous urethra is secondary to prostatitis or to urinary infection, and sometimes, though rarely, to tuberculous Cowperitis. Tubercles are often found and ulcers appear, which usually assume a serpiginous outline and are of variable depth; later the glands of Littré are invaded and through them the periurethral tissues, so that eventually cavities and cold abscesses may form and give origin to fistulæ.

Anterior Urethra.—Three types of lesions are described:—

1. Tubercles, which appear as small granules on the mucosal surface and which are palpable as well as visible; they are but slightly elevated, of greyish or opalescent appearance, and are seen most often in the bulbous portion of the urethra.

2. Ulcerations, which are at first minute but later of variable size and sometimes of linear form. They have been described as of typically tuberculous appearance with a grey or yellowish, perhaps a caseous, base, margins which are at first sharp-cut and later irregular and overhanging, and either with or without a surrounding zone of hyperæmia. Rarely cavitation occurs, and extends beyond the urethra to the surrounding structures. These lesions are found chiefly in the bulbous urethra.

3. Massive caseous infiltration is a very rare condition in which the mucosa as a whole is caseous and yellow (Rayer).

The cavernous tissue of the corpus cavernosum urethræ is involved by the disease either primarily as a hæmatogenous infection, or secondarily when disease of the mucosa extends peripherally. In the former event tubercles form and progress to caseation and tuberculous abscess formation, or perhaps to calcification; histologically typical tubercles can be discovered at the periphery of the mass.

Tuberculous Periurethritis.—This disease occurs in either a localized or a diffuse form. The localized variety is met with either as a tuberculous abscess or in the form of hard, circumscribed nodules which are adherent to the urethra; tuberculous abscesses may open either into the urethral lumen or on to the surface or possess openings to both, and tuberculous fistulæ then result. Infection of the urethral glands no doubt paves the way for these foci. The diffuse variety is characterized by the appearance of multiple foci of tuberculous disease in the periurethral tissues which slowly progress in distinctive fashion (Englisch); these form large and irregular swellings which later increase rapidly in size and give rise to abscesses and fistulæ. The inguinal lymphatic glands frequently become involved.

Tuberculous Cowperitis is usually secondary to, and coexists with, tuberculous urethritis, but on rare occasions may be primary and of hæmatogenous origin. Two types are found, and gonorrhœal infection is said to be a predisposing factor. In the first the infection remains limited to the gland. In the second extension occurs and results in periurethritis and a perineal cold abscess.

Sometimes, although rarely, Cowper's duct in its passage through the bulb to the urethra is attacked primarily. Histologically typical tubercles are found.

Tuberculous Stricture.—Legueu denies the existence of such a condition as a tuberculous stricture, adding that gonorrhœal stricture may coexist with tuberculosis. Nevertheless urethral

obstruction may be brought about either by tuberculous fibrosis of the urethral wall, by the formation of calculi, or by the presence of tuberculous swellings (Perge). Hartmann believes that, as in the cæcum and rectum, a stenosing and hypertrophic tuberculosis can produce true narrowing, and he has described an example in the female; Marion and Minet also hold this view. Recently Rochat has published two indubitable examples of tuberculous stricture.

Symptoms and Clinical Findings.—The symptoms are complicated as a rule by those of an associated genito-urinary tuberculosis. Micturition is difficult and straining occurs, it is slow—either drop by drop, or the stream is thin—and the act is accompanied by a burning sensation similar to that experienced in gonorrhœa. Because of this pain the patient often is enabled to locate the site of the disease, but it sometimes radiates to the penis, testis, perineum, or rectum as well. A urethral discharge is always present, although it may be slight and unnoticed; unlike that of gonorrhœa it commonly is white and watery, but on rare occasions is purulent and associated with acute symptoms so that it then closely mimics gonorrhœa. Hæmaturia is a fairly frequent occurrence, and there is sometimes incontinence or pollakiuria. Periurethral infiltration may give rise to retention, and pain on erection comparable to that of chordee has been noted. On examination the urethra is indurated and thickened as a whole, but sometimes may present discrete nodules. Later there develops a surrounding induration and matting of the parts, and abscesses and fistulæ form. The passage of a bougie often gives a grating sensation in the diseased region and urethroscopy is valuable in locating the lesions; on inspection through the instrument the urethra gapes owing to the rigidity of its wall, tubercles and erosions may be seen, and the glandular orifices are red, enlarged, and perhaps ulcerated. In the posterior urethra the verumontanum appears swollen and ulcerated. The inguinal glands may be tuberculous, and occasionally there are associated tuberculous lesions of the surface of the glans or penis. With involvement of Cowper's gland a small lump forms to one side of the bulb and in front of the anus, and as this increases it forms an abscess which bursts to the surface, leaving a fistula; it is associated with a urethral discharge.

Diagnosis.—A urethral discharge without a history of gonorrhœa and one which is repeatedly negative for gonococci may arouse suspicions, and repeated microscopical examinations and guinea-pig inoculation or culture may confirm them. The shreds which are

present in the urine may be examined for tubercle bacilli. Nevertheless the diagnosis can be extremely difficult if chronic gonorrhœa or stricture coexists. However, in the presence of painful and difficult micturition and a urethral discharge, and in the absence of gonococci, a history of infection, injury, or chancre, then all irregularities of the urethral canal are open to suspicion of tuberculosis and require full investigation. Tuberculosis of the penis is usually of the glans, and is found more especially in the region of the frænulum; it manifests itself as an ulceration which may erode the urethra. On the other hand ulceration of the glans penis may be syphilitic, and is then often of characteristic appearance; or it may be epitheliomatous, when it usually is typical and much more painful than a tuberculous ulcer, which is non-indurated and occurs in a tuberculous individual. Histological examination and guinea-pig inoculation will confirm the diagnosis.

Tuberculous fistulæ differ from those of carcinoma, which show characteristic crateriform or chancriform outline and possess readily bleeding granulations. The simple urinary fistulæ, unlike those of tuberculosis, are associated with marked fibrosis and strictures are present. Microscopy and guinea-pig inoculations again will confirm the diagnosis.

Prognosis.—The prognosis is grave because of the associated urinary or genital tuberculosis. The urethral condition itself can be ameliorated or even cured, but the resultant fibrosis tends to stricture formation.

Treatment.—The patient with urethral tuberculosis requires the customary hygienic treatment. Local measures include instillations of 5 per cent gomenol in oil, of iodoform emulsion, or of lactic acid 5 per cent; and the two latter may sometimes be applied directly to the lesions through the urethroscope. Lavage and the use of silver nitrate should be avoided. When obstruction exists, very gentle instrumentation or internal urethrotomy of the roof may be carried out with the object of keeping the urethral lumen open rather than to obtain dilatation. If Cowper's glands are infected they should be extirpated by perineal incision as for prostatectomy. The tuberculous abscesses of periurethritis are incised, curetted, and drained, and if there is considerable involvement of the perineum with multiple fistulæ, all diseased tissue is excised and curetted away and the fistulæ dealt with as far as is possible. With advanced disease the establishment of a perineal urethrostomy is a good measure,

and an alternative to this is cystostomy. Advanced tuberculosis of the penile urethra requires extirpation of the diseased tissues and even amputation of the penis.

SYPHILIS OF THE URETHRA AND SYPHILITIC PERIURETHRITIS

The urethra may become involved during any stage of syphilis, but more frequently in the primary than in either the secondary or tertiary stages (Baye).

Primary Syphilis.—A primary chancre may involve the external urinary meatus or even arise within the urethral canal at some little distance from the meatus. Meatal chancres are said to form about



Fig. 118.—A hemilateral primary chancre of the meatus.
(Dr. Somerford's case.)

7 per cent of the total (Casoli), and of 414 chancres Fournier found 32 of the meatus, of which 17 were only visible on separating the lips of the meatus—in short, intra-urethral. Queyrat has classified meatal chancres as of three varieties: (a) Circular, which surround the meatus; (b) Hemilateral, either right or left (*Fig. 118*); and (c) Commissural, either superior or inferior. Casoli mentions three more types: (d) An indurated nodule; (e) A diffuse induration of the whole meatus, which is a very rare type; and (f) A chancre extending into the navicular fossa.

The diagnosis should not prove difficult when a correct history has been elicited and if the characteristics of a typical Hunterian chancre can be demonstrated together with the usual enlarged and firm inguinal glands; furthermore, the spirochætes should be demonstrable on dark-ground examination.

The rare intra-urethral chancre is frequently missed, for the accompanying discharge and perhaps pain on micturition cause it to be mistaken for gonorrhœal urethritis. This discharge, however, is slight and seropurulent, becoming sanguineous after palpation, pain is little or absent, and an induration can be detected within the urethra if care is taken to palpate in the ventrodorsal plane as well as laterally; moreover, microscopical examination aids in the diagnosis. A chancre has been encountered $7\frac{1}{2}$ cm. from the meatus. An occasional occurrence is phagedæna, which may result in a fistula of the terminal urethra, but a more common complication is scarring with stricture formation, and in the case of meatal chancres atresia of the meatus of various types and degrees (Albarran, Casoli). The induration of the chancre itself is merely temporary, but the succeeding fibrosis produces a most resistant scar which requires active treatment by dilatation, meatotomy, or excision. Of 126 stricture patients attending the Salford Royal Hospital, 2 possessed meatal strictures almost certainly of syphilitic origin.

Secondary Syphilis.—The urethral mucosa, like other mucosæ, may suffer during the secondary stage of syphilis, although only very rarely. Mucous plaques develop, meatal or intra-urethral in site, and form circular, non-indurated erosions; they cause a slight viscous and glairy discharge which only exceptionally becomes purulent, and they perhaps give rise to some discomfort on micturition. It has been held that the infectivity of the semen is gained during its passage along such an infected urethra. Accompanying skin manifestations are present as a rule. Local treatment comprises irrigation with a lotion of oxycyanide of mercury 1-4000.

Tertiary Syphilis.—The occurrence of urethral or penile gummata is a rare event, and amongst 151 tertiary lesions of the penis in only 19 was the urethra implicated (Fournier); however, when the urethra is involved it is commonly the penile stage (Fournier), and particularly in the neighbourhood of the glans penis. The posterior urethra almost always escapes. The lesions may be either (*a*) primarily urethral, or (*b*) secondary, and the result of invasion by penile lesions.

Pathology.—Tertiary lesions of the penis and urethra appear either as typical gummata or as a diffuse gummatous infiltration. The latter occurs in two forms: first ‘scléro-gommeuse’, which is a combination of gummata and gummatous infiltration; it responds readily to treatment; and secondly the rare ‘forme scléreuse’, a syphilitic fibrosis which, when it involves the urethra, proves resistant to treatment. Gummatous infiltration sometimes develops as a regular and cylindrical induration of the urethral wall extending several centimetres along the long axis of the canal—this is Fournier’s cylindroid syphiloma of the urethra. It is of rare occurrence, for Tanton refers to only 28 recorded examples.

It is very uncommon for a gumma to originate in the urethral wall as a primary event, but should it do so its presence and size cause difficulty in micturition until it bursts and discharges into the canal, when the dysuria disappears and a sero-sanguineous discharge, later becoming purulent, persists. Hæmorrhage and fistula formation are occasional complications.

Secondary involvement of the urethra is more common, and a diffuse gummatous infiltration leading to ulcerative excavation may occur, or circumscribed gummata may develop in the erectile tissue and spread to involve the urethra, causing as they advance considerable destruction and loss of tissue. Sometimes in association with a gumma of the glans penis a gummatous infiltration spreads along the urethra, transforming it into a rigid tube. A fistula is then a frequent complication.

Symptoms.—The onset is insidious and slow. The condition may be discovered by chance, or perhaps a slight clear or glairy urethral discharge may lead to a suspicion of chronic gonorrhœa and so to investigation. Later, when obstruction develops, the symptoms are those of urethral narrowing, with either frequent, painful, and difficult micturition or retention. The pain experienced on micturition varies considerably in its intensity, tenderness is absent, and there is no pain on erection, although the organ may be deflected or curved in one or other direction. On examination a localized rounded induration may be palpable which may reach the size of a walnut and is not tender; if the inguinal glands are not enlarged the presence of a gumma then may be suspected. Gummata may be multiple. With gummatous infiltration the urethra feels thickened, hard, and rigid, like a pen-handle, or as if a sound lay in the urethra (Legueu).

Complications.—First and most important are the long and resistant strictures which are an outcome of the marked fibrosis of these lesions. Secondly, fistula formation which is not uncommon. Thirdly, urethral defects are found; these are due to loss of substance (Minet) and are associated with scarring and fistulæ. Phagedæna is another complication, but curiously enough it is said that urinary extravasation does not occur.

Diagnosis.—Urinary abscess, carcinoma, and tuberculosis are more often thought of than syphilis when making a diagnosis. The very slow insidious onset should aid in excluding urinary abscess. Carcinoma occurs in older men, is usually situated in the perineal or penoscrotal regions, the discharge is purulent, and hæmaturia is more frequent, whilst exploration by instrumentation almost always causes hæmorrhage and the inguinal glands may be obviously involved. Other tertiary lesions and the history may lead to the diagnosis of syphilis, which is then confirmed by the Wassermann reaction.

Treatment.—The primary treatment is that of syphilis in general, whilst at a later date operation may be required to repair urethral damage.

URETHRAL SCHISTOSOMIASIS

Bilharzial disease is endemic in Africa and sporadic in Arabia, Persia, Mesopotamia, and Portugal.

Actiology.—Infection is due to a trematode, the *Schistosoma hæmatobium*, or *Bilharzia hæmatobia*. The intermediate hosts are the fresh-water snails *Bullinus* and *Physopsis africanus*. The cercaria of the trematode enters either through the skin or a mucous membrane, and the parasite lives in the veins of the liver, portal system, hæmorrhoidal veins, and vesico-prostatic plexus. The urinary symptoms are due to the passage of the terminal spined ova from the peripheral veins, where the female worm deposits them, through the walls of the bladder, ureter, and urethra. The spines of the ova pierce the vessel wall permitting their escape, and once the mucosa of the bladder or urethra has been perforated sepsis is inevitable.

Pathology.—

Posterior and Perineal Urethra.—The posterior urethra is commonly involved in an infected subject. Frequently there is a urethral discharge and a perineal abscess slowly forms and bursts

externally, leaving a fistula which may be the first of many, opening anywhere from sacrum to pubis and from the buttocks to the thighs. Their urethral orifices are usually to be found in the membranous and bulbous portions of the urethra and on the lateral walls rather than on the floor of the canal. Blockage of the lymphatic vessels of the scrotum and perineum very commonly results in a false elephantiasis of the surrounding parts. Sometimes an epithelioma originates in one of these fistulæ.

Penile Urethra.—Should the penile urethra, more especially the glandular portion, become involved there is often great distortion and deformity, whilst pseudo-elephantiasis of the skin and subcutaneous tissues of the penis as well as of the glans penis may develop. Many minute fistulæ tunnel the organ. The meatus may become ulcerated, and as a rarity an epithelioma develops. Hard fibrous masses form in the cavernous tissue and lead to chordee, and similar masses are sometimes palpable in the spermatic cords.

Diagnosis.—In the early stages the urine contains blood and pus and the ova can be identified; later it becomes very purulent. Urethroscopy is of great importance in diagnosis and demonstrates the lesions, which resemble those described as occurring in the bladder mucosa. Eosinophilia is present and the complement-deviation reaction is said to be of practical value in diagnosis. A history of exposure to infection may call the possibility of this disease to mind.

Prognosis.—The prognosis depends entirely on the degree of infestation and on the possibility of recurrence of infestation; a single infection often causes symptoms for from thirteen to eighteen years. The extent of sepsis adds to the gravity of the prognosis, as of course does malignant disease.

Treatment.—The specific treatment is the intravenous administration of tartar emetic. An injection of 1 gr. gradually increased to 2 gr. is administered intravenously in saline every second day until five injections have been given, when a rest of a week is usual; then five more injections are given, and so on until 30 gr. have been administered. Courses of this routine treatment are carried out until ova are absent. Pervès recommends the intramuscular injection of trivalent antimony, pyrocatechin-disulphonate of sodium (Fouadin or Neo-antimosan Bayer). Ten injections are given, on the first day $1\frac{1}{2}$ c.c., on the second $3\frac{1}{2}$ c.c., on the third 5 c.c., and then 5 c.c. every second day. He finds it most effective. Local

treatment in the early stages of the disease consists of the exposure of all fistulæ and the careful extirpation of all infected tissues; then after operation a catheter is left *en demeure*, the wounds being packed and allowed to heal by granulation; later, plastic operations are required.

The elephantoid penis is treated by decortication and grafting, all the fistulæ and masses of diseased tissue being excised at the same time. Amputation becomes necessary if epitheliomatous changes have occurred.

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CHAPTER XI

FISTULA OF THE URETHRA. URETHROCELE OR DIVERTICULUM OF THE URETHRA. CALCULUS AND FOREIGN BODIES OF THE URETHRA

FISTULA OF THE URETHRA

CONGENITAL fistulæ and defects of the urethra have been considered under the heading of developmental abnormalities of the urethra. The acquired varieties are discussed here, and these are of either inflammatory, traumatic, or neoplastic origin.

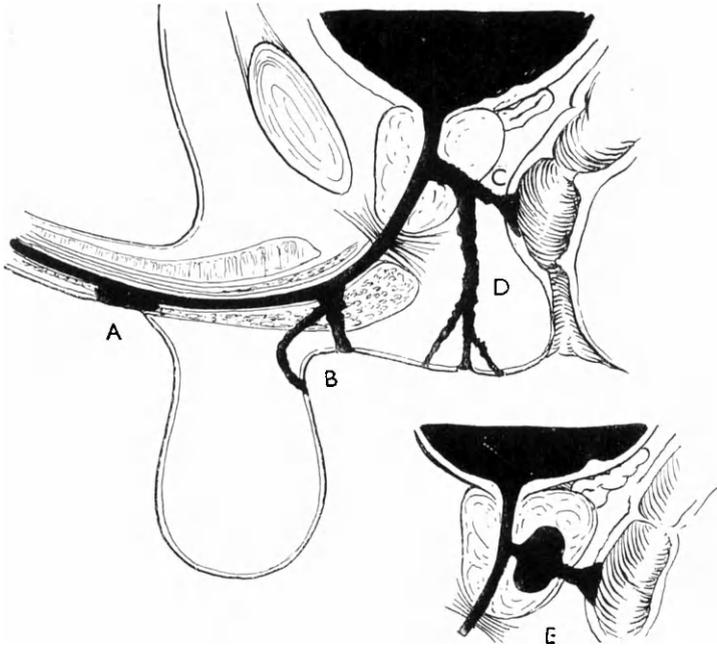


Fig. 119.—Types of urethral fistulæ. A, Penile fistula; B, Urethro-perineo-scrotal fistula; C, Urethro-rectal fistula; D, Urethro-cutaneous fistula of the posterior urethra; E, Urethro-prostato-rectal fistula.

VARIETIES

It is convenient to describe separately fistulæ of the posterior and of the anterior urethra. (*Fig* 119.)

POSTERIOR URETHRA

Fistulæ in communication with the prostatic or membranous urethra open either into the rectum—urethro-rectal fistulæ, or on to the surface in the vicinity of the perineum—urethro-cutaneous fistulæ. Both varieties are distinctly rare.

Urethro-rectal Fistula.—The fistula is as a rule of either inflammatory or traumatic origin, and in the great majority of patients the inflammation or injury is primarily urethral, although in a few it is rectal; only rarely is such a fistula of neoplastic origin.

Inflammatory Fistula.—A prostatic abscess, which is almost always of gonorrhœal origin, may burst into the rectum; this is not a common event, but when it occurs a proportion of cases possess an additional opening into the urethra (2.9 per cent, Séméniako), and as a result a communication between the urethra and rectum by way of the abscess cavity becomes established, the urethro-prostato-rectal fistula. A tuberculous abscess may rupture into both the rectum and urethra and lead to the formation of a fistula, whilst on rare occasions syphilis is the cause. Sometimes the abscess or tuberculous cavity gradually contracts down, leaving a more or less direct track between rectum and urethra, a urethro-rectal fistula.

Traumatic Fistula.—A fistula is sometimes the immediate outcome of an injury, usually either an impalement or a projectile wound, or it may develop later as the sequel to inflammation following upon trauma. Nevertheless it is rare to find a urethro-rectal fistula resulting directly from foreign bodies in the rectum or urethra or from a false passage. It is more usual to find that the fistula has followed an operation on the prostate or seminal vesicles by the perineal route when either the rectum is wounded during the operation or a slough separates later, perhaps owing to infection or perhaps through interference with the blood-supply; consequently these fistulæ may follow the operations of perineal prostatectomy and vesiculectomy and also perineal drainage of prostatic abscesses. The resultant fistula is sometimes urethro-recto-cutaneous. Although rupture of the posterior urethra is as a rule accompanied by infection, a fistula is a rare happening; nevertheless it does result at times,

and another rare cause is accidental injury of the urethra during excision of a fistula-in-ano. Traumatic fistulæ commonly establish a direct communication between the rectum and urethra, a urethro-rectal fistula.

The urethral orifice of these fistulæ is as a rule near, and to one side of, the verumontanum, and the rectal opening lies on the anterior wall of the bowel some distance above the sphincter; very rarely the fistula has its urethral opening in the membranous urethra.

Neoplastic Fistula.—As a late result of prostatic carcinoma, and more particularly sarcoma, a fistula may develop; exceptionally it is caused by a rectal carcinoma.

Urethro-cutaneous Fistula.—This variety of fistula is either of inflammatory or traumatic origin, and the latter mode of formation is the more common.

Inflammatory Fistula.—At times a prostatic abscess of gonorrhœal or tuberculous origin may reach and burst in the perineum, sometimes resulting in a fistula. Nevertheless a urethral fistula is by no means the inevitable sequel of such an abscess and in the majority of patients the urethra remains intact. More often the fistula is the result of infection which has succeeded trauma, and either follows on rupture of the posterior urethra with urinary extravasation, a false passage, or is associated with the presence of a foreign body.

Traumatic Fistula.—This is most often a sequel to operation and only very rarely the result of an injury such as impalement. Operations which may lead to the complication of a fistula are perineal prostatectomy and prostatotomy, vesiculectomy and vesiculotomy, and operations by the perineal route for the repair of rupture of the posterior urethra; a urethro-recto-cutaneous fistula may result. Traumatic fistulæ are usually single, whilst those of inflammatory origin frequently are multiple and may have ischio-rectal or gluteal openings in addition to those in the perineum.

ANTERIOR URETHRA

Fistulæ of the anterior urethra may be subdivided into those of the perineal urethra, urethro-perineo-scrotal, which usually possess a track of some length, and penile, of the penile urethra, commonly opening directly on to the surface. In both regions the fistula of inflammatory origin is much more common than that due to trauma: very rarely the fistula has resulted from a carcinoma of the urethra

(Fig. 120). A fistula of the perineal urethra frequently has its internal orifice actually in the bulb itself, but the external opening or openings may lie at a considerable distance and the communicating tracks are often multiple, tortuous, and narrow, whilst sometimes an abscess cavity exists which communicates with the urethra on the one hand and the surface on the other. A fistula of the penile urethra is as a rule a direct communication between the exterior and the urethra, and owing to the negligible amount of tissue traversed the skin and mucosa actually come into contact.



Fig. 120.—Perineal fistulæ associated with complete obstruction of the urethra by a carcinoma.

Inflammatory Fistula.—The common cause of a fistula of the perineal urethra is a periurethritis which may be either phlegmonous, suppurative (urinary abscess), or chronic. The penile fistula usually originates from a periurethral abscess which itself develops from an infected follicle during an acute gonococcal infection. Rarely tuberculous and syphilitic disease of the urethra are the causative factors of these fistulæ, and both have been considered already under the appropriate headings.

Traumatic Fistula.—A fistula is not often seen as the direct result of injury except in war wounds, but traumatism is frequently an indirect factor in that it may produce periurethritis and abscess formation which lead to fistulæ. Occasionally a fistula persists after the operation of external urethrotomy.

SYMPTOMS

The characteristic feature of a urethral fistula is the escape of urine from the abnormal opening during the act of micturition. The quantity of urine passing through the fistula may vary from a few drops to the whole bladder content, and depends on the calibre of the track and the existence of urethral obstruction distal to the internal opening of the fistula. Semen also may escape during ejaculation.

Urethro-rectal Fistula.—At micturition some urine escapes and is passed per rectum, and flatus and fæcal material are passed per urethram. Rarely the site of the orifice or the obliquity of the track prevents the occurrence of one or the other, and sometimes a doubt arises as to whether the fistula is recto-vesical or urethro-rectal, but with the former urine enters the rectum continuously whilst flatus and fæces escape only during the act of micturition, whereas with the latter gas and fæces escape per urethram independently of micturition. Nevertheless a urethro-rectal fistula in association with a tuberculous or malignant prostate, when the sphincters are out of action and the bladder is continuous with a prostatic cavity, may allow a continuous escape of urine into the rectum; again, when, as sometimes occurs, the urethral opening is in close proximity to the internal urinary meatus, urine may escape independently of micturition. It is usual for the urine to be retained in the rectum for a time unless the rectal orifice of the fistula is between the internal and external sphincters, when escape is constant. Peri-prostatitis is often present, and proctitis may cause diarrhœa, whilst urethritis and cystitis are difficult to prevent.

Urethro-cutaneous Fistula.—Additional symptoms and signs which appear in this variety vary from redness and excoriation of the skin over which the urine passes to chronic urethritis with peri-urethral fibrosis, abscess formation, and numerous suppurating sinuses. Urethral calculi and diverticula may complicate the clinical picture.

DIAGNOSIS

Urethro-rectal Fistula.—The fistula may be discovered by rectal palpation or its orifices may be visible through the proctoscope or posterior urethroscope. Methylene blue taken by mouth colours the urine and by its escape into the rectum may reveal a minute fistula. A metal sound is sometimes seen or felt per rectum, and coloured fluid injected under pressure into the bladder per urethram enters the rectum, but does not do so when injected through a catheter, thus distinguishing a recto-vesical from a urethro-rectal fistula; cystoscopy also aids by excluding a recto-vesical fistula. A fistula of the posterior urethra may be distinguished from one of the anterior urethra by noting that fluid instilled into the anterior urethra does not escape from the fistula, whilst methylene-blue-stained urine escapes during micturition; sometimes prostatic massage will express pus through it.

Fistula of the Anterior Urethra (*Fig. 121*).—As a rule fistulæ of the penile urethra are obvious, and if any doubt exists as to a fistula of the bulbous urethra coloured fluid injected under some pressure into the anterior urethra will confirm the diagnosis. Lipiodol

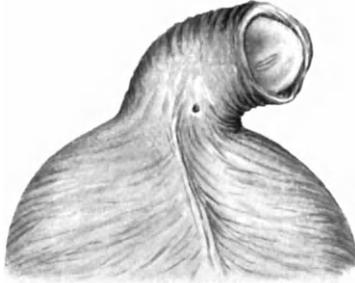


Fig. 121.—A penile fistula which has persisted after repair of hypospadias in infancy.

injection is valuable in the investigation of complicated fistulæ, and an opaque bougie in the urethra aids in the interpretation of the X-ray films.

TREATMENT

In general nothing but palliative measures can be adopted if the fistulæ are the result of neoplasms or tuberculosis; a palliative cystostomy then will be found to be useful. The operative treatment of inflammatory and traumatic fistulæ is for the most part tedious and often disappointing and success at a first attempt is not to be expected; nevertheless with persistence and patience a large proportion of fistulæ can be closed satisfactorily.

POSTERIOR URETHRA

Urethro-rectal Fistula.—As a preliminary—and this applies to the treatment of all urethral fistulæ—sepsis must be combated and urethral obstruction removed; treatment of the former, for example, is by cystostomy and by rectal and vesical lavage, and of the latter by internal urethrotomy.

The choice of procedure is determined largely by the length of time the fistula has existed and by the degree of sepsis present. Sometimes a recent fistula of small size will undergo spontaneous cure as sepsis subsides or is treated, especially if suprapubic drainage

has been established, preferably with suction (Davis); occasionally cauterization per rectum will accelerate healing, but when the fistula is of long standing or of large size operation is required. Nevertheless when a small fistula gives rise to but little trouble it may be advisable to leave well alone. The treatment of a long-standing fistula unassociated with marked sepsis is exposure of the fistula by the perineal route as in the operation of perineal prostatectomy, separation of rectum and urethra, and independent suture of the rectal and urethral orifices of the fistula; a catheter is left *en demeure* and the perineum either sutured or, preferably, left open. The principle of this operation is that, the fistulous openings having been closed so far as possible, they are separated and kept apart. The operation is never easy and extensive fibrosis may render it impossible; sometimes success is only partial and a urethro-rectal fistula may be transformed into a urethro-cutaneous fistula, which, however, is to be preferred. The modification of this operation which should be chosen if feasible is interposition of the levatores ani (Chauvin). After a preliminary cystostomy and restoration of the urethral canal by dilatation or internal urethrotomy the fistulous orifices are exposed as described above. The openings are closed by suture and then the margins of the levatores ani are brought down, closely sutured to each other, and fixed in a position below the fistulous urethral orifice; the rectal orifice of the fistula will then be found to lie below this muscle plane. The wound is left partially open.

When suture is impossible owing to the tissue changes which sepsis and subsequent scarring have produced, another method is utilized; the rectum and urethra are separated, such closure of the orifices as may be possible is effected, and then the wound is packed and kept open so that healing takes place by granulation; Legueu ascribes this procedure to Astley Cooper. Deliberate maintenance of the perineal opening is sometimes practised in order to establish a urethro-cutaneous or recto-cutaneous fistula in preference to the risk of re-establishing the original condition; this may then be dealt with later.

Another method recommended by Legueu is that employed by Segond in which, after dilatation of the anus, the rectal orifice of the fistula is excised, the urethral opening sutured, and the healthy rectal mucosa above the orifice of the fistula dissected up and brought down to the anal margin; a catheter and a rectal tube are left in position. The method is very similar to Whitehead's

operation of excision of the pile-bearing area. Should the rectal opening lie at a high level this procedure becomes impossible.

The procedure devised by Young and Stone includes that of Segond, and has been adopted by Chauvin; a cylinder of rectal mucosa is raised, the urethral fistula closed, and in completing the operation the levatores ani are drawn together and the healthy rectal mucosa above the site of the fistula is brought down to the anal skin. Other methods employed include plastic repair utilizing skin-flaps (Michon) and, the rectum having been freed thoroughly as if for perineal excision, a slight twisting of the rectal axis so that after suture the orifices no longer lie in apposition (Ziembicki, Fuller).

Urethro-cutaneous Fistula.—As a preliminary all urethral obstructions are dealt with and sepsis is treated, if necessary by a catheter *en demeure* or, preferably, by suprapubic cystostomy with suction drainage. Spontaneous healing of a recently formed fistula then may occur and can be accelerated by cauterization. In long-standing fistulæ it is necessary to explore the track by the perineal route, close its urethral orifice, and pack the wound; in the meantime diversion of the urine is maintained. In some patients excision of the fistula and suture of the urethra is possible. When associated with prostatic suppuration Marion advises transvesical exposure and drainage of the prostate as a preliminary to repair.

Tuberculous fistulæ may be treated by curettage and repeated cauterizations, and healing may then take place, but should a fistula persist it is often purely urinary and no longer associated with sepsis.

ANTERIOR URETHRA

It is preferable to consider the perineal and the penile urethra separately when discussing the operative treatment of fistulæ of the anterior urethra. In both these regions, however, the treatment of recent fistulæ without marked fibrosis is again primarily that of urethral obstruction and sepsis, and therefore dilatation or internal urethrotomy is required together with diversion of the urine either by the catheter *en demeure* or by cystostomy. Healing may result especially if all sinuses and pockets have been opened up to help the process. Again, in either, cauterization may be all that is necessary to close minute openings.

Perineal Urethra.—The type of fistula associated with chronic periurethritis and marked fibrosis has been discussed already under

the heading of chronic indurative periurethritis. When a fistula of some length without marked fibrosis exists, the treatment of any existing urethral obstruction frequently brings about closure, but if not cauterization often procures it. At operation it may be closed in layers and a catheter *en demeure* left in place; frequently, however, the fistula reopens when the catheter is removed and this must be replaced for a time whilst repeated cauterizations are carried out. When the fistula is large and leads directly to the surface or when there is loss of substance of the urethra, plastic operations are required, and these should be based on the methods of Guyon (Pasteau and Iselin), Thiersch (Cecil), Duplay, Bucknall, and Nové-Josserand-Rochet (Trillat) as for hypospadias. Grafts of vaginal mucosa, the saphenous vein, and the prepuce, etc., have all been utilized in repair. If there is no loss of urethral wall an attempt or attempts may be made to close the fistula by suturing in layers. In hopeless cases it may prove necessary to establish a permanent perineal urethrostomy.

Method of Guyon.—At a preliminary stage the perineum is carefully shaved and all save the necessary area of skin to one side

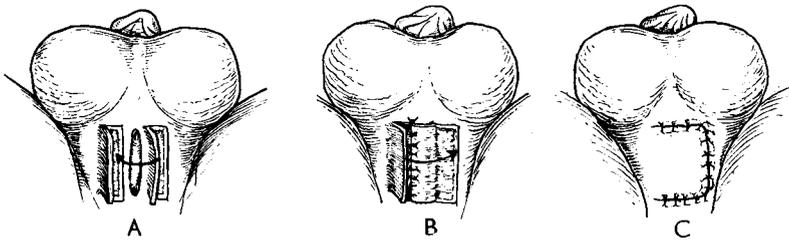


Fig. 122.—Repair of a urethral fistula by Guyon's method (after Legueu). A, The flaps have been shaped and elevated; B, The left lateral flap has been turned across the urethral defect skin surface inwards; C, The right lateral flap has been brought across to bury the inturned flap.

of the fistula and urethra is protected by diachylon plaster. The area of skin selected is either depilated by electrolysis or by the application of Vienna paste for thirty seconds. The next stage is undertaken a week later when the skin has recovered, and is best understood by reference to *Fig. 122*. Two skin-flaps are dissected up on either side of the urethra, that on the prepared side has its base medially, that of the other side has the base laterally. The first flap is rolled back around a catheter introduced through the meatus so that its skin surface is in contact with the catheter as it

lies in the open urethra, and it is sutured in this position. The second flap is brought across the midline to cover the area left by the first, and there sutured; its deep surface is then in contact with the subcutaneous aspect of the flap rolled about the catheter. The catheter remains in situ until healing occurs. Legueu has successfully closed urethral defects 5 to 6 cm. in length by this operation.

Methods of Thiersch and of Duplay.—The technique of these procedures has been described when considering congenital defects of the urethra. Marion finds Duplay's method particularly useful in dealing with urethral fistulæ, both perineal and penile.

It is inadvisable to attempt radical measures when treating a secondary lesion such as a tuberculous fistula, and the only treatment which is permissible is the full exposure and curettage of fistulæ and sinuses with cauterization later. Closure may result, but even if it does not, suppurating foci have been removed and a 'clean' fistula is left without risk of extensive periurethritis.

Penile Urethra.—Small orifices frequently can be cured by cauterization, micturition being suppressed for some days by catheterization thrice daily. A fistula of slightly larger size may be closed by excision with suture of the wound in layers; the principle of flap apposition is maintained. Thomson-Walker

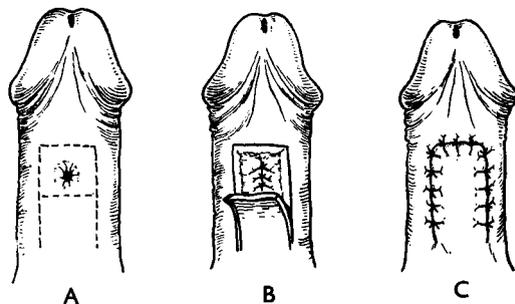


Fig. 123.—Repair of a penile urethral fistula by Loumeau's method (after Legueu). **A**, The incisions are outlined. **B**, The fistulous orifice has been closed after excision of the surrounding skin; a flap has been elevated proximally. **C**, The flap has been stretched distally to bury the denuded area.

closes the urethra, undercuts the skin on either side, and turns skin-flaps back, suturing them in this position; they are replaced later when granulations have formed. Large fistulæ with loss of a portion of the urethral wall require plastic operations; the technique of the Nové-Josserand-Rochet method is described below, and those of Thiersch and Duplay have been considered with

hypospadias; Bucknall's operation for hypospadias can be adapted to certain of these fistulæ, and Godard has reviewed the various operations in which the scrotum is utilized in urethroplasty. Other methods of considerable value are those of Guyon (*Fig. 122*) and Loumeau (*Fig. 123*).

Cathelin's Operation (*Fig. 124*).—An operation suitable for lesser defects is that of Cathelin. This procedure is applicable to small defects of the penile and perineal urethra. A large catheter

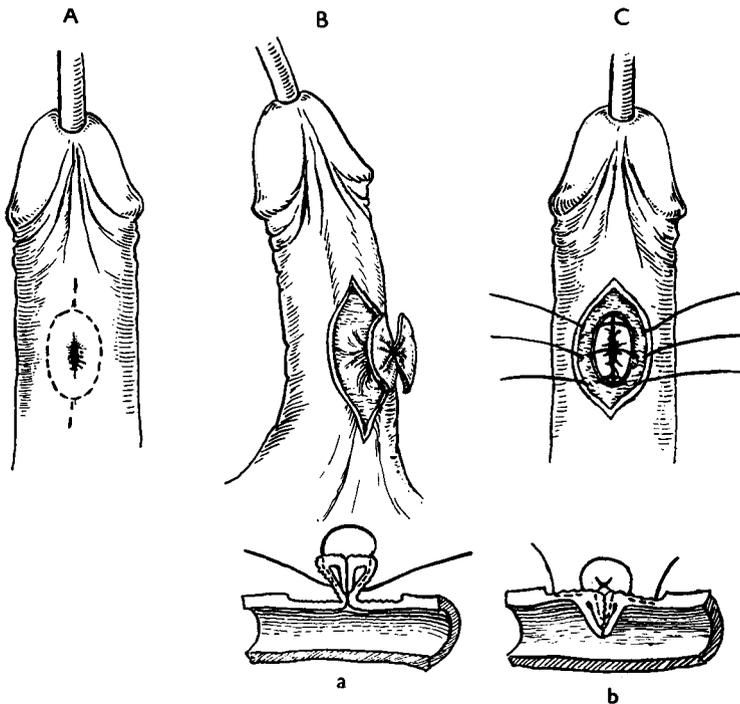


Fig. 124.—Repair of a small penile fistula by Cathelin's method (*after Cathelin*). A, Outline of the incision; B, The cuff is dissected up and split; C, Method of suture, shown also in the insets (a) and (b).

having been inserted into the urethra, a circular cuff of skin is dissected up about the orifice of the fistula and the circular incision deepened to follow and enclose the track; a funnel leading to the urethra results. The funnel is now slit up both proximally and distally so that two lateral walls are formed. These walls are inverted so that their raw surfaces look outwards and are sutured together in position by means of Lembert sutures. Finally the skin is closed.

Method of Nové-Josserand-Rochet.—This operation is utilized when very extensive destruction of the urethra has taken place, and as designed was utilized for repair of the penile urethra. The first step is to mark out on and dissect up from the scrotum, proximal to the fistulous or hypospadiac opening, a rectangular flap of skin with its base at the orifice. The flap is equal in length to the penis and sufficiently wide to be rolled about a catheter. The second step is to insert a catheter (size 16–18 French) into the bladder through the fistulous opening, and to wrap and suture about it the flap previously prepared, so that the skin surface lies in contact with the catheter. The third step consists of tunnelization of the penis from the fistula to the glans penis; for this two small incisions are made at either extremity which are connected by burrowing with a special tenotome beneath the skin of the under aspect of the penis. When this tunnel is sufficiently large the catheter enclosed in its skin-graft is drawn through from fistula to meatus and maintained in position by some sutures at either end. The most recent modification of this plastic procedure is that of McIndoe, used by him for hypospadias in the adult.

Comments.—After these operations erections are controlled by bromides, opium, or a rubber ice-bag repeatedly applied.

DIVERTICULUM OF THE URETHRA (URETHROCELE)

Diverticula of the urethra are uncommon, and when encountered may be of either congenital or acquired origin, the latter being the more common variety of the two. Ehrlich collected 68 cases from the literature in 1908, of which 36 were of this acquired type, and added 1 case himself. Englander added 2 in 1917, Bumpus 4 more later, and McKay and Colston 10 in 1929; Mouat reviewed 40 cases in 1928, and Gutierrez and Lowsley 120 in the same year.

The following classification has been made by Watts:—

1. Congenital diverticula.
2. Acquired diverticula:
 - a. Dilatation of the urethra the result of: (i) Calculus; (ii) Stricture.
 - b. With perforation of the urethral wall following upon: (i) Injuries of the urethra; (ii) Rupture of abscesses into the urethra; (iii) Rupture of cysts into the urethra.

Paris and Fournier, in their review of the subject, prefer to separate urethroceles into primary and secondary. The former

would then include those developing later but from congenital origins. Moreover, such an origin might not be the proximate cause, but only the precursor of a chain of circumstances leading to the development of a diverticulum.

1. Primary or congenital diverticula, which are also termed 'true' diverticula, have been considered with congenital abnormalities of the urethra and are dilatations of the urethra found as a rule in the anterior urethra. Bumpus suggests that a partial failure of closure of the urethral groove during development is a factor in their aetiology and Watts believes that some are the result of congenital obstruction.

2. Secondary or acquired diverticula, which result either from traumatic rupture of the urethra or from the bursting of an abscess or cyst into the urethra are sometimes termed 'false'; a partial or complete epithelialization of the lining wall of the cavity subsequently occurs. Diverticula will be considered under the divisions of the anterior and posterior urethra.

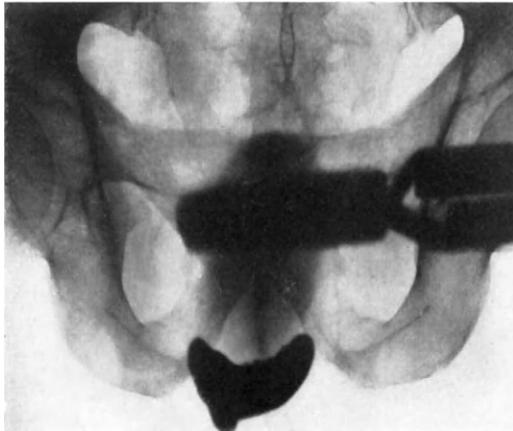


Fig. 125.—Urethrogram of a perineo-scrotal diverticulum which had succeeded a periurethral abscess associated with an indwelling catheter.

Anterior Urethra.—The acquired variety is more common than the congenital. The diverticulum, if the result of stricture, is usually fusiform, and may be so when a calculus is the cause; it frequently is saccular if the outcome of injury, either a rupture or a false passage, periurethral suppuration (*Fig. 125*), or a calculus. It may follow the operation of external urethrotomy.

Posterior Urethra.—The acquired diverticulum is by far the commoner and Mouat found that it was most often associated with calculi; Heitz-Boyer states, however, that even so they are as a rule the result of an earlier suppurative prostatitis. With calculi either a sac containing prostatic calculi gradually increases in size and establishes a communication with the urethra or, more rarely, a stone lodged in the urethra causes dilatation behind it. Calculi, however, may be formed secondarily in a pre-existing sac. Bumpus found that diverticula may result from operations on the prostate or seminal vesicles by the perineal route, from rupture of the posterior urethra, or from an abscess or hæmatoma of the prostate or vesicles which has ruptured secondarily into the urethra. In 16 out of 40 patients with diverticula there was a history of a previous operation on the urethra (Mouat).

Symptoms.—A cavity in communication with the urethra may be symptomless for years until infection takes place. The symptoms, as McKay and Colston have pointed out, depend on the size, site, and degree of infection of the diverticulum. The classical sign of a swelling in the course of the urethra, fusiform or saccular in shape, which increases in size during micturition, is found but rarely; more often the patient complains of a post-micturitional dribbling due to the continued escape of urine from the pocket, of painful micturition and pyuria resulting from urethritis, and of a deep-seated perineal pain associated with a continuous discomfort which is caused by the presence of the inflamed sac. Ejaculation also is interfered with. When a diverticulum contains stones a characteristic grating on palpation may be elicited. Bumpus ascribes incontinence and dribbling when associated with posterior diverticula to involvement of the sphincters by inflammatory fibrosis. Gutierrez and Lowsley point out that an unexplained and persistent urinary disturbance may be due to a diverticulum.



Fig. 126.—Cysto-urethroscopic view of the prostatic urethra showing the orifice of a diverticulum above and to the right side of the verumontanum.

Diagnosis.—With a visible pouch or palpable stones the diagnosis is simple; sometimes rectal examination reveals a depression, otherwise the diagnosis must be made by X-ray examination after the injection of opaque media and by

urethroscopic investigation (*Fig. 126*). Heitz-Boyer stresses the importance of the urethrogram in the discovery of prostatic diverticula (*Fig. 127*). Cystoscopy is only of value in demonstrating a normal bladder.

Treatment.—The minor degrees of urethral dilatation which follow upon stricture formation or the lodgement of a calculus respond to the appropriate treatment of the cause.

Anterior Urethra.—Saccular diverticula, if the communication with the urethra is small, are treated either by excision of the sac wall and suture of the urethral opening (*Fig. 128*), or by excision of the sac and resection of the urethra. If the diverticulum is large or fusiform, a portion of the sac wall is retained and the urethra reconstituted with its aid.

Posterior Urethra.—When possible the sac wall is excised and its orifice closed, but sometimes, especially if calculi are present,



Fig. 127.—Urethrogram in a case of stricture showing diverticula of the prostatic urethra.

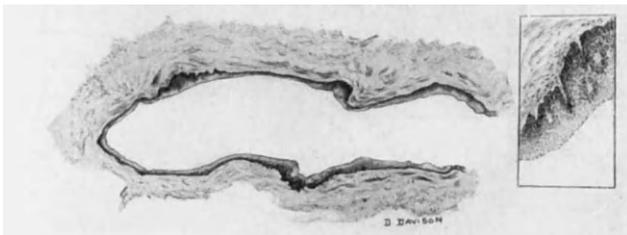


Fig. 128.—A section of a saccular diverticulum excised from near the junction of the penile and glandular parts of the urethra.

nothing more than the removal of these stones is possible. McKay and Colston describe a procedure by which the prostatic urethra and diverticulum are thrown into one cavity, the roof of the latter being excised after exposure either by the suprapubic or perineal

route. Heitz-Boyer destroys the partitions and enlarges the openings by endoscopic resection. Infection always requires treatment by irrigation and instillation.

URETHRAL CALCULUS

A urethral calculus is a stone lodged in the urethra ; one actually in process of traversing the urethra is not urethral. The classification of these calculi depends upon their mode of origin, and falls under the following headings :—

1. *Primary or Urethral Calculus.*—This is a stone actually formed in situ either in the urethra itself or in close connexion with this canal, as in a pouch opening from it.



Fig. 129.—A urethro-vesical calculus of characteristic form which has been displaced into the bladder by sounding. The shadow of another calculus is visible in the bulbous urethra.

2. *Migratory or Secondary Calculus.*—Renal or vesical calculi arrested in the urethra constitute this variety.

It may prove difficult at times to determine to which group a calculus really belongs, especially when it is situated partly in the urethra and partly in the bladder, urethro-vesical (*Fig. 129*) ; in this situation the calculus may be of mushroom shape, the head occupying the trigonal region whilst the stalk extends into the posterior urethra, or in its stead several articulated calculi may be similarly disposed. Huddy applies the term 'combined calculus' to this variety.

Aetiology.—

1. *Primary Urethral Calculi.*—Stagnation and infection are necessary factors in the formation of these calculi, of which the primary causes are either urethral obstruction or the presence of recesses opening from the urethra, which are themselves the result either of trauma or of inflammation. Consequently a stricture

following upon urethritis is a predisposing factor and is aided further by the chronic infection which always coexists with a stricture. Stone formation may then take place in the dilated and infected urethra proximal to the obstruction. Urethral stricture may result in periurethritis with subsequent abscess formation and fistulæ, while calculi may form in these infected pouches and fistulæ. They may develop similarly as a sequel to prostatic abscess. Another predisposing cause is trauma, which, whether it causes rupture, extravasation, a hæmatoma, or an abscess—the last being the outcome of the inevitable infection which takes place—can result in pouch formation or fistulæ. Prostatic calculi may be extruded into the urethra, or the ducts in which they lie may dilate to form pouches communicating with the urethra. Congenital diverticula are uncommon as predisposing factors, whilst calculi laid down about a foreign body are very rare indeed in the urethra.

2. *Migratory Calculi*.—The aetiology of these stones is of course the same as that of renal and vesical calculi. The descending calculus is liable to arrest in the narrower portions of the urethra, for example in the membranous urethra behind the sphincter urethræ membranaceæ, and in the fossa navicularis. When an abnormal or acquired narrowing such as a urethral stricture exists, arrest proximal to the obstruction is usual (see Fig. 134). Clinical observations which combine the anatomical and pathological findings show that arrest occurs most commonly in the posterior



Fig. 130.—An enormous calculus of the posterior urethra which reached the perineum; weight $7\frac{1}{2}$ oz. (Mr. Macalpine's case.) Intravenous urography has outlined the bladder.

urethra (Figs. 130, 137); next most frequently in the region of the bulb; then in the penis, either at the junction of the perineal and penile urethræ, or at the junction of the penile and glandular urethræ; and lastly in the fossa navicularis. (Fig. 131.) It is not infrequent to find that a calculus extends in the lumen from the prostatic to the perineal urethra (see Fig. 130). The calculus is as a rule single, but multiple stones may be found. Englisch noted the site of 361 urethral calculi; 149 were in

the membranous urethra, 68 in the bulb, 50 in the scrotal region of the urethra, 53 in the penile urethra, and 41 in the fossa navicularis. Debenham, in a smaller series, found that about 50 per cent were impacted in the region of the external meatus and only about 7.5 per cent in the prostatic urethra.

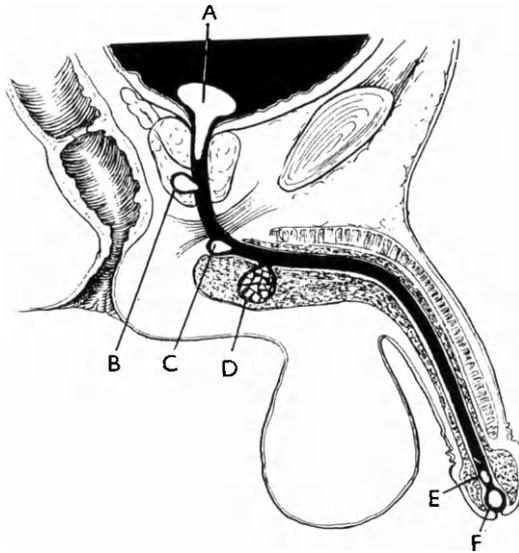


Fig. 131.—The commoner sites of urethral calculi. **A**, Urethro-vesical calculus; **B**, Prostatic calculus protruding into the urethra; **C**, Calculus in the bulbous urethra; **D**, Calculi in a diverticulum of the perineal urethra; **E**, Calculus impacted immediately proximal to the glandular urethra; **F**, Calculus lodged in the fossa navicularis.

Incidence.—Migratory calculi are the more numerous, for of the 405 examples of urethral calculi collected by Englisch, 35 only were of urethral origin, and of 32 examples of stones in cavities, 10 were in congenital and 22 in acquired pouches. Of 40, 3 only arose in the urethra (Debenham).

Calculi are most common in middle life and not in the aged, in whom the prostate bars the descent of a migrating calculus (*Fig. 132*).

In countries where calculus formation is common, migratory urethral calculi often occur in children, otherwise they are rare in youth (*Fig. 133*). When met with they are necessarily of small size. Englisch noted three ages during which stones were

comparatively frequently found: from two to six years, from ten to twenty-one years, and again from thirty-six to fifty years.

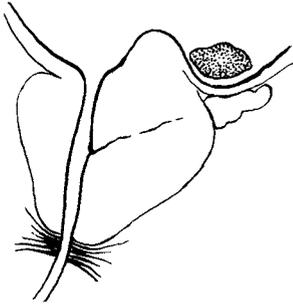


Fig. 132.—The manner in which an intravesical prostatic projection prevents the entry of a calculus into the urethra.



Fig. 133.—A migratory oxalate calculus extracted from the fossa navicularis of a boy of fourteen. (*Twice natural size.*)

Number and Composition.

—The calculus is usually single, and if more than one is present it is as a rule either because stones have developed in a urethral pouch, or because several descending calculi have been arrested behind a stricture (*Fig. 134*). Migrating or exogenous calculi are similar in composition to renal and vesical stones; primary urethral stones are phosphatic, and those of prostatic origin have an albuminoid core around which are deposited phosphates and carbonates.

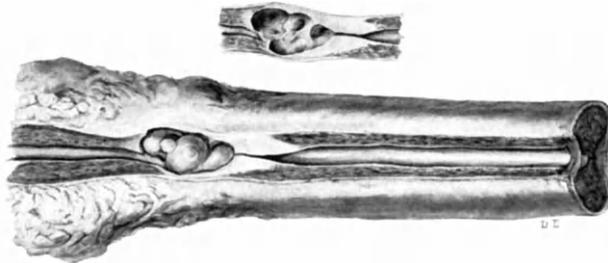


Fig. 134.—Multiple migratory calculi impacted behind a stricture of the bulbous urethra. The inferior wall of the urethra has been removed.

Pathology.—A urethral calculus has been termed either free, diverticular, or urethro-vesical. Free calculi are spherical in shape, or if of descending origin retain their original form; if they become fixed and immovable they adapt themselves to the urethra and elongate proximally in a contrary direction to that of the urethral stream; the surface of the calculi may become grooved by the flow of urine. Diverticular calculi are adapted to the shape of their

cavity and are multiple and faceted. The urethro-vesical calculus is formed usually by the growth in a proximal direction of a calculus of the posterior urethra (*Fig. 135*), but, more rarely, may be a migrating calculus arrested in its escape from the bladder.

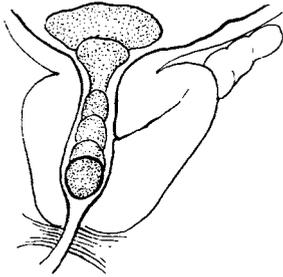


Fig. 135.—Illustrating the manner in which a calculus of the prostatic urethra can extend proximally to become a urethro-vesical calculus.

Calculi which occupy the lumen of the urethral canal produce changes which are of both mechanical and inflammatory origin (Swift Joly).

1. *Mechanical.*—Obstruction is caused by the presence of a stone; complete obstruction results in retention of urine, but if it is only partial the urethra gradually dilates about the stone and later the urethra proximal to it dilates or pouch formation occurs, the latter being the more frequent event in the prostatic urethra. It may be impossible to differentiate between a preformed and an acquired pocket; moreover, occasionally a stone descends into the cavity of a prostatic abscess (Swift Joly).

2. *Inflammatory.*—Urethritis if not already present inevitably occurs; the epithelium appears red and œdematous and on microscopical examination there is desquamation and leucocytic infiltration of the mucosa and glands. After a time metaplasia of the mucosa is observed. More remote effects include the spread of infection, and ulceration or perforation of the urethra, with either phlegmonous or suppurative periurethritis, and eventually chronic periurethritis with fistulæ. The stone then may enter the false diverticulum of the abscess cavity, or, very rarely, escape externally through a fistula (*Fig. 136*). The final picture is that of a hard, irregular, inflammatory periurethral tumour which is riddled with fistulæ. Identical results may follow the presence of calculi in diverticula, whether congenital or acquired.

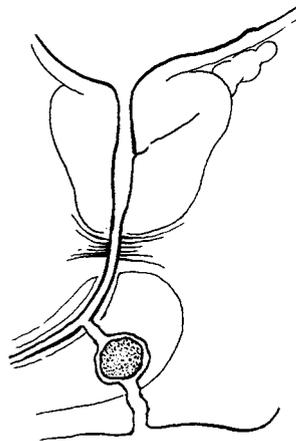


Fig. 136.—A calculus in the abscess cavity of a fistulous tract.

Remote effects on the upper urinary tract are due to infection and obstruction and are similar to those which are the outcome of urethral stricture. Vesical calculi frequently coexist with urethral calculi, and a urethral stricture is usually present either as a primary or secondary event.

Symptoms.—The symptoms are variable and some calculi remain almost symptomless for years. Swift Joly considers them under the following heads: (1) Impaction of a migratory calculus; (2) Calculus of the posterior urethra; (3) Calculus of the anterior urethra; (4) Periurethral calculus.

1. *Arrest of Migratory Calculus.*—

a. In childhood: The onset is extremely sudden, the stream during micturition is abruptly interrupted, and the child grips the penis and screams. Retention of urine may be complete or small quantities of blood-stained urine may be passed by straining. If the obstruction is near the meatus the penile urethra may be distended with urine.

b. In the adult: An attack of renal colic may have been experienced and after a few days of quiescence or of symptoms of vesical irritation something is suddenly felt to enter the urethra during micturition and the stream is abruptly arrested. At the same time severe lancinating pain is experienced along the urethra, in the glans penis, and then at the site of arrest. When impacted in the posterior urethra the pain is rectal or felt just anterior to the anus. The patient may be able to detect a swelling. Complete retention with strangury commonly ensues, but at times a few drops of blood-stained urine may be passed, and sometimes the stream is merely reduced and the bladder can be emptied by repeated attempts. These symptoms may pass off and then recur again after a brief period. A metal catheter, if used to empty the bladder, will strike the stone.

2. *Calculus of the Posterior Urethra.*—Three conditions may exist: (*a*) The calculus is vesico-urethral; (*b*) The stone is purely urethral (*Fig. 137*); (*c*) The stones are urethro-prostatic.

a. Vesico-urethral: The calculus is astride the sphincter, partly urethral, partly vesical, and considerable urethral obstruction is the result. Examples of sudden impaction are rare. The condition is characterized by dribbling micturition and loss of force, accompanied by frequency which develops into false incontinence since retention is usual. The urine contains pus and there may be some slight

hæmaturia. Pain is slight and is felt in the glans penis, anus, or perineum. The mechanical interference with the sphincters is added to by inflammatory fibrosis, and as the result of urinary obstruction the health deteriorates and the final outcome is uræmia following upon septic pyelonephritis. A urethral discharge is not often seen, for the constant dribbling prevents its accumulation.



Fig. 137.—A calculus of the posterior urethra. This stone was entirely symptomless.

b. Urethral: The symptoms vary as the calculus is fixed or movable. A movable calculus may be fixed by spasm of the muscles, becoming mobile again as this relaxes, and it usually acts as a ball-valve, causing interruption of the stream during micturition. Some patients require to adopt peculiar positions in order to micturate and frequently there is some slight hæmaturia and urethral discharge. Pain is noted rarely, except at the actual moment of interruption of the stream, but if it occurs may be felt in the glans penis, perineum, or anus. The general health is good, for the bladder empties completely, and it remains so for a long period since the calculi are slow-growing; eventually if the sphincters become implicated, the symptoms develop into those of the urethro-vesical calculus, and with retention renal symptoms become evident.

c. Urethro-prostatic: Symptoms present themselves only when prostatic calculi protrude into the urethra. Sacral backache is experienced, a heavy pain in the perineum is felt, and a urethral

discharge is present. Frequency and dysuria occur and become accentuated as the stone protrudes farther into the urethra (*Fig. 138*). When a large intra-urethral mass is present, obstruction is marked and the symptoms resemble those of a stone in the urethra.

Calculi of the posterior urethra often interfere with ejaculation and render it painful.

3. *Calculus of the Anterior Urethra.*

—The symptoms frequently give no indication of the presence of a stone, and may be either those of inflammation, cystitis, urethritis, or periurethritis, or of obstruction or stricture. When the calculus is impacted behind a stricture it is usually the latter alone which is diagnosed; there is progressive diminution in the volume and force of the stream, but frequency is not marked. The patient complains of a dull fixed pain at the site of the stone and often a hard mass is felt. When near the anterior extremity of the canal the proximal urethra is distended and post-micturitional dribbling takes place; the jet is deformed when a calculus is in the fossa navicularis. Retention only appears when obstruction is almost complete. The existence of a calculus of the perineal urethra is often overshadowed by the inflammatory symptoms until revealed at operation.

4. *Periurethral Calculus.*—Urinary symptoms are few, for there is no interference with the act of micturition, the calibre of the stream remains unaltered, and frequency is uncommon. The symptoms may be those of a diverticulum with post-micturitional dribbling and perhaps an intermittent purulent discharge. However, as a rule complaint is made of a slowly increasing, hard, painful swelling of the perineum or under aspect of the penis; when suppuration develops pain is severe and the symptoms become those of periurethritis. Should an abscess burst calculi may be found on exploration of the sinus. Calculi in a pouch communicating with the posterior urethra cause rectal symptoms with pain in the rectum or anus, which becomes worse on defæcation; they also cause a feeling of weight and fullness. Sometimes pus escapes from the urethra during defæcation. Urinary findings are few, except that pyuria

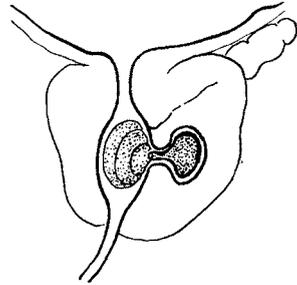


Fig. 138.—Showing how a prostatic calculus protruding into the urethra may increase in size.

is present. A late complication, which is the result of ulceration, is the development of a urethro-rectal fistula.

Diagnosis.—The diagnosis of the arrest of a descending calculus is almost always evident from the patient's history, and it can be confirmed by instrumental exploration, by the urethroscope, by X rays (*Fig. 139*), by palpation, and rarely, if a stone protrudes from

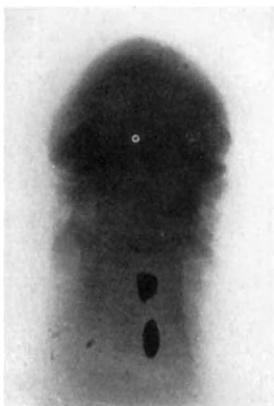


Fig. 139.—Two migratory calculi in the penile urethra shown by X rays.

the external meatus, by vision. Urethral calculi may be recognized when on instrumentation a characteristic click is experienced or there is definite grating. Palpation may lead to the discovery of single or multiple calculi of the anterior urethra, the former being felt as an induration of unmistakable hardness and the latter producing a characteristic crepitation; in a similar manner rectal palpation may elicit crepitation or discover a regular, stony-hard induration. The urethroscope may prove very useful, for a stone is either seen or the orifice of a pouch discovered. X-ray examination is valuable for calculi of the posterior urethra or when the stones are in a diverticulum,

and in the latter event it is helpful if an opaque bougie occupies the urethra (Swift Joly). X rays also aid in determining the size and number of calculi. Nevertheless calculi, particularly of the posterior urethra, may escape diagnosis and only be discovered during operation for such conditions as stricture, fistulæ, peri-urethritis, or diverticula.

Treatment.—

1. *Anterior Urethra.*—The methods of removal of a calculus actually in the urethra are largely governed by the presence or absence of a stricture distal to it. In the absence of a stricture, and particularly if the stone is migratory and but recently impacted, it may be possible to manipulate the stone out of the urethra, or to seize it with forceps and either extract or crush it. Meatotomy under local anæsthesia is necessary if the meatus is small or if the stone is in the fossa navicularis. The urethroscope may aid extraction, but it is rare to find a stone which is sufficiently small to be extracted through this instrument. Sometimes, if an attempt to micturate is made

whilst the meatus is compressed, the calculus will advance along the distended urethra, and after several attempts be extruded. If these manœuvres fail, external urethrotomy should be performed.

In the presence of a stricture and if an instrument can be passed, internal urethrotomy is carried out and the calculus manipulated along or extracted as described above; if the obstruction is impassable or if the stone is large or has been present for years, external urethrotomy is performed and the stone removed. The stricture is treated at the same time, preferably by excision.

2. *Posterior Urethra*.—Free or recently impacted descending calculi in the posterior urethra are best displaced into the bladder by instrumentation, and then crushed with a lithotrite, and the debris evacuated in the usual manner. On rare occasions a stone which has been present for a considerable period can be crushed in situ. Sometimes fixed calculi of small size may be extracted if the urethroscope is utilized as a guide; more usually, and particularly when the calculus is large and fixed, open operation is required. The route of approach selected may be either perineal or suprapubic; perineal prostatotomy is satisfactory for small calculi, but with urethro-vesical stones the method may need to be combined with lithotripsy, and with large calculi is liable to be followed by a fistula and perhaps permanent incontinence if the sphincters have been destroyed by inflammatory fibrosis. The transvesical route therefore is to be preferred for the large and for urethro-vesical calculi; moreover the sphincter can then be incised and an attempt made to extirpate the wall of the cavity. Swift Joly observes that there is a growing tendency to employ this suprapubic route.

3. *Periurethral Calculi*.—Calculi contained in diverticula or fistulæ are removed as an incidental step during operations for these conditions, which have been described in the preceding pages. A preliminary urethrogram is a valuable means of locating the neck of a pouch.

Results.—The mortality-rate depends for the most part on the degree of impairment of the renal function and is thus in direct relationship to the existence and duration of sepsis and obstruction, though the size of the calculus also must be considered.

There is a distinct tendency to recurrence.

FOREIGN BODIES IN THE URETHRA

A foreign body may enter the urethra by one of three routes (Englisch): (1) Through the external urinary meatus, which is the most usual path. (2) From the bladder, to which access has been gained either through a penetrating wound or by way of the urethra. (3) As a rare occurrence a projectile, a fragment of shell or a bullet, lodges directly in the urethra through a penetrating wound.

Foreign bodies introduced through the external urinary meatus either originate from instrumentation and comprise portions of broken bougies, catheters, urethrotomes, or other instrument, or



Fig. 140.—A large needle extracted from the urethra. The patient, who was serving a sentence in gaol, had no satisfactory explanation of its entry.

they have been introduced by the patient during masturbation—an “*accès de folie érotique*” (Marion). Sometimes they are introduced during intoxication, or by a mentally deficient patient. The property common to all such bodies is that of suitable size. Foreign bodies of the bladder which have entered from the urethra and which later return to this canal will be of similar nature; projectiles lying free in the bladder may escape into the urethra. (*Fig. 140.*)

The most usual sites for a foreign body to lodge in are the fossa navicularis and the cul-de-sac of the bulb, whilst sometimes a long rigid body occupies both urethra and bladder and is urethro-vesical. Once introduced through the external meatus the object may be voided spontaneously, remain in the urethra, or enter the bladder. When a longitudinal body such as a pin, pencil, or pipe-stem is introduced it tends to progress towards the bladder, partly because if inserted during erection it is carried more deeply as the organ subsides, and partly because the sharper extremity, not as a rule introduced first, hitches in the mucosa with every movement and so pushes the object step by step towards the deeper urethra.

Pathology.—Urethritis inevitably results from the presence of a foreign body and is associated with ulceration, itself the outcome either of inflammation or, if the object is sharp, of injury to the

mucosa; sooner or later periurethritis follows and frequently fistula formation. A foreign body causes either partial or complete obstruction, and in the former case, if it is retained for any considerable period, urethral dilatation or pouch formation may occur, perhaps as an addition to chronic periurethritis and fistula development. The phenomena of urinary obstruction and infection thus may present themselves.

Symptoms.—The early primary symptoms are due to the foreign body, and are pain and difficulty of micturition, with perhaps some hæmorrhage if there is trauma. Secondary symptoms which develop as the result of inflammation or obstruction are scalding on micturition, a purulent urethral discharge, together with difficulty of micturition and alteration of the jet of urine, and perhaps hæmaturia caused by ulceration. Late sequelæ are periurethritis, periurethral abscess, and fistula; however, occasionally the symptoms may be negligible and remain so for years.

Diagnosis.—A correct history, which however is not obtained invariably, will establish the diagnosis. The foreign body frequently can be palpated from the exterior, or from the rectum. Instrumentation and urethroscopic examination suffice to determine a doubtful case and X-ray examination is valuable. Nevertheless, an unsuspected foreign body may be discovered only during operation for a periurethral abscess or urethral stricture.

Treatment.—

Anterior Urethra.—Foreign bodies in the anterior urethra may be expelled during forced micturition, particularly if the meatus is pinched and then suddenly released. Manipulation may be sufficient in other patients, but usually these two methods will have been attempted already by the patient himself. Extraction by forceps, with or without urethroscopic aid, is often successful, but sometimes external urethrotomy is necessary, possibly because of the shape of the object. The classical method of removing such an object as a pin by perforation and version is illustrated in *Fig. 141*; the resultant puncture of the urethra heals readily; Broussin passes an open-ended catheter over the pin point and then extracts both.

Posterior Urethra.—Exactly as for a calculus, it is preferable when possible to dislodge the body into the bladder, from whence it either can be removed by cystostomy or can be seized more readily and extracted per urethram than when it is in the urethra itself.

When fixed, which is a rare event, it may be necessary to seize and withdraw it under urethroscopic guidance; or, if this fails to extract it, to perform prostatotomy by the perineal route.

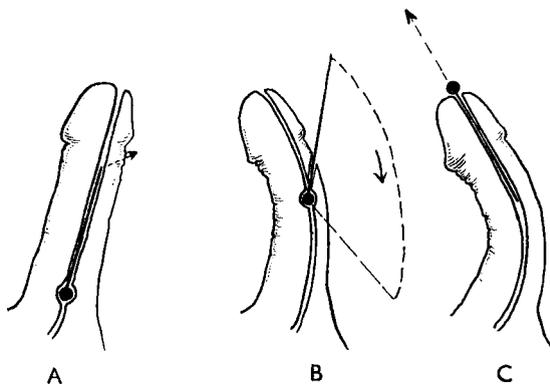


Fig. 141.—The removal of a large pin from the urethra by perforation and version. A, The arrow shows the direction in which the pin is made to perforate the urethral wall; B, The arrow and dotted line indicate the manner of version; C, After version the pin is extracted head first.

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CHAPTER XII

TUMOURS OF THE URETHRA

PRIMARY tumours of the male urethra are uncommon, but secondary invasion of the posterior urethra by carcinoma of the prostate frequently occurs in the late stages of the disease, and it is sometimes invaded by vesical growths. The penile urethra is not infrequently involved by an advancing carcinoma of the glans penis.

BENIGN TUMOURS

These are less common in the male than in the female. The urethral mucosa may give origin to polypoid growths including various types of papillomata and the adenomatous polyp. The urethral wall may give rise to myomata, fibromyomata, and fibromata. Cysts of the urethra are sometimes found, as also are angiomas.

Papilloma.—Two varieties are to be distinguished. The first resembles the vesical papilloma and possesses a many-branched, loose, connective-tissue stalk, richly supplied with blood-vessels and covered by a thick layer of transitional epithelium. It is more often found in the posterior than the anterior urethra, and like the vesical papilloma is usually single. The second variety is akin to the venereal wart and in appearance resembles a cock's-comb; it is compact, and the branches, if any, are single cylinders (Young). The fibrous-tissue core is more developed and the vascular supply less, whilst in appearance it is firmer and paler, than the first variety, and its thick squamous covering often exhibits horny changes. Often these papillomata are multiple, and they are found more frequently in the penile urethra, although sometimes in the posterior urethra; they may be associated, though but rarely, with external venereal warts.

Adenomatous Polyp.—This polypoid tumour may appear as a true adenoma and contain numerous glandular spaces lined by columnar epithelium, but at other times it closely resembles the myxomatous nasal polypus. It is found most frequently in the

posterior urethra, but in elderly men an adenoma here may have a prostatic origin. Buckhardt has described some examples, and Mahar and Urquhart have reported an adenoma of the posterior urethra associated with multiple adenomata of the bladder.

Myoma, Fibromyoma, and Fibroma.—These are quite rare tumours, particularly in the male, but when present they are as a rule pedunculated, smooth, polypoid tumours, which may be found in any region of the urethra.

Cysts.—These comprise retention cysts of the glands of Littre or of the crypts of Morgagni, and, rarely, of the utriculus prostaticus or other urethral diverticulum. They may arise at any age; those of the first group are situated as a rule in the anterior urethra; commonly they are of small size and may be multiple, but the rather larger cysts sometimes encountered in the region of the meatus are more usually single. Cysts of Cowper's glands have been reviewed by Muschat.

Angiomata.—These are very rare tumours which may be associated with angiomata elsewhere; Gentile in reporting an example found 18 other case reports. When viewed through the urethroscope they appear either as purplish petechiæ or as bluish raspberry-like projections into the lumen of the canal.

AETIOLOGY

The second variety of papilloma described above is believed to be related to chronic inflammation either of gonorrhœal origin or associated with urethral stricture. It has been stated that those of the penile urethra are related to and associated with venereal warts of the glans penis; Walker, however, does not admit this relationship. The branching papilloma is of unknown aetiology. Cysts of the urethra, as indicated above, belong to the group of retention cysts.

SYMPTOMS

The symptoms are in general those of urethral irritation and of interference with micturition, with, in addition, hæmorrhage on instrumentation. The growths sometimes give rise to a sensation as of a foreign body and cause a tickling irritation. Tumours of the anterior urethra produce a chronic urethral discharge simulating chronic urethritis; if in the posterior urethra chronic prostatitis is mimicked and there may be disturbance of ejaculation, with either

frequent, premature, or painful emissions or perhaps all these three symptoms together. Most of these tumours are small, but they may give rise to difficulty in micturition and even be the cause of retention. Small cysts sometimes may be symptomless. The angioma is characterized by repeated spontaneous urethral hæmorrhages.

DIAGNOSIS

Papilloma.—Occasionally a tumour may protrude from the meatus (*Fig. 142*) or be visible in the fossa navicularis on separating its lips; however, in the majority of patients the diagnosis must be made by urethroscopic examination.



Fig. 142.—A papilloma protruding from the external meatus.

Cysts.—Rarely a cyst is visible at the meatus, but usually the diagnosis is made by the urethroscope, when a glistening swelling of bluish-white colour is observed bulging into the urethra; from this a glairy fluid escapes on puncture. Minute multiple cysts resemble folliculitis, but the absence of surrounding hyperæmia should suffice to distinguish them.

Angioma.—As already noted, spontaneous and recurrent urethral hæmorrhages are a characteristic of this condition, and through the urethroscope either purple petechiæ or raspberry-like tumours are visible; they may be localized or diffuse. Their size may cause alteration of, even difficulty in, urination and sometimes burning pain on micturition. Situated in the posterior urethra they may cause tenesmus, a deeply situated feeling of discomfort, and frequent and painful ejaculation. Urethrorrhagia, however, may be caused by urethral varices as well as by angiomata (Iacapraro).

TREATMENT

Papilloma.—A tumour situated near the meatus may be destroyed by repeated applications of trichloroacetic acid, or it may be excised. Treatment elsewhere is effected best by diathermy through the urethroscope; there is a tendency to recurrence, and some liability to stricture development (Schifftan).

Cysts.—Cysts should be punctured and their wall destroyed by diathermy.

Angioma.—The rare angioma has been treated either by radium, electrolysis, or diathermy.

MALIGNANT TUMOURS

CARCINOMA

Primary carcinoma of the male urethra is a rare disease, but invasion by secondary growths is not uncommon, as has been noted already. The majority of primary tumours occur in patients between 45 and 50 years of age according to Robb, and between 60 and 70 years according to Huggins and Curtis. Hutchinson's patient, reported in 1861, is stated to be the earliest authenticated case; Robb in 1927 refers to 76 case reports, Huggins and Curtis in 1929 put the figure at 110, but Kirwin in 1932 found the total to be 99 and Mortensen in 1937 found 109. However, Kreuzmann and Colloff in 1939 brought the total number to 150, including a number never before collected.

Ætiology.—A number of authorities hold that chronic urethritis is a predisposing factor, particularly when it is associated with urethral stricture; the sequence being chronic inflammation and trauma, which lead to metaplasia and leukoplakia (*Fig. 143*), and so to carcinomatous change. Rizzi and also O'Neil found that 50 per cent of patients gave a history of stricture, and Robb records an undoubted example of stricture with superadded carcinoma. In addition urethral papillomata may undergo malignant change, and epitheliomata may arise in long-standing fistulæ.

Pathology.—The site of the neoplasm is most often in the perineal portion of the urethra (63 per cent, Legueu; 47 per cent, Rizzi), and next in frequency in the penile urethra (*Fig. 144*); the glandular urethra is only very rarely affected (Diehl, O'Neil, Wurmser).

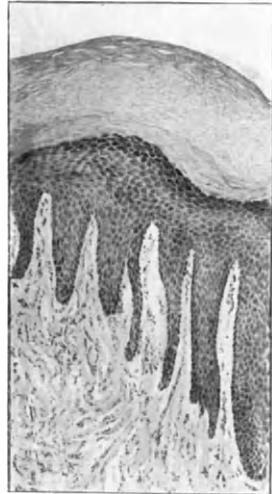


Fig. 143.—Section of a plaque excised from the fossa navicularis; hyperkeratosis is shown.

Wildbolz describes describes two types, a nodular type which projects into the urethral lumen and reduces its calibre, and an infiltrating type which infiltrates the urethral wall without interference with its

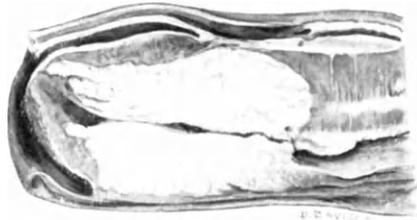


Fig. 144.—Carcinoma of the penile urethra. Although the glans is invaded, its covering is intact.

calibre, at least in the earlier stages. Extension occurs along the urethral mucosa and nodules may appear at varying distances from the primary growth. At a later date spread to the cavernous and periurethral tissues occurs and involves the skin of the perineum



Fig. 145.—Carcinoma of the perineal urethra. The growth is breaking through to the surface and fistulae occupy the burgeons seen in the photograph.

(*Fig. 145*). It is said that the inguinal glands are invaded at an early stage when once the tumour has extended beyond the limits of the mucosa; Huggins and Curtis, however, note that this tumour is indolent, and Kreutzmann and Colloff found that of 45 recoveries only 11 had had the glands of the groins removed. The mechanical effect of the urethral obstruction is dilatation of the urethra proximal to the growth, and as infection is almost invariably present calculi may form. Periurethritis and abscess formation eventually occur, and later fistulae develop and may extend considerable distances. Histological examination as a rule reveals a squamous carcinoma

(Legueu, Kirwin), but at times papillary, columnar-celled, transitional-celled carcinomata, or adenocarcinomata from Cowper's glands are observed (Robb). (*Figs. 146, 147.*) Beck has described

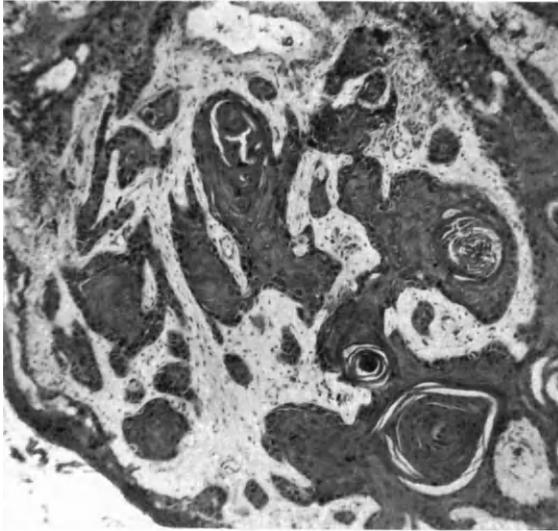


Fig. 146.—Photomicrograph from the growth illustrated in *Fig. 145*.
A keratinizing squamous carcinoma. ($\times 60$.)

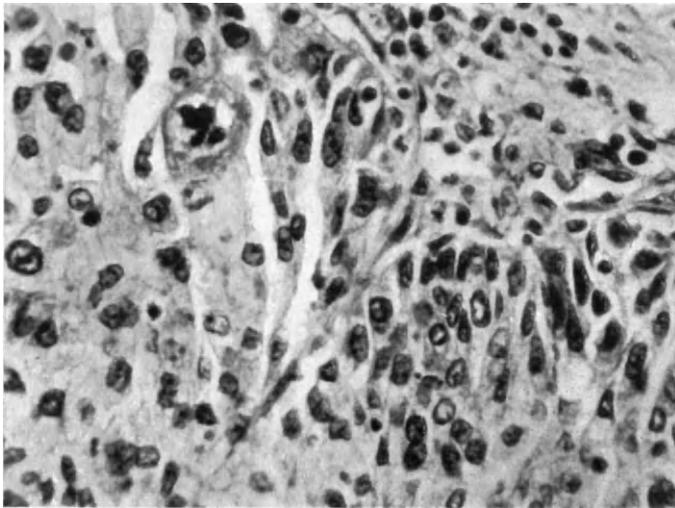


Fig. 147.—Photomicrograph from the specimen illustrated in *Fig. 144*. A non-keratinizing squamous carcinoma showing marked anaplasia. ($\times 400$.)

an example which in its polymorphism embraced most of these types.

Symptoms.—The symptoms of urethral carcinoma are in no way distinctive, and at different stages in the disease simulate different conditions. At first the symptoms are those of urethral obstruction and suggest stricture formation. Secondly, when a tumour appears in the course of the urethra and is associated with obstruction, a periurethral abscess is mimicked. When, later, fistulæ are added, the appearance is that of suppurative periurethritis with fistulæ.

The first symptoms observed by the patient are difficult and sometimes painful micturition, with alterations of the urinary stream; sometimes retention of urine occurs and sometimes there is incontinence. At the same time a purulent urethral discharge which frequently is blood-stained is present, and frank urethral hæmorrhages may occur. Unfortunately it is rare for the diagnosis to be established at this stage by urethroscopy.

The second stage is ushered in by pain, which radiates either along the penis or towards the pubis, anus, or groins, and which is enhanced by micturition. A urethral discharge is as a rule present. Simultaneously or perhaps shortly afterwards, but rarely beforehand, a tumour appears. When in the perineum this tumour is inseparable from the urethra and is of almost stony hardness; when penile the whole organ may be swollen owing to œdema and at some point an ovoid and hard swelling of the urethra can be felt; at times the urethra feels thickened and indurated in its long axis and the hardness of this induration may prove suggestive. The urethra bleeds readily and freely on instrumentation and if the sound passes the obstruction its tip may be felt to lie in a cavity. The inguinal glands are already enlarged in a number of these patients when first seen.

In the late stages periurethritis, periurethral abscess, and fistulæ appear, and are often associated with cystitis and renal infection which may be the cause of death. Pain is constant and cachexia evident. The inguinal glands are enlarged but not necessarily invaded, for their enlargement may be due to sepsis alone.

Diagnosis.—In the early stages the diagnosis usually made is that of stricture, but the true condition should be indicated by the tendency to free hæmorrhage even on gentle instrumentation and by undue friability and tenderness. Severe pain on micturition and spontaneous pain are useful indications. Urethroscopy should demonstrate local growth and supply portions for histological examination.

An induration of the penile urethra is discovered as a rule early in the disease, but is very liable to be mistaken for a periurethral abscess, a calculus, or a gumma; the latter should be confirmed in every patient by the Wassermann test and will disappear on treatment. A perineal swelling is more difficult of correct diagnosis, and periurethritis, stone, or tuberculosis is frequently suspected. Urethral tuberculosis, however, is almost never primary, and if diagnosed should be confirmed by proof of the involvement of other parts of the genito-urinary tract. The carcinomatous swelling spreads and invades surrounding structures in an irregular manner and its hardness should arouse suspicion.

Prognosis.—The majority of patients do not survive for longer than a year, unless operation is feasible; Huggins and Curtis, however, have stated that the growth is of a low degree of malignancy. Death results either from urinary infection and obstruction or from pulmonary metastasis and cachexia.

Treatment.—Carcinoma of the penile urethra permits of treatment either by partial amputation of the penis, or by a radical operation which includes the removal of the inguinal glands based on the technique described by Pearce Gould (p. 284). Carcinoma of the perineal urethra is rarely diagnosed sufficiently early to enable a radical operation to be performed (Young), but either this or emasculation should be done if possible (p. 286). Radium treatment is worthy of trial when operation is contra-indicated, and Watson has published two excellent results. In the later stages a palliative cystostomy or urethrostomy is necessary in order to relieve the painful and difficult micturition. Robb collected 36 cases which it would appear from the records had been treated, and of these 25 per cent died within one year, whilst in 55·6 per cent recurrence had not taken place by the end of the first year. Of the cases collected by Kreutzmann and Colloff, 60 were penile, of which 56 per cent recovered, 25 per cent died, and records were lacking in 18 per cent; 78 cases were proximal to the penile urethra, and of these 14·3 per cent recovered, whilst 74·2 per cent died, and 18 per cent lacked records.

CARCINOMA OF COWPER'S GLAND

Three cases have been reviewed by Wassermann, and Uhle and Archer in 1935 stated that 4 cases had been reported, whilst Gutierrez in 1937 found 5 cases on record and added a sixth. The symptoms

are primarily perineal and rectal, and then, as extension to the urethra occurs, urinary, with painful and difficult micturition which proceeds to retention of urine. On examination a tumour is present in the perineum, palpable from the rectum, and in the early stages unilateral. The treatment of the condition is excision when this is possible, and if it is not, treatment by radiation.

SARCOMA

Sarcoma of the urethra is an extremely rare tumour, and according to Campbell and Fein some 11 examples only, of various types, have been reported; Puhl, however, states that 24 cases are on record, but his figures include both the male and female urethra. Round-celled, spindle-celled, melanotic, and lympho-, angio-, and rhabdomyo-sarcomata have been found. This neoplasm may occur at any age, and, as with carcinoma, the outstanding symptoms are painful and difficult micturition; a urethral discharge may appear and urethral hæmorrhages have been reported, but Campbell and Fein state that such bleeding is singularly rare. A localized tumour is present in the course of the urethra, most frequently in the region of the penoscrotal angle, and usually when first seen by the surgeon the growth has already ulcerated to the surface. With infection a periurethral abscess is suggested. The tumour progresses rapidly, becoming irregular and nodular, and it soon ulcerates to the surface and bleeds readily. In at least one recorded example of sarcoma the inguinal glands were involved, and frequently they are enlarged owing to sepsis. The sarcoma, although closely resembling carcinoma, is as a rule demarcated more definitely and is not of such stony hardness, whilst the rate of extension is more rapid than with carcinoma. When the clinical diagnosis of malignant disease is arrived at, it is usually that of carcinoma. The prognosis is deplorable; radical excision offers the only prospect of cure. A palliative cystostomy may become necessary.

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CHAPTER XIII

**INJURIES OF THE PENIS. PHIMOSIS AND
PARAPHIMOSIS. PREPUTIAL CALCULI**

THE embryological development, anomalies, and applied anatomy of the penis have been described with the urethra; it remains to consider those conditions which are peculiarly penile and not necessarily associated with urethral disease or injury.

INJURIES OF THE PENIS

The great majority of penile injuries are sustained whilst the organ is in erection, for in the flaccid state its great mobility almost invariably protects it from damage. These injuries, all of which are uncommon, fall into two main categories: (1) Contusions of the penis, which include dislocation and rupture or fracture; (2) Wounds of the penis. Another additional and special type of injury is strangulation of the penis.

I. CONTUSIONS OF THE PENIS

The erect organ has been injured in a variety of ways, by blows, kicks, and falls, and by trapping in a closing door, drawer, or window.

Clinical Findings.—The clinical picture varies greatly with the severity of the injury. Pain is variable and may be but slight; swelling and hæmatoma formation occur in differing degree and sometimes are so marked as to simulate gangrene. Should the skin be broken hæmorrhage takes place, its severity depending upon the degree of trauma to the vessels; if in addition the urethra is involved, meatal hæmorrhage makes its characteristic appearance (*see* INJURIES OF THE URETHRA, p. 66).

Prognosis.—Absorption of a hæmatoma is as a rule rapid, but infection and later suppuration may occur. The subsequent fibrosis may cause distortion of the organ during erection and another sequel which has been reported is persistent neuralgia.

Treatment.—A large hæmatoma may be dealt with by incision, but a smaller one is treated quite satisfactorily by support and compresses of an evaporating lotion.

Dislocation of the Penis.—This is an extremely rare injury and some 7 examples only are on record; the probable explanation of the infrequency of the condition is that the accident can only take place when the organ is flaccid, a state in which it as a rule readily escapes injury; if the penis is erect fracture or rupture occurs instead.

Ætiology.—The first essential is that as the result of the trauma the preputial attachment to the glans penis is completely torn; the penis then becomes displaced from its sheath of skin and is found lying beneath the skin of the pubes, scrotum, or inguinal region, whilst the skin and prepuce are left empty. In one patient it would seem that excessive traction on the prepuce ruptured its attachment to the glans and then drew the scrotum over the penis. The injury may be complicated by rupture of the urethra.

Clinical Findings.—Swelling due to œdema and hæmatoma formation, or, if the patient has attempted to micturate, to extravasation of urine, may obscure the diagnosis at first. The patient usually complains of inability to micturate and on attempting catheterization the meatus and glans are found to be wanting. In one or two cases an extravasation of urine has driven the patient to seek treatment.

Treatment.—In some of the recorded cases reposition proved an easy matter; in others it was extremely difficult. It would seem that manipulation should be attempted first and, if unsuccessful, should be followed by open operation.

Rupture or Fracture of the Penis.—The injury is a rupture of the cavernous tissue and results either from compression or excessive flexion; it can only occur when the penis is erect.

Pathology.—Trauma alone is sufficient to cause rupture of a normal organ, but it is certain that such conditions as chronic cavernositis, urethritis, urethral stricture, and periurethritis predispose to the accident. On post-mortem examination a rupture of the tunica albuginea of the corpora and extensive hæmatomata are found.

Ætiology.—The injury may occur during too violent attempts at coitus, either a *faux pas de coït*, or because of disproportion of the parts, but sometimes it is due to excessive dorsal displacement when the female is in the superior position. It may result from a fall on the erect penis. All these stresses result in hyperflexion of the

rigid organ. Rupture when caused by compression is due to an accidental or purposeful trapping of the penis, or may be the result of 'breaking a chordee'. It is of interest to note that the custom of 'breaking' is scarcely mentioned by foreign authors, but appears in English writings.

Clinical Findings.—The immediate symptoms are the perception of a crack, accompanied by pain and subsidence of the erection. The patient may hear or feel the crack, although it is not always noticed; pain at the moment is often very severe but of brief duration; on the other hand, in chordee relief may be obtained. Subsidence of erection occurs immediately in the majority of patients and angulation of the penis may be noted. Later, as the result of œdema and hæmorrhage, the penis becomes greatly swollen and ecchymotic and retention of urine may occur; subsequently, when in some days or weeks the penis returns to its normal size, a transverse depressed area may be felt which indicates a cleavage in the erectile tissue, and may give the impression of an articulation at this point.

Complications.—The complications include gangrene, infection of hæmatomata, and, if the urethra is involved, phlegmonous peri-urethritis. As a sequel to the injury erection is always interfered with, even suppressed, and the resultant fibrosis causes distortion of the penis. Nevertheless Redi reports a case in which coitus was subsequently effected satisfactorily.

Treatment.—Palliative treatment consists of the application of cooling dressings and the maintenance of firm pressure. In operative treatment the hæmatomata are incised and evacuated and the torn tunica albuginea is sutured. Early operation, however, is not at all a sure means of preventing the sequelæ noted above.

2. WOUNDS OF THE PENIS

Four varieties of wounds are described: (*a*) Stab wounds; (*b*) Incised wounds; (*c*) Lacerated wounds; and (*d*) Wounds associated with loss of tissue, such as may result from projectiles.

a. Punctured Wounds.—These are rarities, and they do not differ in essentials from similar wounds elsewhere; pain, hæmorrhage, and subcutaneous extravasation of blood occur, and sometimes if infection supervenes suppuration results. The treatment required is a firmly applied dressing; only rarely is it necessary to ligature bleeding points.

b. Incised Wounds.—These are more often intentional than accidental, and they are inflicted either maliciously or by the patient himself when intoxicated or insane. The wounds are placed transversely or obliquely and if deep the corpora cavernosa are involved. Superficial wounds of the integuments of the body of the penis heal readily, but at times a bleeding dorsal vessel requires ligature; when the glans penis is the site of injury natural repair again is rapid, but some deformity on erection remains. Deeper wounds of the penis have been in part considered with wounds of the urethra, and the important feature is hæmorrhage, which in complete amputation is severe. The treatment of amputation comprises early hæmostasis, with suture of the tunica albuginea across the cut extremities of the corpora cavernosa, and suture of the urethral margins to the skin. Partial wounds involving the erectile tissue are painful and may bleed profusely, although sometimes hæmorrhage is surprisingly small; their treatment includes the arrest of hæmorrhage and careful suture of the parts. Erection is always defective subsequently and may be suppressed.

c. Lacerated Wounds.—Lacerated wounds are sometimes due to the trapping of the penis in machinery or to the bites of animals, usually dogs or horses. The penile skin may be detached at the root of the penis and torn completely off or, remaining attached at the base of the glans, it may be everted like a glove finger; sometimes the glans or even the whole penis, with the scrotum and testes, is torn away. In the latter types of injury the urethra is of necessity involved.

Clinical Findings.—Hæmorrhage can be severe when the corpora cavernosa are implicated, but if the organ is flaccid may be negligible; at a later stage infection results in inflammation, and then, as a sequel to fibrosis, distortion of the penis is produced, whilst if the urethra has been injured a urethral stricture forms. As with the scrotum the repair of the skin loss is remarkably rapid.

Treatment.—The immediate treatment which is required is the control of hæmorrhage, toilet of the wound, and replacement of partially detached skin. When the urethra is involved it must be exposed and either repaired by suture or brought to the surface. At a later date plastic operations are required to free adhesions and to provide skin-grafts, which are obtained, preferably, as pedicle grafts from the scrotum or, failing this, from the anterior abdominal wall. Bogoras in a case of amputation has manufactured a functional penis with remarkable success.

d. Projectile Wounds.—These are only common in war-time, and were of frequent occurrence in the war of 1914-18 (Legueu); they usually cause considerable destruction of tissue and are often accompanied by urethral, scrotal, and testicular lesions. Experience has shown that it is preferable to allow these complicated wounds to heal naturally and without other treatment than a preliminary toilet followed by antiseptic dressings. At a considerably later period operative measures, frequently in many stages, are undertaken to remedy deformity and defects. The methods of urethral repair have already been discussed, and if the penis has become adherent to neighbouring structures bands may be divided and grafting performed, although often it is impossible to remedy deformity and loss of substance sufficiently for coitus to take place. It is extremely rare for a projectile to lodge in the corpora cavernosa.

STRANGULATION OF THE PENIS

Strangulation by a band is one of the more frequently encountered penile injuries. In children a thread, cord, or hair may be tied around the penis by the child himself for no reason at all; or by the nurse, when it may have been done to prevent incontinence. In adults the penis may be passed through a ring, nut, bottle neck, etc., either in sexual perversion, insanity, or intoxication; sometimes intoxicated friends perform the office! Various case reports are noted by Vermooten when describing an example.

Clinical Findings.—The result is a rapidly appearing swelling of the penis distal to the obstruction due in the early stages to œdema, which as it increases produces further circulatory embarrassment and causes still greater congestion and œdema. Gangrene is nevertheless uncommon except at the actual site of the constricting band, and even there the skin alone as a rule suffers, although if there is neglect, as is very common with these patients, the urethra may become involved and finally the corpora cavernosa. Retention of urine does not always result, but, it is stated, may occur and be followed by sloughing of the urethra and phlegmonous periurethritis. The symptoms which bring the patient for treatment are pain, which is often severe, retention of urine, or phlegmonous inflammation.

Treatment.—The cure is simple if the patient attends at a sufficiently early stage, but too often he waits until various complications drive him to seek relief, and the necessary treatment is then much more complicated than the mere removal of the constricting

band. Thread, hair, or string is easily divided, and metallic bands sometimes may be removed like a tight ring from a finger in the following way: distal to the band a fine thread is wound in accurate spiral fashion about the glans and penis so as to compress them; on reaching the ring the end of the thread is insinuated under it and then pulled upon, when the ring is drawn off as the spiral unwinds. However, in the presence of much swelling or when the band is wide its division is necessary, and as a rule can be effected by a guarded circular saw; on occasion gold rings have been dissolved off in mercury. The treatment of urethral fistulæ and of phlegmonous infiltration has been discussed elsewhere.

PHIMOSIS AND PARAPHIMOSIS

The term phimosiis implies such narrowing of the preputial orifice that it is impossible to retract the prepuce sufficiently to expose the glans penis. This narrowing may be of congenital or acquired origin.

Congenital Phimosiis.—In almost all infants the prepuce is long and in many cannot be retracted, but with time alterations take



Fig. 148.—Congenital phimosiis. The redundant prepuce has been retracted as far as possible, but without exposing any part of the glans penis.

place and by the fifth year the glans can be exposed; nevertheless even after puberty the orifice may remain small and prevent retraction, and then a state of phimosiis exists (*Fig. 148*). In these patients the frænulum is found to be short and to have a long attachment

which extends distally on to the glans penis. The narrow orifice is maintained by a ring of fibromuscular tissue which is a continuation of the penile covering and represents the dartos layer of the scrotum. In other patients the prepuce appears to be adherent to the glans either as a whole or in part because of a developmental failure in the separation of the prepuce (Wood Jones) (*Fig. 149*).



Fig. 149.—Congenital adhesions between glans and prepuce causing some obstruction at the meatus.

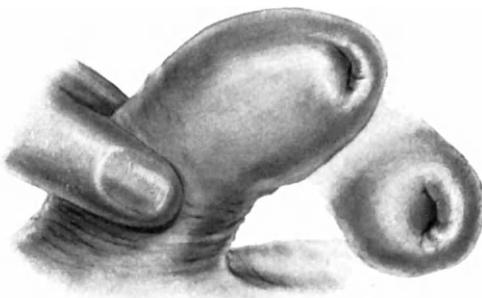


Fig. 150.—Acquired phimosis. The prepuce, which is thickened, rigid, and adapted to the glans as the result of balanoposthitis, cannot be retracted. A dorsal slit exposed an epithelioma of the prepuce.

Acquired Phimosis.—In the adult inflammation is the cause of the narrowed preputial orifice; at first active inflammation through œdema and inflammation produces increased bulk and rigidity, but later fibrosis results in a narrowed orifice (*Fig. 150*). Common causes of inflammatory fibrosis are balanoposthitis, chancres, condylomata, and erysipelas; diabetes is a predisposing factor. The preputial orifice may vary in size from a pin-point to one which almost permits exposure of the glans; the prepuce may be voluminous, projecting far beyond the glans, or may be adapted closely to it.

Symptoms.—The effects of phimosis are various and may be classified as follows:

Urinary symptoms: Urinary symptoms are absent when the meatus and preputial opening of a tightly fitting foreskin correspond, but if these do not coincide and are associated with a pin-point orifice there is difficulty in micturition which occasionally is so marked as to produce obstructive manifestations in the urinary tract. Sometimes when the prepuce is redundant micturition occurs into the preputial cavity and balloons it, finally escaping drop by drop.

Genital symptoms : Ejaculation is hindered if the orifice is small, and thus sterility is favoured ; if the opening is rather larger there is a risk of paraphimosis at each coitus. A narrow orifice predisposes to venereal infection by preventing cleanliness, and aids for a similar reason in the maintenance of a chronic gonorrhœa. The congenitally short frænulum is liable to rupture during coitus, with hæmorrhage as the result.

Inflammatory symptoms : The accumulation of smegma, which is perhaps associated with stagnation of urine beneath the prepuce, predisposes to attacks of balanoposthitis, with gangrene as a possible result, to non-specific urethritis, and also to the formation of preputial calculi. Adhesions may form between the glans and prepuce as the result of inflammation, though those found are sometimes of congenital origin. Repeated attacks of inflammation tend to increase phimosis by the formation of more fibrous tissue.

Reflex symptoms : A variety of reflex disturbances are attributed to phimosis—for example, nocturnal enuresis, constipation, too frequent nocturnal emissions, and even hysteria and neurasthenia.

Phimosis is said to favour the development of carcinoma of the glans penis, which is a disease almost unknown in the circumcised (Travers, Wolbarst).

Paraphimosis.—Paraphimosis is a complication of phimosis which may occur when the orifice is sufficiently large to expose at least a portion of the glans. If the prepuce then is forcibly retracted, as may happen during coitus, it cannot be replaced and consequently forms a tight band encircling the penis behind the corona of the glans (*Fig. 151*).

Clinical Findings.—The glans appears swollen and congested, and on the dorsum of the penis immediately behind the corona the constricting band lies in a deep groove, the anterior lip of which is accentuated as a roll of œdematous mucosa whilst the less-marked posterior lip is the result of œdema of the preputial skin. Ventrally, at the frænulum, œdema always is especially marked, and a swollen, œdematous mass projects. If

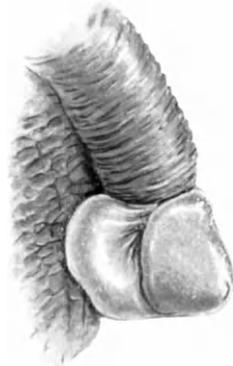


Fig. 151.—Paraphimosis. The prepuce has become retracted and the patient's attempts to replace it have failed. Superiorly the constricting ring of prepuce lies in a groove behind the corona, inferiorly it is accentuated as an œdematous roll.

untreated natural cure may take place by necrosis of the dorsal band, and although this is usually associated with infection and suppuration, gangrene of the glans penis is an altogether exceptional result (Carver, Way) (*Fig. 152*).

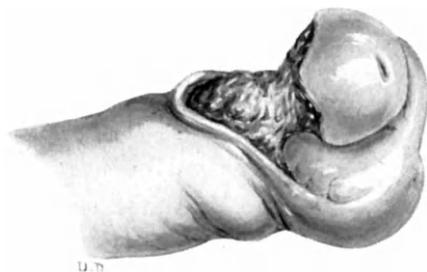


Fig. 152.—Neglected paraphimosis. Infection and ulceration of the constricting band behind the corona have destroyed it at the expense of a partial destruction of the glans penis.

TREATMENT OF PHIMOSIS

A redundant prepuce does not constitute phimosis, and phimosis should be diagnosed rarely in a child under 5 years of age, and not often before puberty.

Successful treatment may be carried out by stretching a narrow orifice, but this is on the whole an unsatisfactory method and one to which operative measures are preferable. Numerous operative procedures have been devised (Thibault), of which two only will be described, the 'dorsal slit' or sagittal dorsal section of the prepuce, and circumcision or excision of the prepuce. The former is advisable in the presence of acute inflammation, but otherwise the latter is preferable, particularly as regards the cosmetic effect.

Dorsal Slit.—Local anæsthesia is satisfactory. Two artery forceps are placed on each lateral margin of the preputial orifice and adhesions to the glans are excluded or broken down by sweeping a probe around the glans; then with the scissors a median and dorsal sagittal slit is made in the prepuce of sufficient length to enable the glans to be freely exposed, but not extending as far as the corona. The mucocutaneous edges of the incision are sutured with catgut and a dressing is applied.

Circumcision (*Fig. 153*).—General or local anæsthesia may be employed. With a sharp-pointed scalpel the incision is marked out in its fullest extent. It commences on the dorsum in the mid-line and approximately halfway between the corona and apex of

the glans and then sweeps ventrally and forwards on either side to reach a point just in front of the attachment of the frænulum to the glans. Two artery forceps are next placed symmetrically on either side of the preputial orifice, the incision is deepened to the mucosa, and adhesions are excluded or broken down by a probe swept around the glans. The prepuce is now slit in the mid-dorsal line to a point

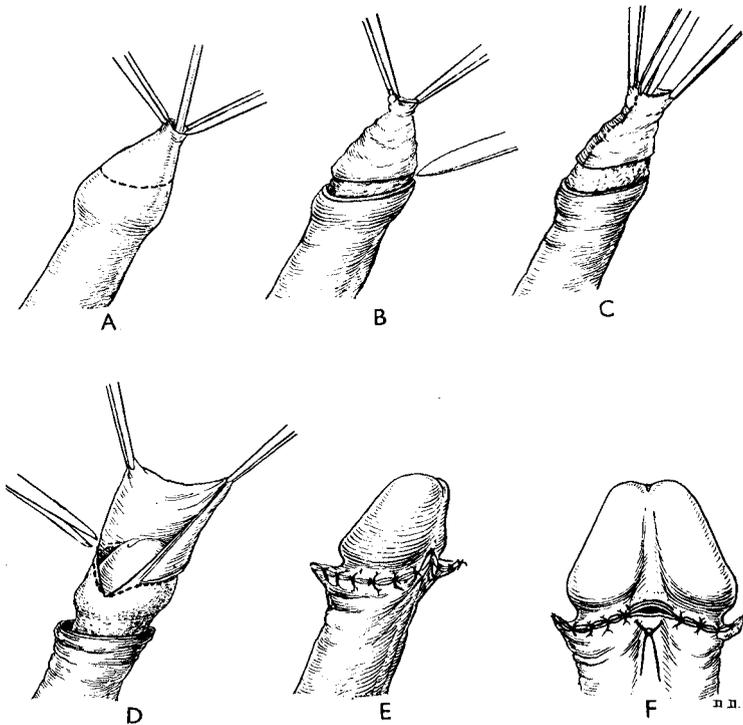


Fig. 153.—The operation of circumcision. A, The line of incision is rather nearer to the corona than to the apex of the glans. A probe has excluded adhesions of the prepuce and glans. B, The first incision; the skin retracts, exposing the inner leaf of the prepuce. C, The midline dorsal slit. D, The incision of the deep layer of the prepuce follows the line of the original incision. E, Interrupted catgut sutures unite the cut edges. F, The first ventral or frænular suture is a mattress stitch controlling the vessels of the frænulum.

halfway between the corona and apex of the glans, but not to the skin margin, which will have retracted. Then with the scissors the mucosa is cut along the planned line of the original incision, again ignoring the retracted skin edge, and the prepuce is removed. The glans penis now is exposed fully and cleansed, and then the edges of mucosa and skin are sutured together by interrupted catgut sutures.

The artery of the frænulum and one or two dorsal veins require artery forceps and the veins are ligatured. The first-named is under-run by the first stitch, which is a mattress suture entering the cut skin on one side of the frænulum to emerge through the mucosa and then re-entering this again to make its exit from the skin on the opposite side of the frænulum. This suture is left long and used for retraction, as is the next suture, which is inserted in the mid-dorsal line. When these two sutures are extended the edges come together and other sutures may be symmetrically placed. A satisfactory dressing is a length of ribbon-gauze soaked in melted vaseline or spread with an ointment such as lanocyllin, which provides a waterproof covering whilst leaving the meatus free.

Comment.—The most frequent error is excessive removal of the prepuce.

TREATMENT OF PARAPHIMOSIS

If the patient is seen sufficiently early and before necrosis of the constricting band has developed, reduction should be attempted. Two methods are employed: (1) After a preliminary application of vaseline to the coronal sulcus, both thumbs are applied to the glans while the penis is grasped between the fore and middle fingers behind the retracted prepuce, and whilst firmly compressing the glans with the thumbs, the prepuce is drawn over it with the fingers. (2) The left hand grasps the penis like a handle behind the prepuce whilst the tips of the fingers and thumb of the right hand are applied to the glans, and as the prepuce is pulled distally with the left hand the compressed glans is pushed into it with the right. Œdema may be diminished beforehand, either by the application of adrenaline (1-1000) or by sustained pressure for from ten to fifteen minutes. Circumcision at a later date is advisable in order to forestall recurrence.

Should reduction fail or ulceration have taken place, antiseptic dressings may be applied and spontaneous cure awaited, or preferably, one or two small incisions are made sufficiently deeply to divide the constricting band and so allow the prepuce to be replaced. Legueu has practised immediate circumcision: the constricting band as it lies in its groove is circularly resected and the parts then remain in apposition without suture and heal within a few days.

PREPUTIAL CALCULI

Concretions are rare, but may be found beneath the prepuce ; they are associated almost invariably with phimosis of either congenital or acquired origin.

Varieties.—Three varieties are described (Kaufmann, Swift Joly):—

1. *Smegma concretions*, which as a rule are composed of fatty substances, epithelium, and cholesterol, infiltrated with lime salts. The existing phimosis prevents proper cleanliness so that balanoposthitis often results, and thus the development of these concretions is favoured. For this reason they are most often found in youth and old age, and in the latter if the prepuce is redundant they sometimes occur without phimosis.

Their shape is variable, but commonly they are adapted to their position, for being of putty-like consistency they become flattened and moulded on the glans, especially about the corona (*Fig. 154*). If multiple they may be faceted, and they may be adherent to the glans, so that on removal a raw surface is left. These concretions are not laminated, and range in colour from white to light brown ; they are said not to contain calcium phosphate.

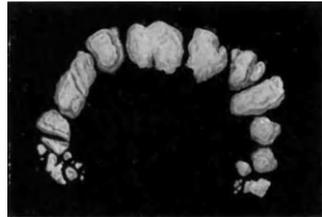


Fig. 154.—Preputial calculi from a youth with congenital phimosis.

2. *Urinary calculi which have been formed in situ* as the result of stagnation of urine in the preputial sac are usually composed of ammonio-magnesium phosphate and calcium phosphate and may contain some oxalates or urates. Indistinct lamination is often present and they may be faceted if multiple ; when single the calculus sometimes forms a cap for the glans.

3. *Migratory urinary calculi* are descending calculi which have been retained because of phimosis ; they may secondarily develop a phosphatic covering and come to resemble the second variety, when their true origin can be determined only by section.

Symptoms.—Frequently symptoms are absent and the condition is discovered accidentally or the patient attends for treatment because of phimosis and the calculi then are found. When symptoms exist they are commonly those of chronic balanoposthitis, and there is

local swelling with a foul-smelling, purulent, and sometimes blood-stained preputial discharge, whilst the urinary stream may be weak or dribbling and distorted. Frequently pain is experienced on erection, and the swelling may increase in size during micturition owing to retention of urine within the preputial sac. Rarely a migratory calculus causes interruption of the urinary stream or requires displacement before micturition can occur. When of long standing the symptoms may be those of the syndrome—urinary obstruction, dilatation, and sepsis. Sometimes ulceration leads to perforation of the prepuce and the calculi may escape.

Diagnosis.—The diagnosis is made by the discovery of crepitus on palpation, by probing, and by X-ray examination. The asym-

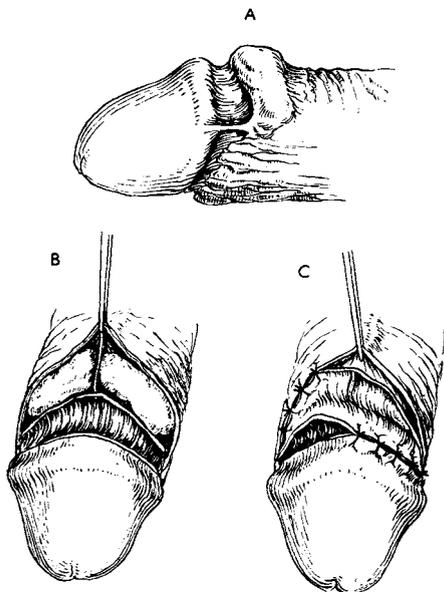


Fig. 155.—Incarcerated preputial calculi which had formed in a shut-off compartment of the preputial cavity. Balanitis and paraphimosis had occurred twenty years before. A, Before operation; B, Exposed by incision; C, Suture of the margins after removal of the calculi.

metrical swelling beneath the prepuce sometimes simulates epithelioma, and X-ray investigation or a dorsal slit is then required to make the diagnosis.

Treatment.—The treatment is by circumcision and removal of the calculi (*Fig. 155*), but if there is gross inflammation or difficulty

in diagnosis the first step is a dorsal section of the prepuce ; removal of the calculi is not always easy if they are adherent to the glans. In the aged, if phimosis is absent, it is sometimes possible to retract the prepuce and remove the calculi.

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CHAPTER XIV

INFECTIONS AND INFLAMMATIONS
OF THE PENIS

INFLAMMATIONS of the penis may be described under the following headings: (1) Inflammation and gangrene of the penile integuments; (2) Inflammation and ulceration of the glans penis; (3) Acute inflammation of the corpora cavernosa penis (diffuse cavernositis); (4) Chronic inflammation of the corpora cavernosa (chronic indurative cavernositis or plastic induration of the penis); (5) Elephantiasis of the penis.

INFLAMMATION AND GANGRENE OF THE
PENILE INTEGUMENTS

Inflammation.—These inflammatory conditions in their appearance and course closely resemble those of the scrotum, and only differ from skin affections elsewhere by reason of the mobility of the skin and laxity of the subcutaneous tissue.

1. *Erysipelas.*—This is but rarely a primary disease and usually occurs as an extension from the scrotum or abdominal wall. Œdema is always marked owing to the looseness of the tissues, and patches of gangrene are apt to form; repair, as with the scrotum, is surprisingly complete and rapid.

2. *Cellulitis.*—Cellulitis may arise from inflammations of the glans penis or from local infected injuries, but it is found more commonly as part of a phlegmonous periurethritis, with which condition it is clinically identical.

3. *Abscess.*—Localized abscess formation, though uncommon, may follow traumatism, whilst boils, eczema, erysipelas, and typhoid fever are possible causes.

4. *Lymphangitis.*—This condition is characterized by the appearance of red lines of inflamed lymph-vessels along the dorsum of the penis, sometimes extending into the groin; they may be infiltrated and palpable and are associated with swelling and œdema,

which may be brawny. Adenitis of the inguinal lymphatic glands coexists. Lymphangitis may arise from any penile, urethral, or glandular inflammation, or from an infected wound; in its acute form it is seen accompanying a hyperacute gonococcal urethritis, and as an indolent subacute change it is associated with syphilitic chancres. Suppuration rarely results. The treatment is that of the cause, with in addition antiseptic dressings and the application of heat either by compresses or sitz baths; resolution usually results.

5. *Phlebitis*.—Thrombophlebitis of the penile veins is sometimes met with during an acute gonorrhœa; it was described by Desruelles in 1837. Two forms are described (Payenneville, Jacoulet): (*a*) Superficial thrombosis, in which the superficial veins of the penis are affected; and (*b*) Deep thrombosis, in which the veins of the vesical and prostatic venous plexuses are involved as well. The first probably results from a primary lymphangitis, as a rule gonorrhœal. The penis appears swollen, the skin becomes reddened and œdematous, there is pain, and the veins are prominent, whilst the dorsal vein may become palpable as a hard cord; the prepuce also is œdematous. As a rule subsidence follows after some weeks' treatment by rest and hot sitz baths together with treatment of the gonorrhœa. Possibly the deep variety is primarily an infective phlebitis of the periprostatic veins, with retrograde involvement of the cavernous tissue of the penis. The corpora cavernosa penis become involved as a rule, but the corpus cavernosum urethræ may escape. The penis appears erect or in semi-erection, it is swollen, sometimes enormously, and there is great pain. The process frequently becomes a suppurative cavernositis, a condition referred to again later. Sometimes gangrene occurs and this may spread to involve the perineum. Efficient treatment demands early and free incision.

Scabies of the penis is not uncommon, and a number of rare infections have been recorded, amongst which is anthrax, successfully treated by serum (Battista). Venereal ulcerations are less commonly of the body than of the glans penis, and they are described with the latter.

Gangrene of the Penis.—It is convenient to describe penile gangrene under three headings: (1) Gangrene of mechanical origin; (2) Gangrene complicating inflammatory infections of the penis; (3) The spontaneous fulminating gangrene of Fournier.

1. *Gangrene of Mechanical Origin.*—Sometimes described as aseptic gangrene, it may be the result of strangulation of the penis by a band, or it may be caused by thrombosis of the vessels of the penis, but only rarely is it a complication of paraphimosis.

2. *Gangrene Complicating Inflammatory Infections of the Penis.*—Commencing at the glans penis, gangrene sometimes complicates balanoposthitis or the various ulcerations of the glans penis, especially if phimosis coexists (*Fig. 156*). Cachectic conditions predispose to gangrene and it has been observed in typhoid fever. It is particularly

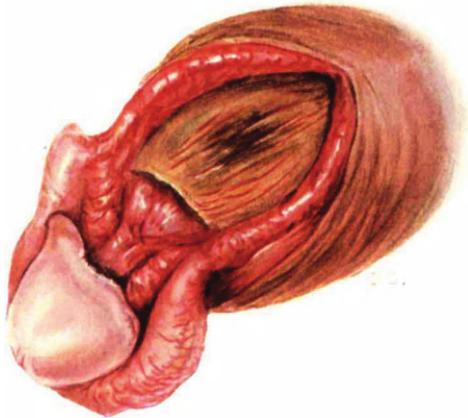


Fig. 156.—Phagedæna originating from a chancre behind the corona and involving the corpora cavernosa penis. The prepuce and penile skin have been slit proximally to expose a large slough of the corpora cavernosa.

prone to be associated with noma and acute phlegmonous peri-urethritis (extravasation) and also with diabetes. Save for the site, gangrene of the penis differs in no way from gangrene under similar conditions elsewhere, and the treatment is the same. *Noma* is a spreading gangrene, most often of the vulva, but also of the penis and scrotum of the male nursling under three weeks of age. It has been regarded as a gangrenous lymphangitis possibly originating at the umbilicus (Rousseau). As a rule, though not always, these infants are debilitated; lymphangitis and œdema are first observed, and are rapidly followed by gangrene. It is a very fatal disease. Treatment by incisions, hot antiseptic applications, and serotherapy should be attempted.

3. *Spontaneous Fulminating Gangrene (Fournier).*—

Aetiology and pathology: This condition is a rapidly spreading gangrene undoubtedly of inflammatory origin, although there may be no apparent portal of entry of infection. It can be caused by differing micro-organisms, the gas-gangrene group, streptococci, and at times by other non-gas-producing organisms. It is sometimes considered to be a gangrenous lymphangitis, but in only a few cases has lymphangitis been shown to exist. Lehmann amputated the penis in one patient and found that a phlegmonous cellulitis was present; this was associated with necrosis of the overlying skin and the vessels showed arteritis and thrombophlebitis. Except for its unknown portal of entry the disease closely resembles acute phlegmonous periurethritis.

Site: The prepuce only may be involved, but usually the whole penis, perhaps together with the scrotum, is affected.

Symptomatology: The patient's attention is first drawn to the penis by a sensation of burning or pain, and then redness and swelling of the skin become apparent. At the same time constitutional symptoms such as fever, rigors, and vomiting appear; local pain increases and the penis becomes swollen; at first red in colour, it rapidly becomes livid and then patches of gangrene appear, yellowish or grey in appearance. Local tenderness is absent. The process is characterized by fulminating rapidity of spread and development. The general condition often becomes grave, high fever continuing with marked prostration, and the disease may terminate in the death of the patient from septicæmia or toxæmia. Dieulafoy, however, suggests that death is unusual in this disease. Recovery is indicated by a sudden fall in the temperature, cessation of spread, and the formation of a line of demarcation. The sloughs are superficial, and after separation repair is extremely rapid and complete; only rarely are the corpora cavernosa involved, but when they are, permanent deformity remains.

Diagnosis: The diagnosis from gangrene of urinary origin, or that resulting from mechanical causes, as well as from gangrene associated with systemic diseases such as diabetes, is not difficult when the history is considered and an examination made, and it is by a process of exclusion that the correct conclusion is reached.

Treatment: Early operative treatment is required, and should consist of multiple and free incisions with knife or cautery. These are made both into the affected tissues and beyond them in order

that spread of the disease may be checked; antiseptic baths and dressings are then instituted. At the same time general measures are undertaken to promote the excretion of toxins and to maintain the patient's resistance. Drugs of the sulphonamide group are employed, and antisera are essential in gas-gangrene infection (Garrod) and are useful in streptococcal cases; it would seem that treatment by X rays is of importance in gas gangrene (Kelly, Dowell, Russum, and Colien). After recovery skin loss may be made good by means of grafts from the scrotum, thigh, or abdomen.

INFLAMMATION AND ULCERATION OF THE GLANS PENIS

INFLAMMATION

Balanoposthitis.—The term balanitis implies inflammation of the epithelial covering of the glans penis, and posthitis inflammation of the deep layer of the prepuce which lies in contact with the glans. It is rare for one to be involved without the other and the condition present is ordinarily one of balanoposthitis.

Aetiology.—The primary cause is infection, and a frequent predisposing factor is phimosis, either congenital or acquired, which, once infection occurs, aggravates the inflammation. Predisposing factors may be of local or general origin, but phimosis, lack of cleanliness, or an infected urine always favours the occurrence of any balanoposthitis.

Local causes: In the young uncleanliness is the usual cause of balanoposthitis; in the adult it sometimes follows the use of too strong antiseptics as prophylactics against venereal disease, and in these varieties the causal organisms are normal inhabitants of the preputial cavity, staphylococci, streptococci, the *B. coli*, and sometimes pseudodiphtheroids or *Oidium albicans*.

Balanoposthitis with the formation of false membranes may be met with in scarlatina, small-pox, and measles, as well as in diphtheria. Specific infections have been described by Bataille and Berdal, Corbus and Harris, and Pusey; in this group, too, one must include diphtheria (Hoyne and Levy) and the rare true gonococcal balanitis. The varieties described by Bataille and Berdal, Corbus and Harris, and Pusey, are venereal and contagious and due probably to infection by spirilla and vibrios which gain entry

under conditions which favour these anaerobes, as, for example, a tight foreskin. The first-named observers have noted circular erosions, more particularly of the surface of the glans about the meatus, which spread slowly and painlessly and respond to applications of silver nitrate. Corbus and Harris described a more severe ulceration chiefly of the coronal region; this type not infrequently merges into a gangrenous condition which sometimes spreads to the whole penis. Pusey also discusses erosive gangrenous lesions. As the infection is frequently due to anaerobic organisms, treatment by hydrogen peroxide applications gives the best results. Circumcision is usually required as well, both to facilitate treatment and for future prophylaxis.

Venereal infection is the commonest precursor of balanoposthitis. Sometimes apparently causeless post-coital inflammations arise, but in general they are associated with gonorrhœa, syphilis, or infection by Ducrey's bacillus. On rare occasions syphilis may be responsible for a primary balanitis, producing multiple, non-indurated, pinhead erosions in which the spirochæte can be found. Other local predisposing causes are tumours of the glans penis, preputial calculi, and stagnant urine retained by phimosis. Infection, too, may follow ritual circumcision.

General causes: Madden classifies exanthemata and metabolic disorders as general causes of balanoposthitis. The first of these includes secondary syphilis, pemphigus, psoriasis, erythema multiforme, and lichen planus; more rarely drugs which produce exanthemata are the cause, for example antipyrine, arsenic, quinine, and iodine. The second results from substances excreted in the urine such as sugar, excess of creatinine, of phosphates, or of oxalates. In these cases it is almost the rule to obtain moulds on culture, either *aspergillus* or *Oidium albicans*. It is to be noted that certain chemicals taken internally can cause balanitis—for example, iodine, bismuth, and cantharides.

A very full classification of the varieties of balanitis has been made by Madden. First is balanitis simplex secondary to phimosis; secondly, balanitis vulgaris which is the result of trauma either chemical or bacterial by the local flora; thirdly, balanitis due to specific local infections; fourthly, balanitis as part of general exanthemata; and fifthly, balanitis associated with general metabolic disorders. These varieties are discussed in the preceding paragraphs, but another group is described under the heading of balanitis following on local

tissue changes. It includes several distinct clinical and pathological entities, all of which are rare. They are: (1) Kraurosis penis; (2) Leukoplakia; (3) Scleroderma; and (4) Balanitis xerotica obliterans. The second will be considered later. Kraurosis penis appears after the age of fifty and as a rule is preceded by pruritus, which persists with it; adhesions and excoriations are seen, and also white rough patches, whilst fissures appear and may precede epitheliomata; in the early stage sections show hyperkeratosis, later the epithelium of the glans is of atrophic appearance. In scleroderma there is at first, and for a brief period only, œdema of the parts, with inelasticity and stiffness; then the epithelium becomes of ivory whiteness and lardaceous appearance and is found to be atrophic, indurated, and bound down to the deeper structures. Balanitis xerotica obliterans has been described following on circumcision, but may arise under other circumstances; it is found in young patients. In general there is at first a thickening and scaliness of the skin of the glans, which becomes very sensitive; then the surface becomes pale, parchment-like, and weeping; whilst finally it is left bluish-white and atrophic, with fine wrinkling and puckering. The condition is progressive and the meatus becomes constricted. On section there is atrophy of the epithelium and immediately below the basal layer a zone of fibrosis.

Madden places under balanitis with new growths the erythroplasia of Queyrat, but here this will be considered under tumours together with intra-epidermal carcinoma of the penis (p. 278). Another author who discusses many rare skin conditions of the penis and glans is Diasio.

Symptoms.—

Acute: The patient usually complains of tenderness and a burning sensation of the part, whilst a purulent discharge with redness and œdematous swelling of the prepuce is observed. In the hyperacute forms there is lymphangitis of the penile lymphatics with enlargement and sometimes suppuration of the inguinal glands; it is in these forms that the varieties which are described by Bataille and Berdal and by Corbus are to be encountered. Systemic symptoms are prominent in the gangrenous forms and pain is severe.

Subacute: This type is more often observed in infancy; there is some redness of the preputial orifice, excoriation of the glans, and a more or less purulent discharge.

Chronic: The chronic form (*Fig. 157*) may be encountered in the diabetic; tenderness is absent and the discharge is serous or seropurulent; the prepuce can no longer be retracted and the margins of its contracted opening are œdematous, thickened, rigid, and fissured (*Madden*). Exacerbations are common, and it may become complicated by gangrene or erysipelas. *Belgodère* observes, however, that in the diabetic the condition is essentially an eczema, and is



Fig. 157.—Photograph of a case of chronic balanitis; there is an exceptional degree of crusting.

distinguishable from other forms by the absence of general infiltration and œdema, for it is limited to the ring of the preputial orifice.

Complications.—Gangrene of the penis or of the glans is infrequent, but gangrene of the prepuce is less rare; thrombophlebitis and suppurative inguinal adenitis are uncommon except with the more severe forms. Adhesions between glans and prepuce may be a sequel to the inflammation, and paraphimosis sometimes occurs if the thickened prepuce becomes retracted.

Diagnosis.—The diagnosis is simple when the prepuce can be retracted, otherwise a non-existent urethritis may be suspected or a syphilitic chancre may escape notice; nevertheless in infancy, or with gonorrhœa or urinary sepsis, the diagnosis is often sufficiently obvious, as it is indeed in diabetes if only this possibility is

remembered. However, it may be, and often is, impossible to differentiate between neoplasm, chancre, or preputial calculi as the cause until a dorsal slit has been made. Balanoposthitis is mimicked by psoriasiform carcinoma of the glans penis (p. 278).

Treatment.—If the prepuce can be retracted treatment must be directed both to the cause—syphilis, gonorrhœa, diabetes, etc.—and to the local condition; local treatment is by antiseptic applications and cleanliness. If phimosis exists and the inflammation is acute, the glans should be exposed by means of a dorsal slit, or if the condition is extremely acute this may be delayed whilst sitz baths and syringing of the preputial cavity are carried out. Later and in the chronic variety circumcision is performed.

ULCERATION

Ulcers of the glans penis may be grouped as of either venereal or non-venereal origin; certain varieties have been considered with balanoposthitis.

VENEREAL ULCERATION

Syphilis.—

Primary Chancre.—A primary chancre usually makes its appearance from two to four weeks after infection. In its initial stages the appearances may differ widely; a papule may form and ulcerate, the surface of the glans may become excoriated and later ulcerated, or perhaps a pustule forms and on bursting a characteristic ulcer develops. The typical ulcer is regular, indurated, and punched out, with slightly overhanging margins, whilst the base appears clean and often is covered by a greyish membrane; the discharge from the ulcer is not obviously purulent unless secondary infection has taken place. At times the process is more superficial and an excoriated red plaque appears, the induration only becoming obvious when it is pinched laterally. Corbus points out that on the glans the chancre tends to form a flat erosion, in the coronary sulcus an infiltrated mass, on the frænulum a thick cord, whilst on the internal surface of the prepuce it tends to be parchment-like. On histological examination there is a marked degree of small round-celled infiltration, together with numbers of plasma cells, which become especially numerous in the later stages; there is some proliferation of the intima of the vessels, and near the surface polymorphonuclear leucocytes are found.

Inguinal adenitis is present invariably and the glands are discrete and firm, abscess formation only occurring if they become infected secondarily. The primary chancre is as a rule single, but, rarely, may be multiple; its most frequent site is perhaps at the corona.

Gummatous Ulceration.—In tertiary syphilis gummatous ulceration may occur, but it is a rare event; either a typical gumma forms and ulcerates characteristically, or a spreading gummatous infiltration accompanied by ulceration develops.

Diagnosis.—The case history is of importance, but a negative history should be accepted only with reservations. The chancre is painless. Dark-ground microscopical examination is essential in the diagnosis of the primary chancre, and if carried out as a routine will demonstrate the treponema in many atypical ulcers; if anti-septics have been used it is best to treat the ulcer with a saline lotion for some days whilst making examinations at intervals. A routine general examination must not be omitted, for early secondary signs may be present and serve to clinch a tentative diagnosis.

Treatment.—Local treatment by such lotions as lotio nigra, lotio hydrarg. perchlor. (1/2000–1/1000) or hydrarg. biniodid. (1/2000–1/1000) is usually efficacious. Systemic treatment on routine lines is of course pursued.

Chancroid or Soft Chancre.—The causal organism is the bacillus of Ducrey, which gains entry during intercourse through some surface abrasion or mucosal defect. In some two to five days a pustule forms and ulcerates; the ulcer is not indurated, its margins are sharply cut, often undermined, and the base is irregular, necrotic, and covered with yellowish purulent secretion; it is painful. On histological examination a round and plasma-celled infiltration of the deeper parts is found, whilst towards the surface polymorphonuclear leucocytes occur; there is no fibrosis and few, if any, alterations are found in the blood-vessels. Multiple ulcers are usual and tend to occur on opposing surfaces, the infection being transmitted by contact. The inguinal glands are involved and periadenitis occurs, causing the glands to become matted together; suppuration is frequent and bubo formation is the result. Secondary infection may lead to extensive destructive processes and even to phagedæna.

Diagnosis.—Dark-ground examination is necessary in order to exclude syphilis; however, not infrequently the two infections are associated. Lymphogranuloma inguinale is difficult to differentiate

clinically, but the response to treatment is very different. Batchelor and Lees recommend a specific test (Reenstierna) in which, when positive, a distinctive reaction occurs forty-eight hours after the intradermal injection of a special vaccine of Ducrey's bacillus. Cole and Levin find that the intradermal test made with chancroidal bubo-pus, as described by several workers, is specific. The reaction, however, cannot be obtained for some five weeks after infection, remains positive for many years, and a negative Frei test must be obtained beforehand. Its clinical value would not appear to be great.

Treatment.—Cleanliness and the use of mercurial antiseptics or of an iodoform ointment give on the whole very satisfactory results. Hanschell and also Batchelor and Lees have obtained rapid healing using sulphanilamide. Young recommends the following application :—

Calomel	ʒij
Zinc Sulphate	ʒij
Camphorated Fluid Extr. of Opium	ʒij
Lime-water	ʒviij

The calomel and lime-water are mixed first and allowed to stand for two days, the remaining ingredients then being added.

Buboes as a rule require drainage; the incision should be vertically placed and the abscess cavity 'bipped' and packed with iodoform gauze.

Granuloma Inguinale or Inguinal Ulcerative Granuloma.—This disease is a rare form of chronic ulceration of the genitalia and adjoining parts. It is encountered in the tropics, is almost confined to the coloured races, in particular the negro, and appears to result from intercourse. The early descriptions of the disease were made by Conyers and Daniels, and Macleod (Daniels). The disease was fully discussed by Aragão and Vianna in 1912. The incubation period is as a rule from two to eight days, but has been known to be as long as twelve weeks. The condition commonly begins on the genitalia, glans penis, penis, prepuce, or scrotum. The initial stage is a papule which proceeds to ulceration, whilst round its margins other papules form and in turn ulcerate, so that there results a slowly spreading ulcer with irregular margins, beyond which nodules may be felt or seen. The base of the ulcer is markedly irregular, and healed areas may be found which, however, readily break down again. Ulceration extends slowly and superficially but extensively,

involving by preference the moister parts of the perineum and groins. The lymphatic glands are not involved except as the result of secondary infection. Histologically there is found a superficial cellular area showing dense infiltration with lymphocytes and large mononuclears, together with some polymorphonuclears and fibroblasts, and a deeper zone made up of dense fibrous tissue. The cellular infiltration is especially marked in the peripheral nodules, and fibrosis is always prominent. There may be epithelial hyperplasia at the margins of the ulcer with finger-like processes of epithelium extending into the deeper tissues (Randall, Small, and Belk). A specific organism was described by Donovan.

Suppuration is but little marked and the ulcer is indolent, causing some irritation but not pain. Frequently a butterfly-shaped superficially ulcerated area results, progressing at its margins but showing partial scarring in older areas. The thickening of the margins and the fibrosis may suggest malignancy, but the edges are shelving. The clinical picture is distinctive, although the disease may pass unsuspected until, antisyphilitic and local treatment having failed, portions are taken for histological examination. In the early stages excision, if feasible, is successful—for example when the prepuce is affected—but the disease is resistant to local treatment. In the more advanced stages antimony and potassium tartrate administered as for bilharziasis (p. 191) cures many patients but fails in a few, and for these Greenwood and Higoumenakis recommend diathermic destruction of the surface and tissues immediately beyond the advancing margin.

Poradenitis Venerea or Lymphogranuloma Inguinale.—It is only in recent years that climatic bubo, lymphogranuloma inguinale (Durand, Nicolas, and Favre), esthiomène, the genito-ano-rectal syndrome, and inflammatory stricture of the rectum, have been shown to be of similar aetiology (Stannus, Findlay) and due to a filterable virus (Hellerström and Wassén).

The disease is largely tropical in distribution but does occur in the temperate zones, being not very uncommon in Europe, although rare in Great Britain. It is commoner in the male than the female, and in the former usually manifests itself as climatic bubo, whilst in the latter bubo is very rare and genital elephantiasis and stricture of the rectum are more common. The difference in distribution is attributed to the varying paths of lymphatic drainage in the two sexes.

The disease is transmitted by sexual intercourse ; in the male the primary lesion appears within a few days of infection as a transitory herpetiform ulcer usually situated near the corona, though it may be intra-urethral and cause a discharge. Its appearance may be delayed for as long as thirty days after exposure. Lymphangitis of the dorsal vessels of the penis sometimes occurs. From six days to six weeks after infection evidence of involvement of the medial group of the inguinal glands becomes evident. Subsequent progress is variable, the glands may increase rapidly and break down rapidly, being associated with systemic symptoms, or the process may be slow and take weeks or months to develop, with little general disturbance, perhaps then progressing with rapidity and suppurating. Sometimes it manifests a relapsing character. The general symptoms, which are variable in intensity, include fever, lassitude, chills, pains in the limbs, etc. Erythema nodosum and other skin eruptions have been noted. The diseased lymphatic glands lose their normal architecture and show many scattered areas of plasma-cell infiltration as well as numerous collections of large, lightly staining cells with small nuclei. Within these areas develop foci of suppuration, and these multiple foci are usually regarded as characteristic ; nevertheless the process may not be so typical and instead may resemble non-specific lymphadenitis or, uncommonly, a single abscess may form (Lillie). One or more glands become involved and the condition may spread to the surrounding tissues, so that a large matted mass results. As a rule the small abscesses become adherent to the skin and discharge through multiple sinuses. Associated enlargement of the iliac glands is said to be a distinctive characteristic. Elephantiasis of the genitalia may follow because of destruction of the lymphatic paths.

This account is based on the description given by Stannus, who states that the first recognizable account of climatic bubo was given by Wallace of Dublin in 1833. The disease may be identified by the Frei intradermal test, which appears to be specific, but the time at which it becomes positive varies (Wilmoth).

Diagnosis.—The bubo requires differentiation from that of chancroid, but the chancroid and bubo are coexistent and its bubo is painful and contains Ducrey's bacillus. As regards tuberculosis the histological picture of tubercle is distinctive and animal inoculation will confirm the diagnosis. Plague also is to be distinguished, but its development is rapid, with fever and systemic symptoms, and on aspiration *B. pestis* is found ; moreover the Frei reaction

is negative. Levaditi, Ravaut, Lépine, and Schoen have shown that the serum of these patients possesses protective properties.

Treatment.—When limited to inguinal adenitis treatment by aspiration, drainage, or complete excision is often successful. Antimony and potassium tartrate is recommended for this disease as for granuloma inguinale. Treatment with antigen is said to be specific, doses up to 5 c.c. being administered subcutaneously or intravenously.

NON-VEREAL ULCERATION

Herpes of the glans penis may occur and is characterized by the appearance of vesicles, but signs of inflammation are absent until infection occurs; this takes place invariably when the vesicle ruptures and then a small ulcer with slight surrounding inflammatory reaction is found. The diagnosis rests on the clinical sequence of papule, vesicle, pustule, and non-indurated ulcer, particularly if there is a history of previous attacks, for the condition tends to recur. Treatment is merely by cleanliness and the use of mild antiseptics.

Scabies of the glans penis is not uncommon and careful search will usually discover a typical burrow either on the glans or elsewhere, for it is unusual to find the disease limited to this region. Sulphur ointment and cleanliness provide the treatment required.

Diphtheria of the glans penis is known (Hoyne and Levy) and may simulate venereal infection; the diagnosis depends upon bacteriological examination.

Tuberculosis of the penis has been described on rare occasions; it may be of the body of the penis and then originates from a tuberculous lymphangitis (Hansteen).

Tuberculous ulceration of the glans penis has been reported in association with genito-urinary tuberculosis, but is very rare (Frontz and McKay). Tuberculous ulcers in patients in whom no other focus could be discovered have been described by Kraske, by Prat and Lecène, and by Lazarus and Rosenthal; direct infection is of course possible and might be effected through an abrasion during coitus, either from a diseased cervix or in perversion from tuberculous sputum; however, proof of such origin is difficult to substantiate. Theoretically a hæmatogenous infection is possible. Infection during ritual circumcision is known and series of cases have been collected by Ware and by Wilson and Warthin. Lazarus and Rosenthal find that only 25 cases of primary tuberculosis of the penis have been reported in adults. They and also Brunati state that the disease

usually appears as a small, painful papule on the glans penis, frequently near the meatus and resembling a papular chancre; sometimes, however, it may begin as a pustule or indefinite elevation. Later the appearance becomes that of a chancroid, and a slowly spreading, painful ulcer is found which is sensitive to touch; it is of reddish colour, is superficially ulcerated, covered by a yellowish slough, and is indurated. The margins are irregular, bluish-grey, and show a tendency to become undermined. The ulcer extends in serpiginous manner, nodules are apt to appear in its base, and it readily scars in parts but equally readily breaks down again; Brunati describes it as geographical. In the advanced stages areas of cheesy necrosis may be found along the margin. The lesion is most resistant to treatment and eventually spreads to the urethra as well as to the glans and body of the penis. The inguinal glands may be involved, although rarely prominently; nevertheless sometimes as the result of mixed infection they become painful and tender, and on rare occasions suppurate. The first symptom and for a time the only one is pain. When the urethra becomes involved it is said that micturition becomes painful and frequent; Brunati, however, observes that pain on micturition has only once been reported, but difficulty occurs later owing to contraction by scarring. As a rule the diagnosis is missed at first and it can be confirmed only by histological examination and animal inoculation. Excision or curettage has cured some patients in the earlier stages, but advanced disease may necessitate radical amputation of the penis. In adults the prognosis is better than in children infected during circumcision.

Actinomycosis of the glans penis has been recorded and does not differ from the disease elsewhere. Amputation of the organ is as a rule necessary.

Anthrax of the penis and leprosy have also been reported.

ACUTE INFLAMMATION OF THE CORPORA CAVERNOSA

Acute inflammation (diffuse cavernositis) is rarely primary, but is secondary either to infected wounds of the penis and urethra or to inflammations of the neighbouring structures, e.g., the superficial tissues of the penis, urethra, glans, or perineum. A systemic infection such as pyæmia is a predisposing factor. Three varieties are described: (1) Suppurative; (2) Gangrenous; and (3) Thrombophlebitic.

Persistent erection, constituting one variety of priapism, is a characteristic of all three types and may obstruct micturition and hinder or prevent catheterization.

Suppurative Cavernositis.—In this form the onset is sudden, with fever and rigors, the penis is in erection, and there is œdematous swelling of the penis and prepuce. Later areas of softening appear, the overlying skin becomes red, and suppurative foci burst through to the surface or open into the urethra. The corpora cavernosa may become riddled with sinuses and the pus may track for long distances into neighbouring regions. The corpus cavernosum urethræ, however, is involved but rarely. Pyæmic symptoms are unfortunately common and pyæmia is one cause of death. The disease is as a rule painless, but may be acutely painful.

Gangrenous Cavernositis.—Infection of the corpora with the organisms of gas gangrene may take place and the majority of these patients succumb with symptoms of profound toxæmia. Frequently anaerobic organisms have been isolated from such patients.

Thrombophlebitic Cavernositis.—This is characterized by a thrombophlebitis of the veins which drain the corpora cavernosa, and the process may extend even to the hypogastric vein by way of the prostatic venous plexuses, or may reach the internal saphenous vein. It is a less fatal condition than the preceding variety, but the suppuration which results may cause death by pyæmia. Deep thrombosis of the penile veins has been noted already (p. 247).

Treatment.—Wide and free incision of the partially necrotic corpora, either by knife or cautery, is an essential of treatment and the sloughs are permitted to separate gradually. The power of erection is never recovered.

Acute cavernositis is distinguished from priapism by the local signs of inflammation and the systemic symptoms.

CHRONIC INFLAMMATION OF THE CORPORA CAVERNOSA (CHRONIC INDURATIVE CAVERNOSITIS OR PLASTIC INDURATION OF THE PENIS)

Chronic inflammation of the corpora cavernosa is almost unknown if the disease known as chronic indurative cavernositis and the rare cases of tuberculosis and tertiary syphilis are excepted; Sewell and his co-workers, however, have observed a chronic suppuration resulting from infection by a diphtheroid bacillus. Ricord in 1840

described fibrous indurations of the corpora cavernosa in syphilis. Chronic indurative cavernositis is characterized by the appearance of fibrotic plaques in the tunica albuginea of the corpora cavernosa and, on rare occasions, by the development of similar nodules in the erectile tissue. The disease has been reviewed by Corbineau; its first description is possibly that of La Peyronie in 1743, followed in 1850 by Kirby. These plaques are a not uncommon occurrence and make their appearance for the most part between the ages of 40 to 70 years. The condition is slowly progressive.

Pathology.—The fibrous plaque develops on the dorsum of the penis or in the pectinate septum which separates the two corpora, and only very rarely on other aspects of the tunica albuginea. The nodules may be multiple and sometimes others may be found in the erectile tissue, very rarely indeed the latter exist alone. Each plaque is composed of dense fibrous tissue and as a rule does not involve the underlying cavernous tissue, although it may do so. Extension tends to occur in the longitudinal direction rather than transversely.

Aetiology.—A chronic sclerosing cavernositis may persist after acute cavernositis, but in the great majority of patients the condition develops insidiously and the cause remains unknown. It is deemed probable that it is of the nature of a chronic productive inflammation, and a variety of possible causative factors have been suggested—trauma, rheumatoid changes, syphilis, phlebitis of the corpora, diabetes, and gout. Nevertheless a number of observers do not subscribe to the view that it is of inflammatory or traumatic origin (for example a scar following partial rupture), and some have regarded it as a physiological degeneration comparable to the changes of senility and perhaps to an atheromatous degeneration; however, it is not found more frequently in the aged. Sacher analysed the causative factors in a number of cases and found the incidence to be as follows:—

	<i>Per cent</i>
Diabetes and gout	23·5
Syphilis	11·0
Gonorrhœa	9·0
Trauma	8·2
Rheumatism	2·1

Symptomatology.—The patient frequently discovers the condition accidentally or may complain of deformity of the penis during erection, this being due to the area of fibrosis which prevents expansion and therefore deflects the organ towards the side of the induration.

Pain may be experienced on erection and micturition may become difficult. Sometimes the deformity renders coitus impossible, and rupture of the diseased penis during erection has been recorded.

Diagnosis.—The diagnosis is made easily from the history of deformity on erection and from examination which discovers the plaque as the shaft of the penis is palpated between finger and thumb. A syphilitic gumma is the only condition which can give rise to confusion, but then the nodule lies in the erectile tissue itself.

Treatment.—Treatment has proved unsatisfactory, although many methods have been tried. Treatment by excision must be complete for otherwise the remnants continue to extend and the plaques re-form, although at times this effect is mimicked by the appearance of the disease in fresh areas. Even when excision is complete the deformity which necessarily remains is in many patients as troublesome as that present before operation; however, some good results have been obtained, particularly when grafts of the fascia lata have been utilized to replace the loss of the tunica. Excision, however, is only permissible when the induration is small and single and the disease quiescent (Marion).

Electrolysis, diathermy, X rays, and massage have provided some successes, but at other times fail completely; medicinal treatment is apparently useless.

Ossification of the Corpora Caverosa.—It is extremely rare to find a plaque which contains calcareous matter or true bone, but the discovery has been made in a few patients, usually at autopsy, sometimes after excision, and rarely by X-ray examination. In one example the corpora cavernosa were completely calcified. It is probable that the condition is a further development of the fibrous plaque of chronic indurative cavernositis, for the distribution and age incidence are similar; it bears no relationship to the os penis of animals. The clinical findings are very similar to those of chronic cavernositis, but treatment is not possible.

ELEPHANTIASIS

Elephantiasis of the penis and scrotum are usually found together, but in rare instances both in filarial and non-filarial elephantiasis the penis alone is involved.

The condition is associated most commonly with infection by *Filaria bancrofti*, a worm living in the lymphatics of the trunk and extremities, but whether or not a streptococcal infection is joined with the filaria in producing the disease is a moot point. *Filaria bancrofti* is found in almost all tropical and subtropical countries,



Fig. 158.—Elephantiasis of the penis in filariasis (*Dufougeré*, from *Botreau-Roussel*).

and has been met with in Europe. Transmission occurs through the agency of various mosquitoes. The affected lymphatics undergo repeated attacks of lymphangitis, and hypertrophy and fibrosis of the skin and connective tissue may develop and result in elephantiasis, or the lymph-vessels may undergo dilatation leading to lymphangioma. Non-filarial elephantiasis, or elephantiasis nostras, exists and it is clinically indistinguishable from the filarial variety (Castellani).

Either following on repeated attacks of lymphangitis, or with insidious onset there occurs a regional hypertrophy of the entire skin and subcutaneous tissue of the penis (*Fig. 158*); it is inflammatory in nature, and associated with œdema and, later, with hyperplasia and marked fibrosis. The skin may be smooth, but more commonly is rough and fissured; the consistence of the affected tissue is firm, may be wooden, and does not pit. Repeated attacks of lymphangitis are common and result in bouts of so-called erysipelas.

Non-filarial elephantiasis is rare. Elephantiasis nostras has been noted (*Fig. 159*); another variety is caused by lymphatic obstruction secondary to scarring, which may result from adenitis, the surgical removal of the glands of the groins, frequent attacks of erysipelas, lymphangitis, or the infective granulomata, tuberculosis, syphilis, and lymphogranuloma inguinale. Bilharziasis of the urethra results in multiple fistulæ, and at times a false elephantiasis of the penis results from the fibrosis thereby produced.

Treatment.—The treatment is operative. All diseased tissue must be excised completely, and skin-grafts then provided. Only



Fig. 159.—Elephantiasis nostras. The hypertrophy of the penile skin is clearly seen. The scrotum is involved.

occasionally is the scrotum available for this purpose, and usually the bare penis is placed in a subcutaneous tunnel on the inner aspect of the thigh and freed with its new covering some ten days later.

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CHAPTER XV

TUMOURS AND CYSTS OF THE PENIS

BENIGN TUMOURS

BENIGN tumours of the penis are uncommon if the venereal wart is excepted. These tumours may be divided into those of congenital origin and those which are of later development.

TUMOURS OF CONGENITAL ORIGIN

Tumours of congenital origin comprise cysts of the raphé and angiomas. The former are either dermoid or mucoïd cysts, and have been discussed already in the chapter on congenital malformations of the urethra (p. 38). The dermoid cyst arises from a malunion of the ectodermal lips of the urogenital fissure, which results in portions of the ectoderm becoming included as rests; the mucoïd cyst is the result of malunion of the lips of the urethral gutter. Both varieties are found in the immediate neighbourhood of the raphé and more frequently near the frænulum of the prepuce than elsewhere; they are usually noted during infancy. In size they are rarely larger than a hazel-nut. The two varieties are distinguished from each other only by their contents and both may be treated satisfactorily by excision. Angioma of the penis or glans penis is rare (*Fig. 160*); it may be of congenital origin.

Both venous and lymphatic swellings are encountered at times on the penis. Varicose veins here may be associated with a similar condition of the veins of the anterior abdominal wall or, sometimes, with

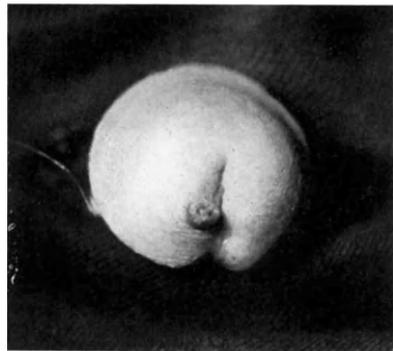


Fig. 160.—Hæmangioma of the meatal margin (Dr. Somerford's case).

carcinoma of the penis. Venous dilatations have been noted on the glans penis (*Fig. 161*) and they are said to possess the peculiarity of diminishing during micturition. Lymphatic dilatations may be seen in filariasis, when the condition is analogous to lymph-scrotum, but apart from this disease single or multiple dilated lymphatic spaces, which are painless and contain clear fluid, some-



Fig. 161.—A venous dilatation of the glans penis (Mr. Macalpine's case).

times are observed, most usually on the prepuce and near the frænulum. They may be destroyed, if desired, by incision and the application of silver nitrate or by diathermy.

TUMOURS OF LATER DEVELOPMENT

Tumours which develop later include: (1) Cysts—sebaceous, 'atheromatous', and dermoid; (2) Epithelial horns; (3) Various rare tumours; (4) Venereal warts.

I. Cysts.—Sebaceous cysts developing on the penis are similar to those found elsewhere. 'Atheromatous' cysts also are derived from the sebaceous glands; they are multiple, of millet-seed size, usually confined to the prepuce, and similar to those which may be found on the scrotum. Their treatment consists of incision with evacuation of the white cheesy contents and destruction of the lining membrane by means of silver nitrate. Acquired dermoid cysts are inclusion cysts originating at the time of circumcision and require no special description.

2. Epithelial or Cutaneous Horns.—These sometimes form on the penis and glans penis and are probably the effect of a hyperkeratosis in which the prickle cells do not permit of the shedding of the keratinized stratum corneum; it is believed that they occur more often when certain keratoses are present. Martini has reported a horn developing from a venereal wart. He quotes Pasini, who classified these horns as of two types—first the wart-like form resembling the fibrokeratoma of Unna, and secondly keratinization preceding epithelioma development. These horns are yellowish or greyish in colour and may be found at any age; their size and length vary, one of 12 cm. being on record. They are curved, the curve of their convexity being smooth and hard, whilst the curve of their concavity is rough and fissured.

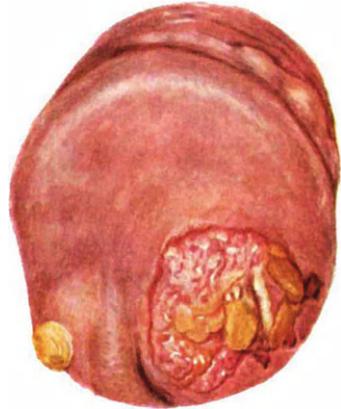


Fig. 162.—Hyperkeratosis of the glans penis with epitheliomatous change of the wart on the left of the meatus. Warty elevations had repeatedly formed on either side of the meatus for many years.

Treatment should consist of excision of the wart and its base, both on account of the inconvenience caused and because an epithelioma arising at the base of a cutaneous horn is a known danger (*Fig. 162*). A very similar example to that illustrated here has been reported by Goldstein.



Fig. 163.—Fibroma of the prepuce (Mr. Wilson's case).

3. Rare Tumours.—These include adenomata (probably of sebaceous origin), fibromata (*Fig. 163*), fibrolipomata (Gernon and McKenna), fibromyomata, and leiomyomata; fibromyomata of the prepuce have been studied by Delfino.

Other tumours which have been reported include keloids (Smith), angiomata of the glans of traumatic origin (Gibson), and also enchondroma of the corpus cavernosum, of which 1 example has been placed on record.

4. Venereal Warts (or Condylomata Acuminata).—Venereal warts are the common type of penile tumour and arise on the surface of the glans penis and deep aspect of the prepuce, more especially about the corona glandis.

Aetiology.—The warts may develop spontaneously in the presence of chronic irritation and infection, balanoposthitis, herpes of the glans, or gonorrhœa, especially if phimosis exists; more usually, being contagious, they are transmitted during coitus.

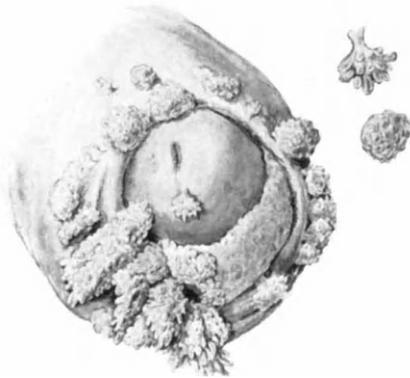


Fig. 164.—Venereal warts or acuminate condylomata.



Fig. 165.—Venereal warts of the meatus.

Pathology and Clinical Findings.—The tumours are simple papillomata, and when examined closely are seen to branch little if at all (Fig. 166); they are firm and do not bleed unless markedly inflamed and ulcerated, and the latter condition is unusual. A single wart may be found, but more often they are multiple and indeed may cover the whole glans. At times the wart is cauliflower-like, at others it is flattened and gives the appearance of a cock's-comb (Figs. 164–166).

Complications.—Balanoposthitis is often present, particularly when there is an associated phimosis; malignant changes may occur, and on rare occasions the warts extend to the urethra.

Diagnosis.—Papillary carcinoma, to which the wart may give origin, offers the one diagnostic difficulty, but when first seen the carcinoma usually has ulcerated, bleeds readily, and shows some induration of its base; the venereal wart neither ulcerates nor bleeds, except in the presence of acute infection.

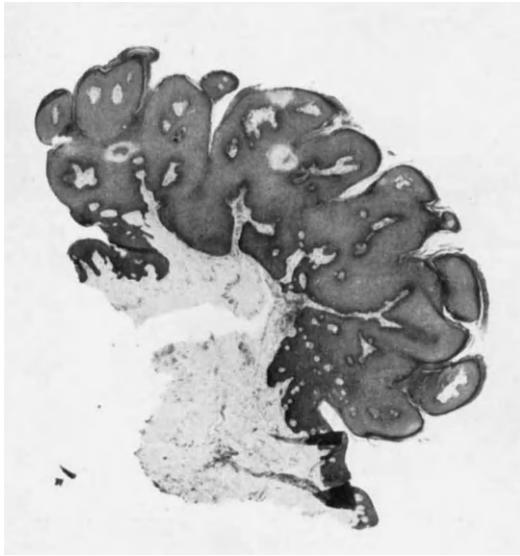


Fig. 166.—Section of a venereal wart.

Treatment.—Cauterization is the best treatment, and it may be carried out either by the customary caustic applications, of which one of the most satisfactory is trichloroacetic acid, or by the use of diathermy or the actual cautery. When warts are numerous a preliminary curettage is necessary, and under exceptional circumstances amputation of the penis may be indicated.

MALIGNANT TUMOURS

Epithelioma of the glans penis is the commonest penile tumour if the acuminate condyloma is excepted; sarcoma of the penis is rare and endothelioma rarer still.

EPITHELIOMA OF THE GLANS PENIS

Actiology.—Epithelioma of the glans penis and prepuce comprises from 1 to 3 per cent of all carcinomata and usually develops

between the ages of 40 and 60 years. A predisposing cause is chronic irritation, which may be provided by congenital phimosis, traumatism, or syphilitic lesions ; the disease is almost unknown in the circumcised (Travers, Wolbarst).

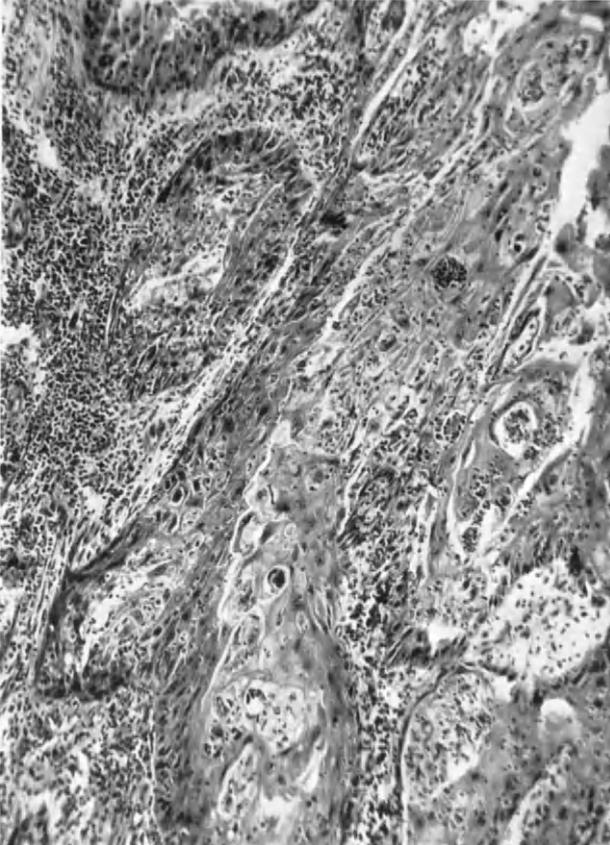


Fig. 167.—Photomicrograph of a section of an epithelioma of the glans penis. ($\times 100$.)

Pathology.—An epithelioma usually arises on the dorsum of the glans or its prepuce or perhaps on both ; rarely does it originate at the meatus or on the prepuce in this neighbourhood. When examined histologically the tumour as a rule is found to be a typical squamous carcinoma (*Fig. 167*), but a sebaceous carcinoma is sometimes encountered. On naked-eye examination there are two chief

types and two uncommon varieties: (1) Warty; (2) Ulcerous; (3) Epithelioma developing upon leukoplakia; and (4) Infiltrative.

1. *Warty or Papillary Epithelioma*.—This variety is said to be the most common. A cauliflower-like growth of the glans penis or prepuce occurs and sometimes there is a contact growth of the opposing surface (*Fig. 168*); only very rarely does the tumour develop on the superficial aspect of the prepuce. The condition may originate from a venereal wart. Ulceration with a foul sanious discharge soon occurs and the appearance is then typical. The base of the tumour is indurated, but infiltration does not take place readily and the tumour tends to grow superficially and sometimes to a large size.



Fig. 168.—Warty or papillary type of epithelioma of the glans penis. The tumour has fungated through the prepuce.

2. *Ulcerous Epithelioma*.—The ulcerative type is almost as common as the papillary. An erosion forms, the edges of which are indurated, and gradually and slowly the process of ulceration extends until a typical epitheliomatous ulcer develops which possesses indurated and rolled-over margins and an indurated base (*Fig. 169*). Extension occurs in the deeper tissues and this variety is characterized by its destructive changes.

3. *Leukoplakic Variety*.—A leukoplakic patch develops commonly in a patient with long-standing balanoposthitis, and this gradually thickens and ulcerates to become a definite epithelioma; congenital phimosis is usually present in these patients. Dubreuilh has written on genital leucokeratosis in man and has collected a number of case reports, whilst more recently Fukai has found records of 43 examples of this condition in the literature and has observed 6 cases himself.

4. *Infiltrative Variety of Epithelioma*.—In this uncommon variety a nodule forms and gradually the whole glans becomes infiltrated until it becomes a greyish deformed mass, perhaps of somewhat increased size (*Fig. 170*).

Course.—Extension of the neoplasm occurs along the erectile tissue and a considerable time elapses before the barrier of the tunica albuginea is passed, but thereafter spread is more rapid and

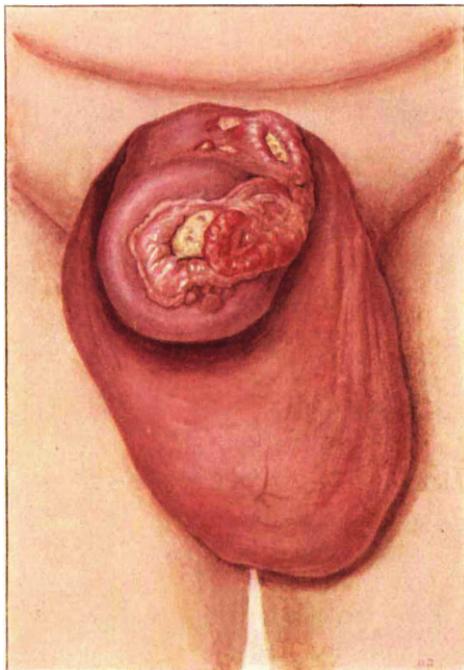


Fig. 169.—Ulcerative epithelioma of the glans penis and prepuce. The patient had suffered from venereal warts for fifteen years.

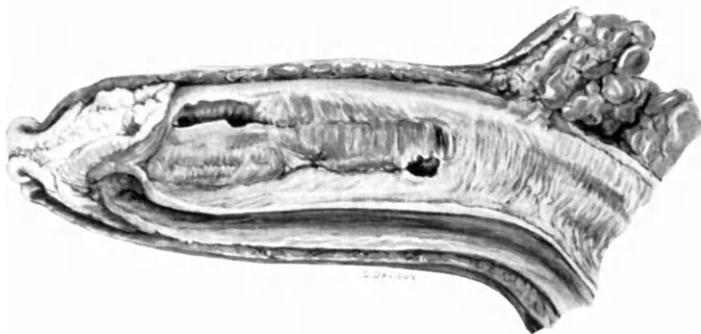


Fig. 170.—Infiltrative type of epithelioma of the glans penis. The glans has been completely infiltrated by the growth, which, fungating through the preputial orifice, has blocked the meatus so that micturition occurred through fistulae. The fistulae are visible as they traverse the corpora cavernosa penis.

the whole penis, scrotum, testes, prostate, and even bladder may become involved. Lymphatic extension also takes place and the inguinal glands become invaded; at times the infiltrated lymph-vessels are palpable along the dorsum of the penis. The frequency of involvement of the inguinal glands at the time when a patient is first seen, is a matter of debate. Frequently the glands are enlarged, not because of epitheliomatous invasion, but because of the associated infection which is so often a prominent feature. Barringer and Dean find that the glands are enlarged in 63 per cent of patients, but only actually invaded in 30 per cent; Barney puts these figures at 75 per cent and 60 per cent respectively. Le Roy des Barres found that the glands had been invaded in 51 per cent of patients. Like most cutaneous carcinomata spread beyond the regional lymph-nodes is not a marked feature, but the iliac glands may become involved and a number of indubitable instances of visceral deposit are on record. Barney remarks that when giving a prognosis, spread by the deep lymphatics must not be forgotten.

Symptoms and Clinical Findings.—Growth is slow and painless and therefore it is unusual to meet with these patients in the early stages of the disease. Consequently, when first seen, the penis often is greatly enlarged and a readily bleeding cauliflower-like mass



Fig. 171.—Epithelioma of the glans penis which has excavated the meatus and extended proximally along the urethra.

protrudes from the prepuce, or is exposed by a dorsal slit or circumcision; ulceration is present and is accompanied by a sanious and offensive discharge. Sometimes a typical epitheliomatous ulcer with hard everted edges is found, or a heavy enlarged glans with characteristic induration is discovered. The urethra commonly escapes, but in the unusual meatal variety (*Fig. 171*) it is excavated, ulcerated, and becomes irregularly funnel-shaped. Pain is a late symptom and appears with infection and ulceration, it is felt in the penis and also radiates to the groins and lumbar regions; it is

described as 'cutting', and is increased by contact of the urine with the ulcerated area. Micturition may be difficult and painful as noted above, and rarely retention occurs; even uræmia has been observed (Cope). Erection is always affected and usually becomes painful, but it is gradually suppressed as the disease progresses; nevertheless occasionally an almost continuous and painful priapism occurs. The sanious discharge may be the first sign of the disease if phimosis is present, and in the later stages this discharge becomes extremely fœtid. Severe hæmorrhage is uncommon, but may take place. General signs such as loss of weight and cachexia are unusually long delayed, and the duration of life also is unusually long, commonly three to four, but sometimes many, years. On the other hand Barringer states that few patients, even when treated, survive for longer than five years if the glands are invaded at the time of treatment.

Diagnosis.—The diagnosis is difficult when phimosis is present, and a dorsal slit or circumcision must be done if any suspicion of a neoplasm is aroused; nevertheless indurated irregularities beneath the prepuce and a fœtid discharge, together with enlarged glands in the groins, usually indicate the correct diagnosis. Venereal warts if infected are the principal cause of difficulty in diagnosis, or an epithelial horn, a gumma, a chancre, or granuloma inguinale may give rise to confusion, and necessitate the removal of a portion of the ulcer or swelling for microscopical examination.

Treatment.—The choice of procedure requires some discussion for it lies between: (1) Partial amputation of the penis, with or without excision of the glands of the groins; (2) Radical amputation of the penis, or sometimes emasculation, with or without removal of the glands of the groin; (3) Treatment of the neoplasm by irradiation, with or without excision of the glands.

1. *Partial Amputation.*—It is necessary to remember that when once the tunica albuginea has been penetrated, spread is rapid, but that the tunica forms a barrier which resists invasion for a considerable period. Furthermore, extension in the erectile tissue is not always in continuity, for it is possible to meet with distant and isolated nodules in the corpora cavernosa.

2. *Radical Amputation.*—This is curative as regards the local condition in the majority of patients, but is a mutilating procedure, so much so that it is necessary to consider whether emasculation is not also advisable.

3. *Treatment by Irradiation.*—In the early papillary type with but little induration of the base and before spread has occurred, cure is attainable by radium treatment (Dean), and it is valuable for any circumscribed growth; but with extensive involvement of the corpora it would appear useless.

Excision of the Inguinal Glands.—Published statistics indicate that the lymphatic glands are involved in some 30 to 60 per cent of patients when they are first seen, although enlarged in a greater percentage. It is therefore a matter of probability and of opinion which determines the advisability of their removal; it is improbable that natural cure by inflammatory fibrosis of definitely invaded glands ever occurs. In the presence of secondary infection treatment of the glands by irradiation is stated to be quite ineffective and, on the whole, it is not yet as effective as surgical removal (Dean).

Partial amputation without removal of the glands of both groins appears comparable to treatment by radium, but greater deformity results; on the other hand, radium therapy entails a longer stay in hospital and is more painful. The partial operation is also at times indicated for the palliative removal of an offensive mass or when radium is not available.

It would seem that the decision at present should lie between radical amputation or sometimes emasculation on the one hand, and irradiation on the other. Radium avoids or reduces mutilation, and the patient's age should be taken into consideration when coming to a decision on this point, but the risk of local recurrence is greater if the cavernous tissue is involved. The radical operation is curative at all times when radium is utilizable, and it is necessary if the disease is advanced. Both are best supplemented by excision of the inguinal glands in all save early growths of the non-infiltrative type (Colby and Smith). Doubtless, as progress is made, radiation therapy will gradually displace the radical operation, for penile carcinoma is especially well situated for its use, but at the present time complete amputation still holds its place as the most effective method of cure at our disposal.

The lymph-glands should always be removed in either method of treatment unless the surgeon is convinced of their freedom from invasion; their removal may be deferred for a month or two, but nevertheless when amputating it is best to excise them at the same time except when infection is prominent, for its presence is a definite contra-indication. Barringer considers that cancerous glands should

be treated either by irradiation and implantation of radon seeds through an incision and so under direct vision, or by irradiation according to the Coutard method and followed immediately by operative removal.

PSORIASIFORM CARCINOMA OR INTRA-EPIDERMAL CARCINOMA

(*Paget's Disease, Bowen's Disease, Erythroplasia of Queyrat*)

A number of examples of intra-epidermal carcinoma of the penis are on record, and Paget himself observed this condition of the glans penis. Susman has collected 7 cases; others have been



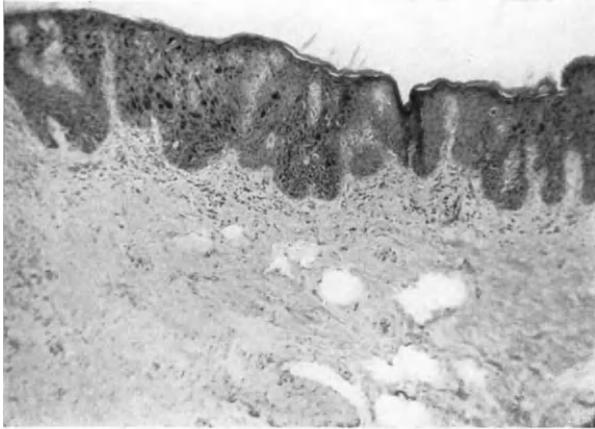
Fig. 172.—Psoriasiform or intra-epidermal carcinoma of the under-surface of the glans penis and prepuce (Dr. Savatard's case). Sections from this case appear in *Fig. 174*.



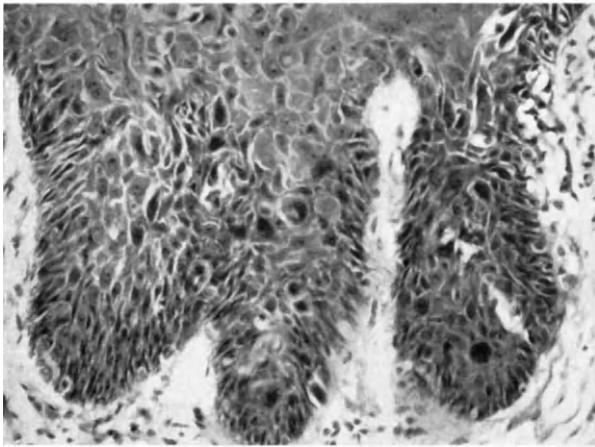
Fig. 173.—A penis showing both intra-epidermal carcinoma and epithelioma. On the body of the penis is seen the red raw area of Paget's disease, which had existed for a number of years. On the glans is seen a frank epithelioma, a change of comparatively recent development.

published by Yoshida and Funabashi, and also by Stiles, Sulzberger, and Satenstein under the title of erythroplasia of Queyrat; 2 more are illustrated here. After the nipple, the glans penis is the most frequent site of the disease (*Fig. 172*).

Pathology.—The appearances are distinctive and comparable to those of the nipple, for the epithelium becomes thickened, its interpapillary processes become irregular in form and depth, its



A



B

Fig. 174.—Photomicrograph of an intra-epidermal carcinoma of the glans penis.
A, Low-power view ($\times 48$); B, High-power view ($\times 224$).

cells are irregularly disposed and confused, presenting a variety of sizes and shapes, and their nuclei show variations in size, form, and staining powers, whilst mitoses are to be seen (*Fig. 174*). Vacuolated

cells are quite commonly present, but are not found invariably—these are the Paget cells originally described by Darier. A constant finding is a layer of plasma-celled and round-celled infiltration deep to the epidermis. Savatard has pointed out that the disease is from its initiation an intra-epidermal carcinoma. The malignant change may remain limited to the epidermis for long periods and even may regress, but eventually it breaks through at some point and becomes manifest as an epithelioma (*Figs. 173, 175*).

Clinical Findings and Symptoms.—Savatard describes the condition as psoriasiform carcinoma. Susman quotes as follows from Paget: “There is a florid, intensely red, raw surface, very finely granular, as if nearly the whole thickness of the epidermis was removed, like the surface of very acute eczema or like that of an acute balanitis . . . there was always clear, yellowish, viscid exudation. . . . The sensations were commonly tingling, itching, and burning, but the malady was never attended by disturbance of health. . . . The eruption has resisted all treatment, local and general.” He adds two features which aid in the differential diagnosis and distinguish it from eczema—first, sharp definition, and secondly slight induration—and observes that the condition is more easily mistaken for syphilis than vice versa, whilst balanitis is distinguished by its ready response to adequate treatment. Savatard reminds us of the fact that Paget himself wrote of psoriasiform as well as of eczematous appearances.

Treatment.—An epithelioma was already present or followed in at least four of the recorded cases and in the two illustrated here, while local applications appear to be without effect, as is to be expected if Savatard’s views are accepted. Radiation therapy has not given the satisfactory results which were expected, for although temporary improvement is brought about by X rays, relapse takes place, and although radium has given more promising results, and may be tried, amputation would seem to be the treatment of choice.

SARCOMA OF THE PENIS

Sarcoma of the penis is extremely uncommon (Galt). As with sarcomata elsewhere in the body the age incidence is earlier than that of carcinoma and it has been observed in childhood. The collected cases have been discussed by Joelson, Colmers, and Legueu.

Aetiology.—Injury has been noted as a probable predisposing factor.

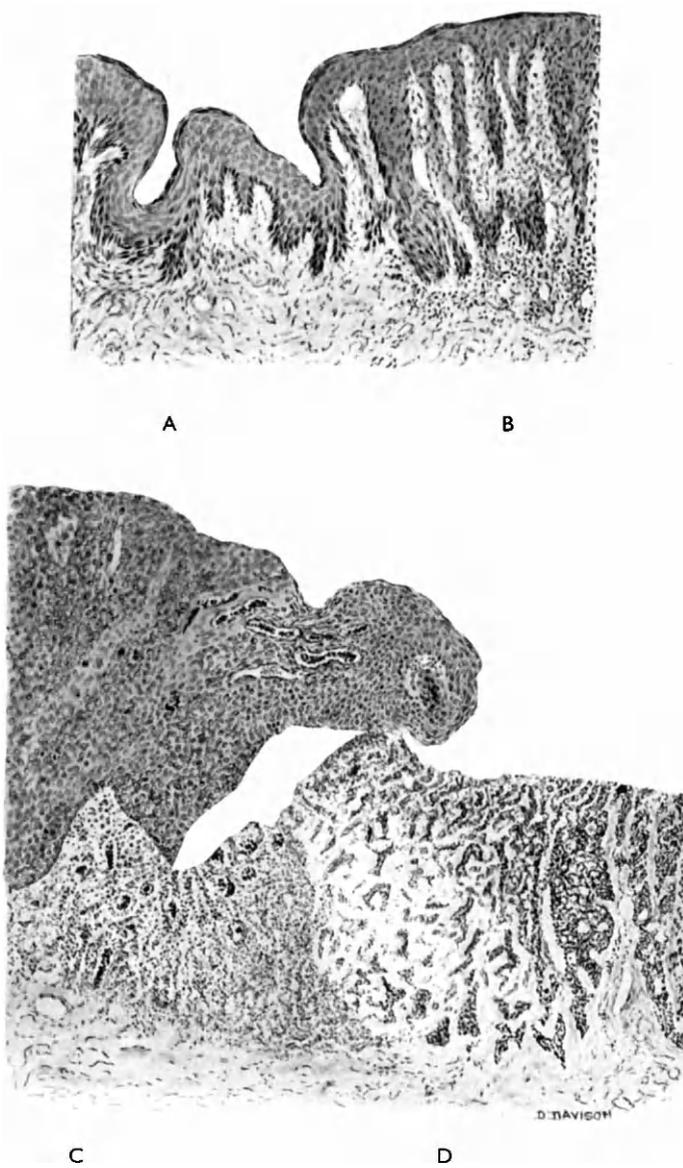


Fig. 175.—A drawing made from sections of *Fig. 173*. A, Normal skin passing into the area of intra-epidermal carcinoma (B); C, Intra-epidermal carcinoma passing into epithelioma (D).

Pathology.—A sarcoma may arise from the superficial tissues or from the corpora cavernosa and their sheath. Amongst the varieties observed have been round-celled, spindle-celled, melanotic, and leiomyosarcomata; a fibrosarcoma of the corpora cavernosa has been reported by Evans. Invasion of the regional lymphatic glands is an early event as a rule, except in Levi's case of leiomyosarcoma (Meller), and metastases to distant parts, especially the lungs, are common. Vintici and Alterescu state that up to 1933 36 examples of tumours arising from the corpora cavernosa were on record, and included only 16 or 17 sarcomata.

Clinical Findings and Symptoms.—The findings are similar to those of carcinoma and except in the melanotic variety it is unusual to make a diagnosis other than that of carcinoma prior to operation.

Prognosis.—The prognosis is exceedingly grave and but few cures have been claimed. The extensive and rapid glandular involvement and metastasis sufficiently account for this gloomy outlook.

Treatment.—The sole treatment worthy of consideration is emasculation or radical amputation of the penis together with excision of the lymphatic glands of both groins, combined perhaps with coincident deep X-ray therapy.

ENDOTHELIOMA

This neoplasm is said to be even rarer than sarcoma, and the recorded examples are studied in the papers of Colmers, Joelson, and Foulds and Ross. The tumour is presumed to arise from the endothelium of the vascular spaces of the erectile tissue. On examination a deeply situated mass is felt, firmly elastic and circumscribed, and not adherent to the skin. Of the recorded cases three were slow-growing and were submitted to operation, surviving for at least some period; four men suffered from rapidly extending tumours. The condition, on the whole would not appear to be of as great a degree of malignancy as sarcoma.

OPERATIONS ON THE PENIS

Partial Amputation of the Penis.—Amputation of the penis distal to the scrotum can be performed by elliptical incision or by flap operations.

1. *Amputation by Elliptical Incision* (Fig. 176).—The growth is carefully cleansed with antiseptic as a preliminary, and is covered by a swab wrung out of antiseptic lotion. The base of the penis is then surrounded by a tourniquet made from a piece of rubber tubing and, the site of amputation having been selected, the skin is drawn proximally and the incision begun on the dorsum of the penis. It is directed obliquely, proximally, and inferiorly, and encircles the penis; the corpora cavernosa penis and urethræ are exposed and the former are divided by incisions from the dorsal surface; it facilitates subsequent steps if the section of each is oblique

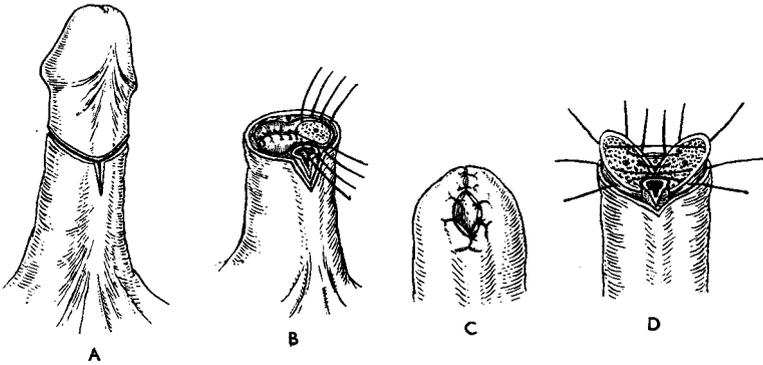


Fig. 176.—Local or partial amputation of the penis by elliptical incision. A, The incision of the skin; B, Suture of the cut ends of the corpora cavernosa penis—the urethra has been split proximally; C, The operation completed and the urethral margins stitched to the skin edges; D, Suture of the corpora cavernosa penis by the method of Kalliontzis.

so that the cut surfaces face towards one another (Kalliontzis). The corpus cavernosum urethræ is now dissected free in a distal direction for about half an inch and then cut obliquely from above, downwards and backwards. The dorsal arteries and vein and the arteries of the corpora cavernosa are ligatured. Sutures are inserted next from side to side through the tunica albuginea and corpora cavernosa penis, and their cut surfaces are drawn together, thus controlling bleeding; if the corpora have been divided transversely the edges of the tunica are approximated over their extremities. To complete the operation the urethra is split proximally for about one-third of an inch, the skin margins are sutured together in the sagittal plane, the dorsal sutures should pass sufficiently deeply to include the tunica albuginea, and the corpus cavernosum urethræ with the urethral mucosa is then sutured to the skin.

2. *Amputation Utilizing a Flap.*—Either a long dorsal or a long ventral flap may be used; the latter is probably preferable, for the urethral orifice is farther removed from the wound by this method.

Long ventral flap (Fig. 177):

The flap marked out is equal in length to the diameter of the penis and in width to half of the circumference; a short dorsal flap three-quarters of an inch in length is also made. The flaps having been dissected back, the corpora cavernosa are cut transversely, hæmostasis is attended to, and the tunica sutured over their ends; the urethra is, as in the preceding method, dissected forwards and cut across about half an inch beyond the cut corpora cavernosa. The ventral flap is then punctured and the

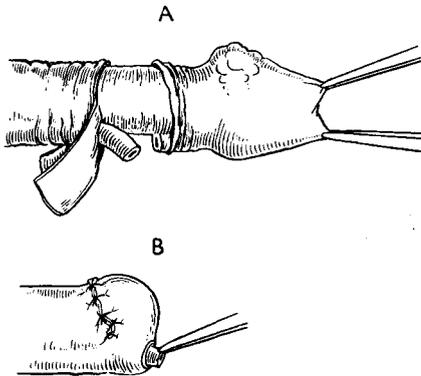


Fig. 177.—Local amputation of the penis by means of a long ventral flap. A, The flap has been made and the divided urethra drawn through a perforation in it; B, The operation approaching completion.

projecting urethra drawn through the orifice thus made; the skin edges are sutured and, the urethra having been split, its margins are sewn to the edges of the punctured wound.

Amputation utilizing a *long dorsal flap* is illustrated in Fig. 178.

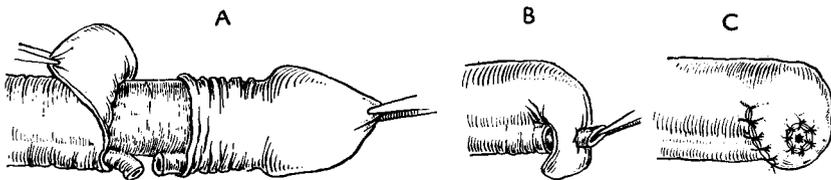


Fig. 178.—Local amputation of the penis using a long dorsal flap. A, The flap has been made and the urethra divided; B, C, Completion of the operation.

Complete Extirpation or Radical Amputation of the Penis (Fig. 179).—The entire penis and the glands in both groins are removed *en bloc*.

First Stage.—The patient at first lies on his back. The growth is disinfected with tincture of iodine or other suitable antiseptic, and is securely covered by a swab wrung out in antiseptic lotion. A skin incision is made following the fold of the groin on either side

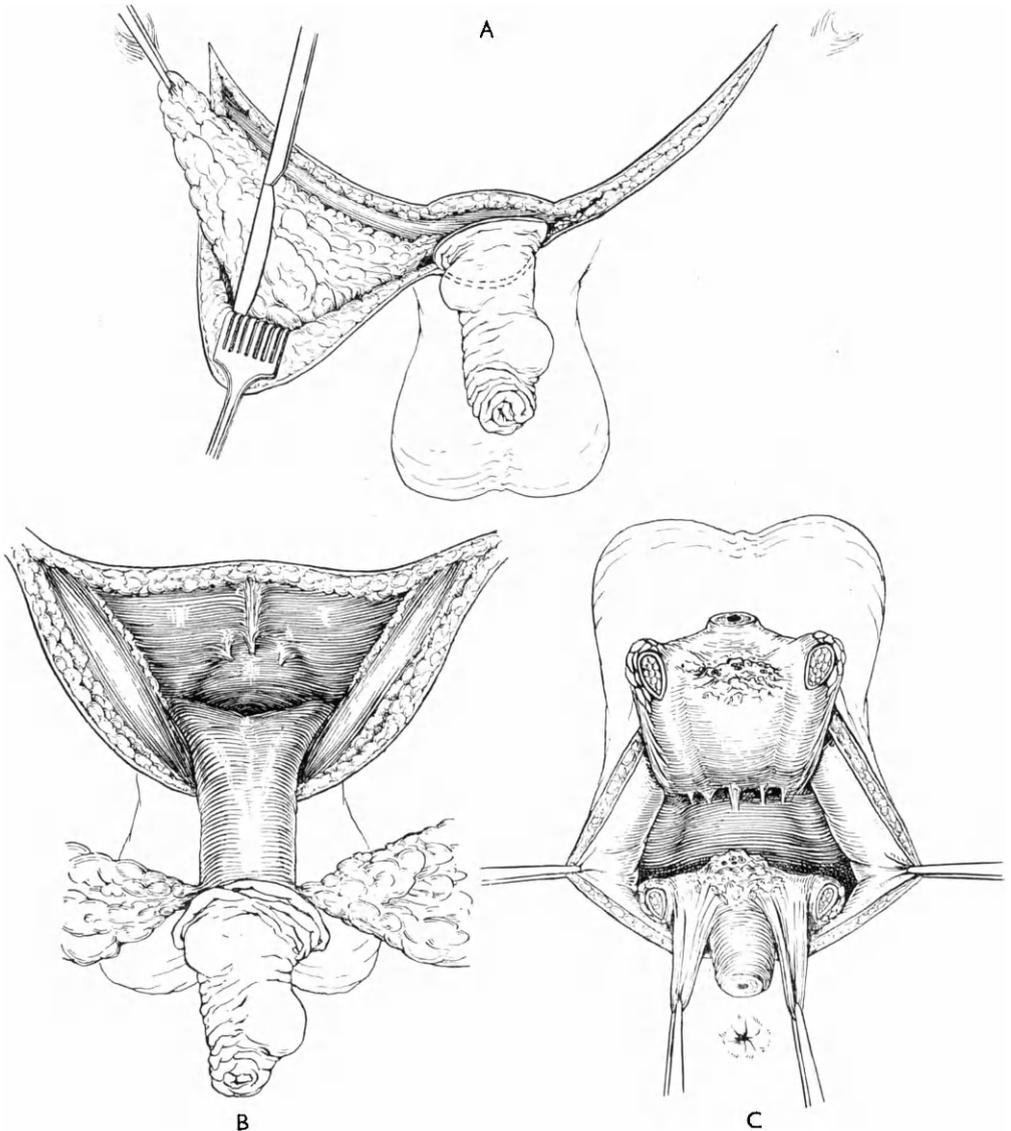


Fig. 179.—Radical amputation of the penis. **A**, The incision for the first stage, and, on the right side, clearance of the contents of Scarpa's triangle. **B**, Completion of the first stage. The penis has been freed rather farther than the point of convergence of the crura. The groin incisions have been closed. The masses of fat and glands from Scarpa's triangles are attached to the penis. **C**, The second or perineal stage. The crura have been cut across close to the ischial rami. The corpus cavernosum urethrae has been divided about one inch from the urogenital diaphragm. The freed root of the penis has been turned forwards to be removed through the superior incision. The vessels are visible as they pierce the urogenital diaphragm in front of the urethral stump.

from one anterior superior iliac spine to the other and in the midline dividing to surround the penis at the penoscrotal junction; many superficial vessels require ligature. The skin and superficial fascia overlying the inguinal glands are dissected up and, commencing laterally, the glands and surrounding connective tissue are separated carefully from the fascia lata towards the penis, the ligation of numerous vessels being necessary; when the femoral ring is reached search is made for the gland of Rosenmüller lying within it. This procedure having been accomplished on both sides, the penis is freed backwards to the point where the crura and corpus cavernosum urethræ diverge, the suspensory ligament being divided. The wound is now protected with sterile swabs and the second stage commenced.

Second Stage.—The patient is placed in the exaggerated lithotomy position, with shoulder rests and pelvic grip. The scrotum is drawn upwards and an incision made in the midline from a point immediately posterior to the scrotum to within three-quarters of an inch of the anus. This incision is deepened until the bulbocavernosus muscle is seen and the muscle is split in the sagittal plane and the bulb exposed. The bulbous urethra is now cut across about one inch anterior to the bulb and the proximal or posterior portion is freed as far back as the superficial fascia of the urogenital diaphragm and then temporarily laid aside. Each crus now is exposed and each ischiocavernosus muscle divided, and the crura are detached from the margins of the pubic arch with chisel or rugine. When almost detached the apex of each crus, which includes the artery to the crus, is crushed, ligatured, and divided. The remaining attachments of the root of the penis are cut and the dorsal vein secured and ligatured immediately below the pubic arch. The penis is then free and is drawn upwards through the primary wound anterior to the scrotum and removed together with the mass of glands. Hæmostasis having been secured, the stump of the bulbous urethra is brought to the surface midway between anus and scrotum, and made to protrude a short distance before being sutured to the skin. The cutaneous wounds are closed with interrupted sutures and small drains may be inserted in each inguinal region. A catheter can be left in the bladder for two to three days in order to prevent contact of the urine with the wound.

Radical Extirpation of the Penis together with Emasculation (*Fig. 180*).—Inguinal incisions are made as described for the previous

operation, and join in the midline proximal to the penis. The glandular dissection is similar to that previously described. Incisions are then made surrounding the scrotum, each of which commences

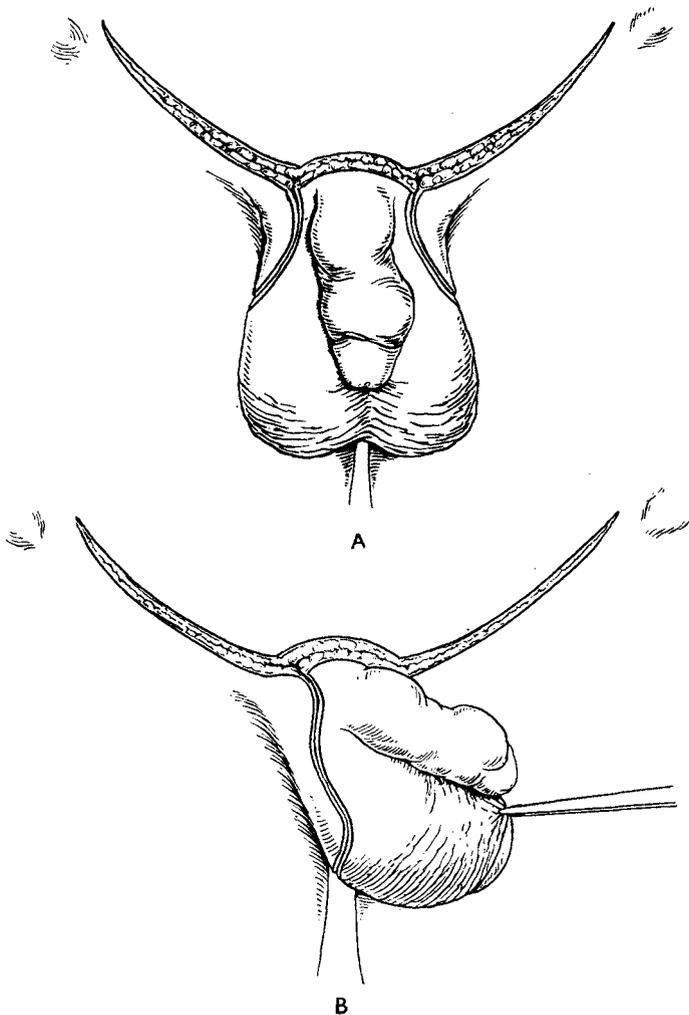


Fig. 180.—Emasculation. The incision is illustrated from in front (A) and from the right anterolateral aspect (B).

superiorly in an incision over the superficial inguinal ring and is carried downwards into the perineum along each side of the scrotum to meet its fellow immediately behind. These extend sufficiently

far on to the scrotum to leave enough skin to close the wound. A prolongation in the midline carries the wound to within three-quarters of an inch of the anus. The spermatic cords are exposed and their constituents ligatured and divided, and the surgeon then proceeds to free the root of the penis: the suspensory ligament is cut, the dorsal vein ligatured, the crura separated and their arteries secured, and finally the bulbous urethra is divided one inch from the urogenital diaphragm. Hæmostasis is effected and the urethral stump brought to the surface, its mucosa being sutured to the skin. The remainder of the wound is closed, drainage usually being provided.

Comments.—

Partial Amputation: Hæmatoma formation is a not uncommon complication, and an endeavour may be made to avoid this by careful suture of the tunica albuginea, by suture of the skin to the tunica, and by loose closure of the wound. A long ventral flap prevents soiling of the wound with urine.

Radical Amputation: The operation described is based on that of Pearce Gould, but follows Taylor in that the scrotum is not split and in the simultaneous excision of the penis and inguinal glands. Excision of the lymphatic glands is, on theoretical grounds, best performed at the same time as the penis is removed, for the whole lymphatic field is thus cleared; nevertheless, sepsis is a definite contra-indication to the procedure, and in its presence the removal of the glands should be deferred until a later date. When clearing the glands of the groin the incision may be Y-shaped, the stem of the Y pointing to the apex of Scarpa's triangle (Le Roy des Barres). A common complication of their removal is that the skin overlying Scarpa's triangle sloughs owing to the unavoidable damage to its blood-supply: this is sometimes given as a reason for deferring the glandular removal until the penile and perineal wounds have healed.

Young has described an operation for epithelioma of the glans penis which corresponds closely to the first stage of the radical operation described above. The lymphatic-field clearance extends on to the lower abdominal wall and clears the lymphatic confluence in front of the os pubis, then the penis is cut across immediately anterior to the penoscrotal junction as in a partial amputation; the urinary orifice is therefore anterior to the scrotum, and micturition more natural. A catheter is not a necessity after these operations except when the urine is infected.

Emasculation : This operation was first performed by Annandale and proved valuable in Morison's hands ; it is required if the growth is extensive and spreading towards the scrotum, and it is preferred to the radical amputation by various Continental surgeons for the reasons summed up by Montaz and quoted by Legueu that " les testicules ne sont plus desormais que les temoins muets et tristes d'une fonction à jamais abolie ".

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CHAPTER XVI

PRIAPISM

THE term priapism connotes a state of persistent erection of the penis unassociated with erotic sensation or ejaculation and unrelieved by coitus. Pain is a marked feature of the condition in the majority of patients. It is to be distinguished from chronic intermittent priapism, which is discussed later.

Actiology.—A normal erection of the penis is the result of reflex action and the centre for the reflex is situated in the lumbosacral cord. The afferent path is either along the sensory nerves of the glans penis, urethra, and related organs, for example the prostate, or it passes through the nerves of the special senses and is part of a psychic reflex; sometimes, however, the stimulus may originate from the sensory nerves of distant areas. The efferent impulses pass to the hypogastric ganglion through the nerves of the autonomic system which are derived from the *nervi erigentes* (parasympathetic) and hypogastric nerves (sympathetic). The function of this reflex is to cause engorgement of the cavernous tissue with blood and consequent erection of the penis, but the exact means by which this is brought about is not clearly understood. Erection occurs normally under one of two conditions, either in association with sexual desire and coitus, or in relation to a full bladder when inhibition has become relaxed, as during sleep.

Priapism therefore must be the result either of nervous stimuli, or of purely local and mechanical causes which interfere with the vascular system of the penis.

The following comprehensive classification is slightly modified from Scheuer :—

I. Peripheral Causes.—

A. Reflex :

1. Inflammatory and irritative states of the urethra and its glands—
e.g., acute urethritis.
2. New growths of the anterior or posterior urethra.

B. Mechanical :

1. Spread of disease from the urethra into the cavernous tissue.
2. Independent local disease of the penis :
 - a. Inflammatory—e.g., cavernositis.
 - b. Neoplastic.
 - c. Traumatic—e.g., hæmatoma.

*II. Central Causes.—**A. Organic Disease of the Brain or Spinal Cord :*

1. Traumatic—e.g., paraplegia.
2. Neoplastic.
3. Inflammatory—e.g., encephalitis.

*B. Functional Disturbance of the Brain or Spinal Cord.**III. General Diseases Causing Priapism.—**A. Peripheral :*

1. Infectious diseases—e.g., syphilis, tabes dorsalis.
2. Intoxications.
3. Constitutional and blood diseases—e.g., arteriosclerosis, myeloid leukæmia.

B. Central :

Intoxications.

Pathology.—It can be understood clearly how a local mechanical cause such as a neoplasm, cavernositis, or thrombosis may result in prolonged erection, but why a reflex erection should persist is not clear in view of our knowledge of nervous fatigue. Ward held that if the corpus cavernosum urethræ escapes then the cause cannot be of nervous origin, and he with Morson distinguishes priapism in which the whole organ is involved from thrombosis of the corpora cavernosa penis in which the corpus cavernosum urethræ escapes. Nevertheless in some spinal cord lesions erection of the corpora cavernosa penis alone has occurred in association with spasm of the ischiocavernosi muscles (Hinman).

A very general explanation of the condition which is given is that it is the result of thrombosis, some holding that this is primary and others that it is secondary to prolonged stasis. McKay and Colston find that if erection has persisted for two days or more, thrombosis has occurred in the vascular spaces of the corpora cavernosa; on the other hand, Legueu has asserted that thrombosis does not occur and that the corpora contain a thick syrupy and blackish blood. Twenty-five per cent of all cases occur in leukæmic patients, and, as hæmorrhages are prone to occur in this disease, it has been suggested that local hæmatomata may be the cause of the priapism.

Incidence.—The condition is encountered during the age of sexual activity, from 20 to 50 years. Hinman collected 170 cases from the literature in 1914, McKay and Colston added 22 in 1928, and Berkey 3 more in the same year.

Clinical Findings.—The onset of priapism is as a rule abrupt and usually the corpora cavernosa penis alone are involved; nevertheless, the corpus cavernosum urethræ and glans may take part. The organ may be fully erect against the abdomen (*Fig. 181*), or



Fig. 181.—Priapism. The figure is drawn from an illustration of McKay and Colston's.

may be in a state of semi-erection, projecting at an angle of 45° to 90° to the abdominal wall. Pain is present almost invariably and varies in intensity from discomfort to extreme and intolerable agony, and the latter is the more usual. Micturition may or may not be affected; Legueu states that nothing more than a little straining is caused, but Berkey observed that in many patients great pain and difficulty of micturition are experienced. It would seem that its effects on micturition vary (Hinman). Loss of sexual desire is usual. The condition tends to subside gradually, but may persist for months and has continued for years. After subsidence the sexual function is gradually restored in the great majority of patients.

Treatment.—The treatment of such local causes as neoplasms and cavernositis has been considered elsewhere, and it is the priapism of nervous origin or that due to constitutional disease which remains to be discussed. Treatment is on the whole unsatisfactory, and this is largely due to our ignorance of, or to our inability to cure, the causative disease—for example, leukæmia and certain lesions of the central nervous system. Various local measures may be adopted in an attempt to give relief: hydrotherapy, radiotherapy, especially for the priapism of leukæmia, diathermy (Riches), and certain surgical procedures.

A number of operative measures have been tried. Pryce recommends incision and evacuation of the corpora cavernosa, one of which is incised on its dorsolateral aspect and the contents of both squeezed out; the immediate results are good, but frequently the power of

erection is abolished thereafter. Callaway had performed this operation in 1824, incising one crus. Other operations include ligature of the dorsal arteries, division of the ischiocavernosi muscles, ligature of the arteries entering the crura, and section or injection of the pudic nerves, but with any of these procedures the power of future erection is almost certainly abolished. McKay and Colston have successfully substituted aspiration and lavage for incision of the corpora. Under local anæsthesia a large-bore needle is inserted into one corpus and the contents of both then aspirated, for intercommunication is free ; they are finally washed out with saline solution. This procedure is capable of repetition, and retention of the power of erection is said to be more probable.

CHRONIC INTERMITTENT PRIAPISM

Chronic intermittent priapism (nocturnal priapism—Marion, Raichline) is characterized by repeated and sometimes prolonged erections but is to be distinguished from the persistent variety described above. These intermittent attacks are nocturnal and again are unassociated with sexual desire. Although the patient himself often succeeds in obtaining relief by various means, insomnia eventually affects the general health. The condition may recur over a period of years and finally lead to impotence. Huhner reported 6 examples in 1930.

Actiology.—The basic cause is a nerve irritation, which may be due either to local reflexes arising from lesions of the posterior urethra, prostate, or seminal vesicles, or to lesions of the central nervous system. In certain patients, however, neurosis may be the determining factor.

Diagnosis.—A thorough investigation of the genito-urinary tract and of the central nervous system is essential before a diagnosis of neurosis is made.

Treatment.—Should a lesion of the urethra or genital organs be found, treatment is directed to this ; if disease of the spinal cord is discovered some palliative measures may be possible, but when due to neurosis little can be done. Sexual excitement must be avoided, locally cold sponging is useful, and drugs which may be administered include the bromides and chloral hydrate. Huhner obtained good results by epidural injections of novocain in saline in two patients in whom the priapism was of obscure aetiology.

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