canal, it may also have arisen from the cicatrization of a chancroid, or from the specific induration surrounding a chancre. I have long held the opinion that masturbation is a not infrequent cause of stricture, and am pleased to see that my friend Dr. Gross thinks likewise.[1]

Seat.—There are several sources of error which should be avoided in attempts to determine the anatomical seat of strictures during life. These are the mobility of the stricture itself, which may often be thrust back to a considerable distance on the point of an instrument; the liability of the penis to be elongated by traction at the time of taking the measurement; and the actual elongation which often ensues as a consequence of the frequent handling which this organ receives from persons suffering under stricture. The great discrepancy in the statements of authors as to the most frequent seat of this complaint shows that these, and perhaps other sources of error, have not been sufficiently guarded against; and the tendency has almost invariably been, as shown by recent investigations, to assign to stricture a seat posterior to its true situation.

Sir Henry Thompson made a careful and laborious examination of over three hundred preparations of stricture contained in the chief museums of Paris, London, and Edinburgh, and arrived at the following conclusions as to its site. He premises by dividing the urethra for the sake of convenience into these three regions:

I. The Sub-pubic Curvature, which comprises an inch of the canal before, and three-quarters of an inch behind, the junction between the spongy and membranous regions, thus including the whole of the membranous portion.

II. The Centre of the Spongy Portion, a region extending from the anterior limit of the preceding, to within two inches and a half of the external meatus, and measuring therefore about two and a half to three inches in length.

III. The External Orifice, including a distance of two inches and a half behind it.

Of 270 preparations, embracing 320 distinct strictures, Mr. Thompson found

In region	I., ...	216, or 67 per cent.
" "	II., ...	51, " 16 " "
" "	III., ...	54, " 17 " "
		320

According to this eminent authority, the largest number of strictures are therefore situated at the sub-pubic curvature; and he would still further limit the most frequent locality to the anterior portion of this region, since he says "that part of the urethra which is most frequently affected with stricture is the portion comprised in the inch anterior to the junction, that is, the posterior or bulbous part of the spongy portion. The liability of this part to stricture appears

[1] See a paper by Dr. Samuel W. Gross, On sexual debility and impotence, with special reference to masturbation as an exciting cause of stricture, Med. and Surg. Reporter, Phila., May 5, 1877.

to diminish as it approaches the junction, where it is less common; while behind, it is very rare. Most rarely is a stricture found so far back as the posterior part of the membranous portion."[1] The next most frequent situation of stricture is stated to be the external two and a half inches, and the least frequent the middle portion of the spongy region, although the difference between the two is not very great; while both are of but small importance compared with the anterior portion of the bulb.

Mr. Walsh[2] and M. Mercier[3] arrived at results very similar to the above.

On the other hand, in 1866, M. Verneuil read a paper before the Anatomical Society of Paris,[4] in which he denied the frequency of *organic* stricture at the bulb and at the commencement of the membranous portion; or rather he maintained that in cases of stricture a *fibrous* contraction is almost always met with at about two and one-half inches from the meatus, and that beyond this, at the depth of five inches, *i. e.*, at the bulbo-membranous junction, there is constantly a second contraction, but only *spasmodic* and symptomatic of the former. "Whenever there is irritation of the anterior portion of the urethra, the membranous portion contracts and arrests a sound." "Whenever a patient shows symptoms of urethral stricture, one contraction exists in the spongy portion, a second in the membranous portion. The first alone is fibrous; the second spasmodic and symptomatic of the first." Verneuil's views are still further developed in an able article by M. H. Folet,[5] in which an extensive bibliography of the opinions of different authors on the seat of stricture is given, and the following conclusions are arrived at:

1. Fibrous, organic stricture is frequent in the spongy portion of the urethra, where it is often overlooked.

2. Organic stricture of the bulbo-membranous region, although said to be frequent, is rare.

3. In *all* cases of stricture of the spongy urethra there exists a second obstruction five inches from the meatus, at the commencement of the membranous region. This obstruction is due to muscular spasm, and is only a symptom of the penile stricture. The latter (penile) is often slight and incapable in itself of notably impeding micturition. The secondary spasm is the efficient cause of the dysuria, and constitutes a serious and sometimes invincible obstacle to catheterization.

4. The calibre of the penile stricture is constant, and can be only slowly and regularly dilated. That of the spasmodic stricture is subject to the most sudden and capricious variations; it may perhaps be easily passed in the morning, and in the evening, under the influence of some irritation, be completely impassable.

[1] Op. cit., p. 83.
[2] Med. Press, Dubl., Jan. 23, 1856, p. 51.
[3] Recherches sur le traitment d. mal. d. voies urinaires, 1856, p. 377. Also Bull. Soc. anat. de Paris, 1858, p. 441.
[4] Bull. Soc. anat. de Paris, avril, 1866, p. 170.
[5] Arch. gén. de méd., Paris, avril, 1867, p. 401.

5. In those rare cases in which the organic stricture is seated at the bulb, a secondary spasmodic stricture exists none the less, immediately behind it.

Dr. Otis,[1] whose views on spasmodic stricture have already been referred to, is also a firm believer in the greater frequency of organic strictures in the spongy portion of the urethra. He states that out of 258 strictures under his care, 52 were in the first quarter inch of the urethra; 63 in the following inch, viz., from ¼ to 1¼; 48 from 1¼ to 2¼; 48 from 2¼ to 3¼; 19 from 3¼ to 4¼; 14 from 4¼ to 5¼; 8 from 5¼ to 6¼; 6 from 6¼ to 7¼.

These discrepancies may, perhaps, be explained when we consider the two methods by which the results have been obtained; Sir Henry Thompson and others founding their observations upon post-mortem specimens, and enumerating only such cases of stricture as are apparent after death; Verneuil and Dr. Otis making their examinations during life, and counting in a large number of slight contrac-

FIG. 56.

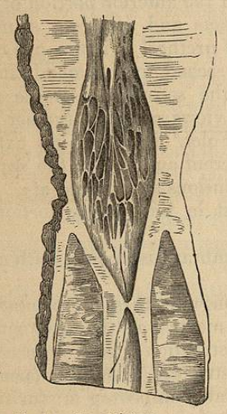

FIG. 57.

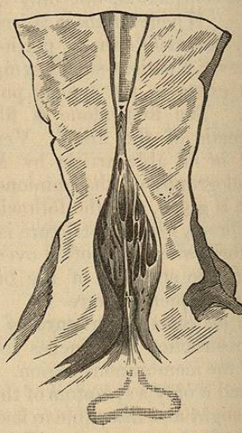

FIG. 56. Annular stricture.
FIG. 57. Irregular, or tortuous stricture. Posterior to the stricture in each figure are seen pouches of the mucous membrane, formed by dilatation of the lacunæ and ducts, and capable of entangling the point of an instrument. (After Thompson.)

tions, even of the meatus, which their opponents would not admit to be strictures at all. Further and *unbiassed* investigation is, however, necessary before this question can be regarded as settled.

Stricture never occurs in the prostatic region of the urethra, at least no unquestionable instance of the same is to be found recorded.

Number.—Thompson states that in most cases there is only one stricture in the same subject. Of 267 preparations examined by him, the stricture was single in 226. Others have reported several distinct contractions. Hunter[2] met with six; Colot with eight; and

[1] Op. cit., p. 97. [2] Ricord and Hunter, op. cit., p. 168.

Ducamp with five; but Boyer never found more than three, and Mr. Thompson[1] never more than "three, or at the most four." Civiale[2] says that when there are several one of them is almost always situated in the sub-pubic curve, and the others between it and the meatus. Here again Otis, with a different method of examination, is at variance with other authorities, regarding multiple strictures in the same person as the rule and not an exception. He reports one case in which he found fourteen.[3]

Form.—The form of stricture necessarily varies with the amount and situation of the fibrous deposit which produces it. This may consist of a few fibres which encircle the whole or a part of the urethral circumference, like a thread, or may form a band varying in extent and thickness. This is the "linear stricture" of Mr. Thompson and others; the "bridle stricture" of Charles Bell; and the "valvular stricture" of French writers.

FIG. 58.

Strictures near the orifice of the urethra. (After Thompson.)

Where the fibrous deposit is more extensive, the stricture covers a larger portion of the urethral walls. In some instances, it is abrupt on either side, like the last-mentioned form, but wider, as if a whip-cord were tied externally to the mucous membrane; this is called an "annular stricture." If the induration be more diffused around its base, a section of the canal will resemble an hour-glass, and the contraction receives the name of "indurated annular stricture." Again, stricture may involve the canal to the extent of half an inch or several inches, when the passage is often more or less deviated from its normal direction, and the stricture is said to be "irregular or tortuous."

Degree of Contraction.—The plastic material of stricture exhibits a constant tendency to contract, and become harder and firmer with time; it is consequently true, as a general rule, that the longer a stricture has existed the more callous it is, and the less susceptible of dilatation. Exceptions to this law, however, sometimes exist, and strictures of long duration are met with which yield readily, while others, recent in their origin, prove very obstinate.

Complete obliteration of the urethra may take place as a consequence of a wound of the canal, sometimes from within, but more frequently from without. In strictures other than those of traumatic origin, the urethral walls are probably never completely fused together, although cases are reported in which fistulous passages had

[1] Op. cit., p. 54. [2] Op. cit., vol. i., p. 157. [3] Op. cit., p. 68.

for a long time turned the urine from its normal channel, and in which, on post-mortem examination, it was impossible to introduce the finest probe through the contraction, even after the external portion of the penis had been slit up.[1] Instances of this kind, however, are rare; in most cases, however great the narrowing, urine will still find its way out, though it may be only by a few drops at a time.

There has been no little discussion of the question, whether the urethra, when permeable to urine, is always permeable to instruments. The late Mr. Syme, of Edinburgh, and also Mr. Liston, asserted, in the earlier years of their practice, that whenever any urine comes out a catheter may, with patience and perseverance, be got in sooner or later, but they were both of them repeatedly foiled at a later period of their lives, and it is safe to say that no surgeon of any considerable experience will maintain that he has never met with a case of "impassable stricture."

Pathology of Stricture.

In mild cases of stricture, the canal in front of the contraction preserves its normal dimensions and character; but in severe and chronic cases, when the flow of urine has been much obstructed, and the anterior portion of the urethra, through continuity of tissue, has participated in the inflammation which chiefly affects the part behind the stricture, it is contracted; another condition, difficult of explanation, is one of dilatation, which, in a case described and figured by Charles Bell, was very considerable. Instances in which the urethra was ulcerated in front of the stricture are also given by the same author.

Posterior to the stricture, the urethra is generally enlarged, as a natural consequence of the impediment to the free evacuation of the bladder. The canal ultimately loses its elasticity and becomes dilated so as readily to admit the finger, or even form a pouch, which may appear as a fluctuating tumor in the perinæum. The lacunæ of the mucous membrane and the orifices of the prostatic and ejaculatory ducts frequently participate in this enlargement; and the septa between the pouches thus formed constitute a network, chiefly confined to the floor and sides of the canal, which is well adapted to obstruct the passage of an instrument unless the point be well elevated towards the pubes.

The mucous membrane behind the stricture is the seat of chronic inflammation; it is sometimes contracted and puckered; sometimes thin and minutely injected with bloodvessels; the surface is generally covered with a layer of pasty exudation, and it is from this source that the gleety discharge, which is so constant an attendant upon stricture, is derived. Ulceration frequently takes place, which may be superficial, or which may extend to the deeper tissues, producing

[1] Thompson, op. cit., p. 60–61.

large and ragged excavations of the urethral walls, or, in rare instances, it may even occasion destruction of the contracted portion of the canal.

Abscess and Fistula.—A still more serious consequence of stricture is the development of abscesses and fistulæ in the neighborhood of the urethra. In some cases the urethral mucous membrane is impaired or destroyed at one or more points by ulceration; during the straining of micturition, urine, perhaps in a very minute quantity, escapes into the cellular tissue; an abscess is formed, which burrows in various directions, or which opens and establishes a fistulous communication between the external surface and the urethra. In other cases abscesses are developed without rupture of the urethral walls or infiltration of urine, and they may occur even when the obstruction to the evacuation of the bladder is far from complete. In most cases, however, a communication is subsequently established by the ulcerative process. When a urethral opening exists, it is generally behind the contracted part, but sometimes in front of it. The course taken by urinary fistulæ is often very erratic; they may open into the rectum, upon the perinæum, upon the surface of the scrotum, upon the abdomen, even as high as the umbilicus, or upon the thighs or nates.

These abnormal passages rarely have more than one opening into the urethra, but very frequently a number upon the external surface; in one case, seen by Civiale, the latter amounted to no less than fifty-two.[1] Their internal surface becomes lined with adventitious tissue, which bears a very close resemblance to mucous membrane, but is destitute of glands and follicles; it is organized, well supplied with nerves and bloodvessels, and constantly secretes a muco-purulent fluid. Calcareous matter is deposited in fine particles or in larger masses, resembling mortar, upon the walls, and more particularly near the orifices or in some blind pouch opening into the passage.

Deposition of similar matter often takes place in the dilated sinuses of the prostate, and this gland may become inflamed, and abscesses form in its substance.

Bladder.—The vesical walls become hypertrophied, as a consequence of the obstruction to the flow of urine and the additional force requisite for its expulsion induced by stricture. This hypertrophy chiefly affects the muscular layer, but does not wholly spare the areolar tissue, which is somewhat thickened and increased in density. The walls of the bladder may attain five or six times their normal thickness, and measure from half an inch to an inch in thickness. The developed fasciculi of muscular fibres form prominent ridges upon the mucous surface, and have been aptly compared to the columnæ carneæ of the heart's cavities. Frequent and violent expulsory efforts cause protrusion of the mucous membrane between these columns, and pouches are formed, which, small at first, may gradually increase in size, until they equal or excel the dimensions of the bladder itself.

[1] Op. cit., vol. i., p. 539.

On post-mortem examination, the mucous membrane of the bladder is found to be thickened, soft and pulpy, and much congested in patches; its color is heightened, and generally of a dark-red hue, its surface is smeared with slimy mucus, which, when mingled with the urine, may obstruct the narrow orifice of the stricture; scattered over it is a quantity of fine calcareous matter, or it is covered with lymph, sometimes in small patches, at others, in layers of considerable extent.

The irritability of the bladder excites to frequent acts of micturition, and the capacity of this viscus is eventually much diminished. Instances are recorded in which it would not contain more than an ounce, or even half an ounce of fluid.

Ureters and Kidneys.—As a stricture obstructs the exit of urine from the bladder, so it cannot but impede the passage of fluid into it; consequently, we find changes similar to those already described in the ureters and kidneys. The former are often so dilated that they will admit the finger or thumb, and in some instances have been mistaken for a portion of the small intestine; their parietes are thickened, and lymphy deposits, and other evidences of chronic inflammation are found upon their internal surface. The kidneys may participate in these lesions; the pelvis, infundibula, and calices are distended; the medullary tissue of the organ is atrophied under the pressure to which it is subjected, and enormous reservoirs may be formed, capable of containing five, ten, and, in one instance, observed by Sir Henry Thompson, twenty ounces.

Genital Organs.—Stricture is not unfrequently attended with hypertrophy and induration of the penis, and tumefaction and œdema of the prepuce.

The ejaculatory ducts may be dilated; their walls, and those of the vesiculæ seminales, inflamed and thickened; and their cavities contain pus and other products of inflammation. There is often considerable irritability of the testicle, and attacks of epididymitis sometimes occur, especially after the use of instruments within the urethra.

It is evident from a consideration of the organic lesions which stricture induces in the bladder, ureters, and kidneys, that the secretion of urine must be seriously interfered with, and the perfect elimination of effete matter consequently prevented; and it is also probable that more or less noxious material is absorbed from the partially decomposed urine which collects in the bladder and elsewhere. The inevitable effect of this upon the system at large, and especially upon the nervous centres, is too well known to require explanation.

Symptoms of Stricture.

One of the earliest symptoms of organic stricture is generally a gleety discharge from the urethra. If the contraction of the canal has immediately succeeded an attack of gonorrhœa, the urethra may never have recovered its normal condition since the acute symptoms

were present; but in some instances all traces of muco-purulent matter had entirely disappeared, when suddenly, perhaps after some excess, the linen is found again stained, or the lips of the meatus adherent. This discharge is not a constant symptom of stricture, but is present in the great majority of cases. It is chiefly derived from the contracted portion of the canal, and the parts lying directly behind it.

Another early symptom, and sometimes the first which attracts the notice of the patient, is a gradual diminution of the power over his bladder. He is not able to retain his water as long as usual, and a desire to urinate calls him up several times during the night. The stream, moreover, is diminished in fulness, is projected with less force than natural, and may be variously distorted; sometimes it is flattened, at other times spiral like a corkscrew, forked, or divided into two or more portions which diverge from the meatus; or, at the same time that a small stream issues from the canal, a portion falls in drops at his feet; he is obliged to take special care to avoid soiling his shoes and clothes; and finally, when he supposes the act fully accomplished, a few drops dribble away, and wet his person and clothing. The above symptoms cannot, however, be regarded as pathognomonic of organic stricture, since they may be produced by other causes, as the presence of inspissated mucus in the canal, spasmodic contraction, calculi, irregular action of the bladder, etc.

At the same time, each passage of the urine may be attended with pain and disagreeable sensations, varying in intensity, position, and character. Most frequently there is a sense of dull aching in the perinæum, back, and loins, or in the glans penis; often pain of a sharper character is felt in the course of the urethra or at the neck of the bladder, or follows the course of the spermatic cord, and is most severe in the groins and testicles, while sometimes it shoots down the thighs. Another frequent seat of pain is behind the pubes, where it is probably due to some degree of inflammation of the bladder.

As the disease progresses, all the above symptoms are aggravated; and the urgency of micturition, especially, is much increased. Frequently, the patient is almost wholly deprived of sleep by repeated calls to urinate, and the length of time which this act requires. In aggravated cases, the urine dribbles away in small quantities, while the patient is asleep, or without his consciousness during the day. This has sometimes been mistaken for incontinence of urine; whereas it is almost invariably due to distention of the contracted bladder and overflow of its contents. The urine also undergoes certain changes in consequence of its retention and partial decomposition, and the vesical inflammation which is thereby excited. These have already been mentioned in the chapter on cystitis.

Hœmaturia, which, however, is seldom excessive, sometimes occurs in connection with stricture, and is most frequently met with in old and aggravated cases in which the mucous membrane of the urethra and bladder is much congested.