

extend, in the direction of the rectum, into the ischio-rectal fossa. It first invades the penis, but does not remain confined there for a long time; it extends to the scrotum, escapes from the chamber on a level with the suspensory ligament, and reaches the pubes and the walls of the abdomen, which are sometimes undermined in their totality.

In this compartment, also, urinary tumors and urinary abscesses are developed, which are so often the consequence of strictures of the urethra. This accident should be carefully distinguished from infiltration of urine. The latter takes place suddenly in consequence of rupture of the urethra; the urine immediately invades the inferior chamber without any obstacle to its passage, passes beyond its limits, extends to a distance, and causes mortification of the tissues wherever it extends.

Urinary abscesses and tumors occur in quite a different way. The inflammation of the urethra, which always exists behind a stricture, extends slowly to the neighboring tissues. There is thus gradually formed on the inferior wall of the canal, a nodule, varying in size (possibly as large as a large hen's egg), and of extreme hardness. This is a urinary tumor. These tumors are also immovable, and in case they fill the space between the two ischia, no line of demarcation separates them from the osseous walls. They occupy exactly the median line, which serves to distinguish them from chronic inflammation of one of Cowper's glands.

If the urethra breaks after this preparatory work has taken place, the urine finds before it an insurmountable barrier and cannot become infiltrated; then we have a urinary abscess.

If pus forms within this indurated mass, its envelope is so thick and resistant, that we can never feel fluctuation at the outset. These abscesses should be opened early, for fear that the envelope may become perforated and urinary infiltration follow. It is often necessary to cut through several centimeters of indurated tissue before reaching the cavity.

SUPERIOR OR PROSTATIC CHAMBER.—The prostate is circumscribed by a series of aponeurotic planes which isolate it on all sides. They are above and in front, the pubio-vesical ligaments or tendons of the vesical muscle, which run into the pelvic fascia; behind and below, the prostato-peritoneal fascia and the superior layer of the triangular ligament; on the sides, the lateral aponeurosis of the prostate.

The *pubio-vesical ligaments* are very resistant, but they do not form a continuous plane. Between their fibres exist spaces traversed by large veins coming from the penis; the urine may follow the same road, and infiltration is then the more easy, since, in front of the ligaments, exists a layer of lax pre-vesical cellular tissue.

The prostato-peritoneal aponeurosis (Fig. 51, *n*) extends from the cul-de-sac of the peritonæum to the posterior edge of the triangular ligament. It is continuous below with the superior layer of this liga-

ment, just as the superficial fascia is continuous with the inferior. Its adherence with the peritonæum prevents this membrane from ascending into the pelvic cavity as the bladder becomes distended, and, on the contrary, makes it form a very deep cul-de-sac. It covers all the posterior surface of the prostate, which it thus separates from the rectum. But this layer, composed almost exclusively of smooth muscular fibres, generally presents only feeble resistance. It is easily destroyed and perforated by pus, as, for instance, in suppurative prostatitis, and thus a urethro-rectal fistula may form.

It is evident that, if the posterior wall of the prostatic chamber gives way, before any barrier has been formed against infiltration, the urine at once extends into the anal portion of the perinæum, invades the ischio-rectal fossa, completely isolates the rectum, and extends upwards into the pelvic cavity. The penis, the scrotum, and the abdominal wall are absolutely intact. This dangerous form of infiltration is insidious, and at the outset often recognized with difficulty. It is happily rare, and follows most frequently false passages in the prostatic urethra in persons with a middle lobe so enlarged as to obstruct the entrance of a catheter.

The *lateral aponeurosis* completes the prostatic chamber. It is a fibrous plane nearly quadrilateral, placed directly on each side of the prostate in such a manner as to present an internal and an external face, a superior and an inferior border. It extends from before backwards, from the pubis, where it is continuous with the pubio-prostatic ligaments and the triangular ligament, to the rectum, to the lateral walls of which it is attached, whence the name of *pubio-rectal*, which has been given it. From above downwards, it occupies the space comprised between the superior perineal fascia and the prostato-peritoneal aponeurosis, to which it is attached. Besides the prostate, the prostatic chamber contains Wilson's muscle, and especially a large number of veins.

It is very exceptional to find that the lateral aponeuroses of the prostate give way in consequence of organic lesions of the urethra, or the violent use of a catheter; but they are readily cut in the operation of lithotomy, especially in the lateral operation. This condition is favorable to infiltration of urine, which then takes place in the anal portion of the perinæum; and the subperitoneal cellular tissue is likewise invaded.

The perinæum, as we have said, is divided into two distinct portions; one anterior, the genito-urinary; the other posterior, the recto-anal. This division is justified by the course of infiltrations of urine. Two great forms of infiltration may occur; one has for its starting-point the portion of the urethra included in the penile or inferior chamber, when the urine invades the penis, the scrotum, and, if not arrested in time, the abdominal wall; the other proceeds from the part of the canal inclosed in the superior or prostatic chamber; the urine extends into the rectal portion of the perinæum, fills the ischio-

rectal fossa, gains the pelvic and often the abdominal cavity. This is in accordance with fact and with our knowledge of anatomy.

Dimensions, Mobility, and Direction of the Urethra.—Having considered the separate portions of the urethra and the various tissues which surround it, we may now regard it as a unit; and more especially with reference to the size and form of instruments required in the treatment of stricture.

The statements of authors relative to the length of the male urethra represent it to be from five and a half to twelve inches. This discrepancy may be accounted for by the different methods employed in taking measurements; whether upon the living or dead subject; by the amount of traction exercised upon the parts; and, also, to a certain extent, by an actual variation in different persons. The size of the penis appears to have no influence upon the length of the urethra; the latter, as shown by Sappey's observations,¹ often being in an inverse ratio to the former. The greatest source of variation is found in the length of the anterior or ascending portion of the subpubic curvature. Without seeking for any absolute standard, it is desirable to obtain an average which may assist in determining the situation of strictures, and afford useful information in their treatment; and after all that has been said by authors of the variable length of the urethra in different individuals, the results of measurements are found to be nearly identical, provided the method of making them be always the same.

The length of the urethra may be estimated during life by means of a graduated catheter, the flow of urine indicating when the eye near its point has reached the vesical extremity of the canal, and care being taken that the penis is not stretched upon the instrument. After death, the urethra and bladder may be removed from the body, slit open superiorly, gently extended upon some smooth surface, allowed to contract by their own elasticity, and then measured with a tape. Attempts have also been made to ascertain the length of the urethra by casts of the canal in fusible metal; but the two methods just mentioned are far more reliable.

According to the careful and minute observations of Mr. Thompson and Mr. Briggs, the results of measurements thus taken during life and after death are not identical; by the former, the average length is found to be seven and one-half inches;² by the latter, eight and one-half. This difference is constant, and may be readily accounted for by the different conditions under which the measurements are taken. It is worthy of remembrance, "since all accurate researches into the pathological anatomy of stricture are, of necessity, confined to an observation of the parts *after death*, while, in relation to treat-

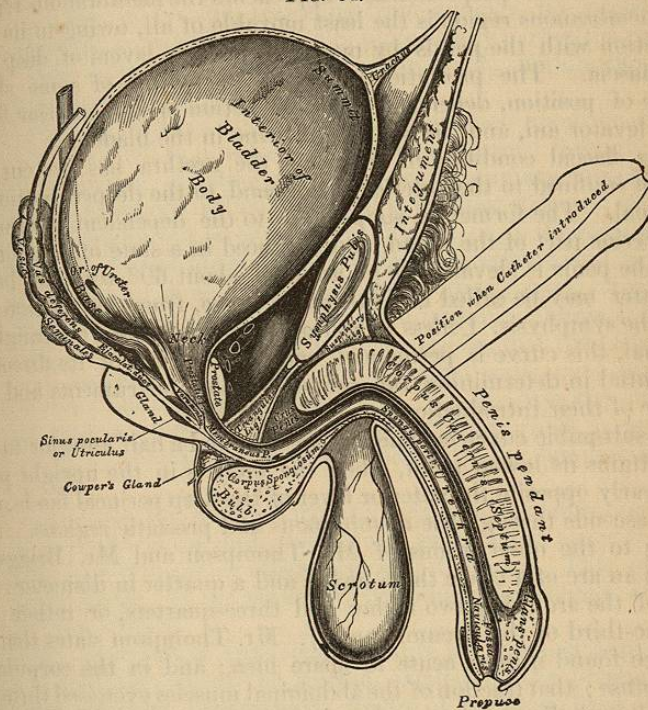
¹ Recherches sur la conformation extérieure et la structure de l'urètre de l'homme, Paris, 1854.

² Leroy d'Etiolles obtained an average of eight inches from one hundred measurements during life, by means of a graduated gum-elastic sound. (*Des rétrécissement de l'urètre, etc.*, Paris, p. 5.)

ment, the measurement *during life* is that which alone must be remembered."¹

The urethra cannot be said to have any fixed and absolute diameter, since its walls admit of greater or less expansion, according to the amount of force exerted upon them. A No. 12 catheter or sound of the English scale rarely fails to pass with ease, if the parts be healthy, and not unfrequently No. 15 will pass without difficulty.

FIG. 54.



Vertical section of bladder, penis, and urethra. (After Gray.)

It is more important to be familiar with the relative than with the actual diameters of the different portions of the canal. The external orifice or meatus is almost invariably the most contracted part; so that whatever instrument fairly enters the urethra will pass through it, if no obstruction exists. Another important inference from this fact is, that, to restore to its original calibre by dilatation one of the deeper portions of the urethra contracted by stricture, the meatus must be enlarged, which can generally be effected only by incision. The next narrowest point of the canal is at the junction of the bulbous and membranous regions, while the middle of the prostatic portion and the sinus of the bulb are the widest.

¹ Thompson, op. cit., p. 4.

The degree of *mobility* of different portions of the urethra is chiefly influenced by the attachments of the neighboring fasciæ. The anterior part of the penis is free, and capable, in a flaccid condition, of assuming almost any position; in its posterior third, however, this organ is connected with the symphysis, by means of the suspensory ligament; with the ischiatic and pubic rami, by the crura of the corpora cavernosa, and with the anterior layer of the deep perineal fascia, by means of the bulb; the spongy urethra may, therefore, be said to be fixed in proportion as it approaches the membranous region. The membranous region is the least movable of all, owing to its firm connection with the pelvis by means of the two layers of deep perineal fascia. The prostatic urethra is susceptible of some slight change of position, dependent upon the action of the anterior fibres of the levator ani, and the amount of urine in the bladder.

In a flaccid condition of the penis, the urethra has two curves: the first confined to the anterior, the second to the deeper portion of the canal. The former is simply due to the dependent position of the anterior part of the organ, and is effaced in a state of erection or when the penis is elevated to an angle of about 60° with the body. The latter may be called the sub-pubic curve, from its position beneath the symphysis. Unless some degree of force be used to straighten the canal, this curve is permanent, and a knowledge of its direction is essential in determining the proper form of instruments and the manner of their introduction.

The sub-pubic curve commences an inch and a half anterior to the bulb, attains its lowest point, when the body is in the upright position, nearly opposite the anterior layer of the deep perineal fascia, and finally ascends through the membranous and prostatic regions. According to the observations of Mr. Thompson and Mr. Briggs, it "forms an arc of a circle three inches and a quarter in diameter; the chord of the arc being two inches and three-quarters, or rather less than one-third of the circumference." Mr. Thompson states that he has often found it more acute in spare men; and in the corpulent, more obtuse; that traction of the abdominal muscles exercised through the suspensory ligament may also render it more abrupt, whence the advantage of raising the shoulders when performing catheterization upon patients in the recumbent posture. The elevation of the bladder above the pubes in children, and the enlargement of the prostate so common in old men, also effect a change in the direction of the sub-pubic curve from its usual adult standard, and require therefore a corresponding variation in the form of instruments. Swellings and abscesses about the lower extremity of the rectum, large hæmorrhoidal tumors, and various other circumstances may also operate in a greater or less degree to cause some change in the direction of this curve.

STRICTURES.

Strictures may be briefly classified as SPASMODIC and PERMANENT or ORGANIC.

SPASMODIC STRICTURE.—The chief element of a spasmodic stricture is *muscular spasm*, with which is usually associated more or less *congestion*. Either of these may exist alone; commonly both are combined.

Many of the older writers on venereal diseases, as Charles Bell, denied the influence of spasm, except perhaps in the membranous region, to which their knowledge of any muscular tissue surrounding the urethra was mainly confined. The subsequent discovery by Kölliker and Hancock of organic muscular fibres about the canal has shown the possibility, and, reasoning from analogy, the probability, that spasmodic contraction may take place in any part of the urethra, where these fibres are circular; in other words, within the limits already defined. (See page 278.)

The exciting cause of spasm is some impression upon the sentient nerves, transmitted to a nervous centre, and returned through motor fibres, terminating in either voluntary or involuntary muscles. In the urethra, spasmodic action, sufficient to produce stricture, may take place in the submucous layer of organic fibres; or, in the membranous region, in the striped fibres of the compressor urethræ; and, *perhaps*, to a less extent, in those of the acceleratores in the spongy region.

While performing catheterization upon irritable subjects, it has occasionally been observed by nearly every surgeon, that the instrument is grasped and temporarily held by the urethral walls, even when the canal is free from permanent obstruction. In this case, the sound, or catheter, acts as a foreign body, and the irritation which it produces is followed by contraction in accordance with the familiar laws of reflex action.

In other cases, the eccentric irritation is caused by laceration, abrasion, or a wound of the lining membrane, such as may ensue from the rough use of a catheter, or other surgical instrument. This, of itself, may excite spasm; or the same may be induced by contact of urine with the raw surface.

Striking examples of spasmodic stricture are also met with as the result of irritation about the rectum, excited by the presence of a tapeworm, ascarides, hæmorrhoids, fissure of the anus, fecal accumulation; or by operations upon this part, especially the ligature of piles. Sir Benjamin Brodie¹ met with a case of spasmodic stricture, in which the spasm was intermittent, recurring every twenty-four or forty-eight hours, and which was finally cured by quinine after the failure of other means.

Among other causes of spasm, are the presence of a stone in the bladder, or urethra; organic stricture of this canal; immoderate sexual intercourse; the free use of alcoholic stimulants; long retention of the urine; horseback exercise; digestive derangements; exposure to sudden changes of temperature, and mental emotion.

A spasmodic stricture is characterized by its short duration. It

¹ Lond. M. Gaz., vol. i., p. 507.

appears suddenly in persons of delicate habit, especially in those who have committed some imprudence in diet, and as suddenly disappears. Exploration of the canal by means of a sound after the spasm has passed, and frequently during its continuance, shows that there is no organic obstruction. Mr. Smith¹ details a case in which a patient, who had suffered from a violent attack of retention a short time before, suddenly died; and, at the post-mortem examination, not the slightest contraction was found.

Prof. Otis believes that a spasmodic stricture due to reflex irritation may exist continuously for years, even fifteen or twenty years, during which time it is nearly or wholly impassable to any instrument, although at any moment it may be made to entirely disappear by the removal of the source of irritation. He says: "Deep organic urethral stricture is often simulated by muscular spasm, the result of irritation caused by slight anterior strictures, even by a slight contraction of the meatus urinarius alone. *The great proportion of cases treated by gradual dilatation are treated for deep stricture which does not exist.*"² (The italics are in the original.) So far as I know, such long-continued spasm is never met with in other muscular tissues. Moreover, I believe that any spasmodic stricture can be passed with patience and suitable instruments, and until I meet with a case of the kind described by Dr. Otis, as I never yet have done, I cannot admit of spasm lasting through years.

I shall presently have occasion, when speaking of the seat of strictures, to mention Verneuil's views regarding spasmodic stricture at the bulbo-membranous junction, which are of interest in this connection, and are quite similar to those recently set forth by Dr. Otis.

In the great majority of cases which come under the observation of the surgeon, inflammation and spasm are combined, and to these is added some degree of permanent contraction. A patient has an organic stricture which has given him but little annoyance, and offered no serious obstacle to the complete evacuation of the bladder; suddenly, after freely indulging in spirits, or coitus, and retaining his urine for several hours, he finds himself utterly unable to pass water. The urethra, partially contracted by organized deposit in and around its walls, is entirely closed by the supervention of congestion and spasm, and complete retention is the result. Under appropriate treatment, the congestion and spasm may be subdued, though the organic stricture remains after their disappearance.

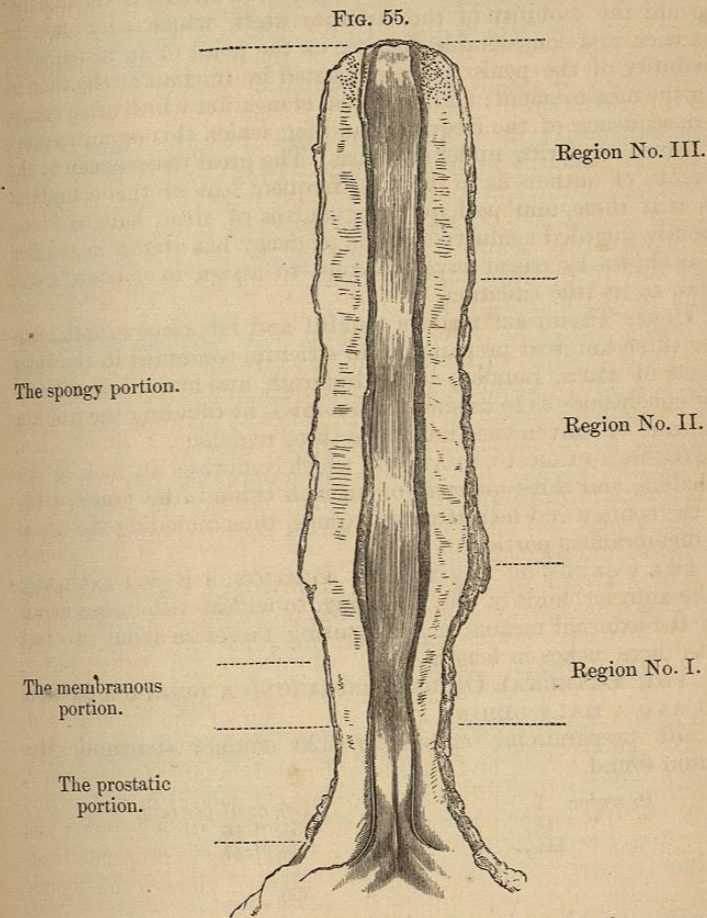
PERMANENT AND ORGANIC STRICTURE.—The albuminous fluid which infiltrates the tissues in acute urethritis, and which may contribute to the formation of congestive stricture, is, in most cases, eventually absorbed, and the canal recovers its normal calibre. But under other circumstances, and especially as a consequence of chronic inflammation, products of a more plastic nature are thrown out, which become organized, exhibit the same tendency to contract as adventi-

¹ Henry Smith, *Stricture of the Urethra*, London, 1857, p. 23.

² *Stricture of the Male Urethra*, 1878, p. 301.

tious deposits in other parts of the body, and give rise to permanent contractions of the canal.

According to the more recent views of pathologists, stricture is due to a proliferation of the elements of the submucous cellular tissue, and not to the organization of any effused fluid. It is evident that



"A healthy urethra, eight inches and a half in length, slit up from the upper part, accurately reduced on scale from a drawing made from the original while fresh, to half the natural size. On the left-hand side are indicated the anatomical divisions of the urethra, and on the right the boundaries of the regions referred to in relation to the locality of stricture." (After Thompson.)

the diminution in the calibre of the urethra is but one of the bad effects of stricture; the normal elasticity of the canal is lost, and the exercise of its function seriously interfered with.

Organic stricture may be due to traumatism, as a fall upon the perineum, in which case it is peculiarly obstinate and not generally amenable to treatment by dilatation. In an anterior portion of the