of the prostate by delineating the normal prostate below the vesical growth, by observation of the urethral length, which is not increased unless the cancer is prostatic, and by cystoscopy, which shows an intravesical growth, but commonly fails to make out a prostatic one.

Treatment.—Extirpation of the prostate has been done 8 times (von Frisch). Five of the patients died within two months, 2 survived nine months (Czerny, Verhoogen), and 1 fourteen months (Billroth); but all these died of recurrence. Such a record discourages the hope of radical cure by the knife. Indeed, the well-known rapidity with which secondary glandular involvement takes place precludes expectation of any very brilliant results in this direction. Yet partial prostatectomy has given results which, if not brilliant, are at least slightly encouraging. Two of von Frisch's cases (middle lobe) remained well one year, and a case operated upon by Socin for sarcoma of the right lobe remained well two years.

Palliative treatment is almost equally futile. In the early stages, sedatives, tonics, and the catheter (if there is retention) may relieve the symptoms somewhat. Later, opium, suprapubic cystotomy, as for cancer of the bladder (p. 422), and colostomy, as soon as the rectum becomes ulcerated or obstructed, are the chief elements of palliative treatment.

CHAPTER XXI

THE BLADDER: ANATOMY, PHYSIOLOGY, EXAMINATION—EXSTROPHY OF THE BLADDER

ANATOMY

The bladder is a muscular sac lying, in the male, between the rectum and the pubes when empty, and distending, when full, into an oval bag occupying more or less of the hypogastrium (Fig. 86). Its position is fixed below by the urethra, by the pelvic fascia, which, after lining the cavity of the true pelvis, is reflected upward and lost on the bladder and rectum (as pubo-prostatic and inferior vesical ligaments), and by the recto-vesical fascia, which binds the prostate and the neck of the bladder to the rectum. The muscular tissue of the organ is covered on the outside by peritoneum, on the inside by mucous membrane. Above and on the sides the peritoneum covers the bladder, but is attached loosely, especially at the base, so as to offer no obstacle to any change in shape or position of the viscus.

A knowledge of the peritoneal reflections upon the bladder is essential to a correct understanding of the operations of epicystotomy and suprapubic aspiration. When the bladder is empty it lies contracted behind the pubes; the peritoneum leaves the abdominal walls at the symphysis, and passes at once to the bladder, over which it is spread, and thence reflected upon the rectum from the base of the bladder, so that, when the latter is absolutely or even partially empty no trocar or aspirating needle may reach it from the anterior abdominal wall without traversing the peritoneal cavity.

Very different, however, is the condition of the viscus when distended. Then, as its cavity fills up, the peritoneum is carried with it. In this way the distended bladder carries up the peritoneum in front, so that in extreme retention a distance of 2 to 5 cm., or even more, above the symphysis becomes bare of peritoneum. Hence the election of the region immediately above the pubes for aspiration and the necessity of filling the bladder before attempting suprapubic

cystotomy. The relation of the peritoneum to the bladder also varies behind. When the viscus is distended the peritoneum barely reaches the blind ends of the seminal vesicles; when empty it descends between them almost to the prostate.

The *shape* of the bladder varies with age. The bladder of an infant is ovoidal in shape with its long axis running downward and

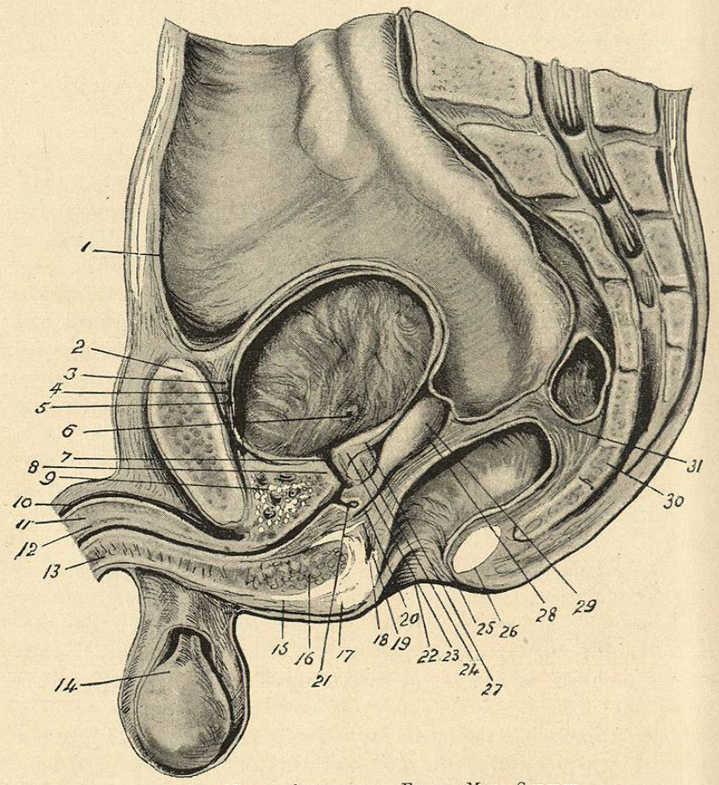


Fig. 86.—Median Section of a Frozen Male Subject.

The small intestine is removed. *1*, peritoneum; *6*, opening of the ureters; *8*, internal sphincter vesicæ; *9*, external sphincter, with the compressor urethræ muscle; *10*, dorsal vein of the penis; *15*, bulbo-cavernosus muscle; *16*, bulb of the urethra; *17*, sphincter ani; *21*, utricle; *24*, isthmus of prostate; *29*, seminal vesicles. (Henle.)

a little forward and its apex at the urethral orifice. It lies when full almost entirely out of the pelvis. As age advances the bladder sinks into the pelvis, assumes an almost spherical shape when filled,

and possesses a flattened floor in the region of the trigone. Later still the *bas fond* appears with its attendant ills (p. 259).

The *muscle* of the bladder is composed of three coats—external, middle, and internal. The external or longitudinal coat consists of numerous fibres running from the prostate up over the fundus, where they are met by a similar set of fibres from the anterior surface. On the place of meeting there is often a swirl or "cowlick" of muscle fibres (Versari [1]). Over the sides of the organ the longitudinal layer is thin and unimportant. Its fibres are closely connected with the

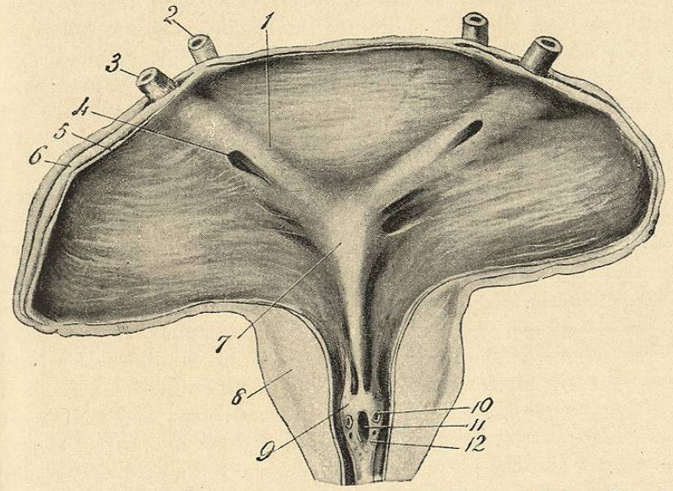


Fig. 87.—Lower Part of the Male Bladder, with the Beginning of the Urethra.

Exposed by incising the anterior wall and laying it open. *3*, ureter; *4*, opening of the ureter; *2*, vas deferens; *9*, colliculus seminalis; *7*, centre of trigone; *8*, section of prostate; *10*, orifice of the common ejaculatory duct; *11*, opening of utricle; *12*, mouths of prostatic gland-ducts; *1*, interureteric fold. (Henle.)

prostate and the deep layer of the recto-vesical fascia, and intermingle with the deeper layers of the bladder muscle. The middle layer forms the bulk of the vesical muscle. Its fibres are densely interlaced and have a generally circular character. The internal layer of muscle consists of a few scattering bundles of longitudinal fibres, so irregular and inconspicuous that some anatomists deny their existence.

The *trigone* is a part of the bladder wall deserving special mention. It is a triangular region with sides some 2 cm. long lying between the orifices of the urethra and the two ureters (Fig. 87).

[1] Guyon's Annales, 1897, xv, 1089.

The muscle here is denser than elsewhere in the organ. A few fibres derived from the longitudinal coats of the ureters and urethra spread over its internal surface. A bundle of these fibres running along the base of the triangle is known as the muscle of Bell. The dense muscle tissue of the trigone has been declared by Kalischer to be part of the internal urethral sphincter (p. 240). This interpretation, though novel and startling, is very ably supported by its author.

The *mucous membrane* of the bladder is of a pale salmon colour, remarkably insensitive in health, covered by a stratified pavement epithelium, and lying in folds when the bladder is contracted, except over the trigone, where it is always smooth. The glands are not numerous, except on the trigone and near the neck. They are exceedingly small, and composed of clusters of simple follicles. The coats of the bladder are united by connective tissue, which is everywhere loose, except at the trigone.

The bladder is arbitrarily described as having four sides—anterior, posterior, and two lateral. These four sides meet above in the *fundus*, below and in front in the *neck*, which is the urethral orifice. The trigone and surrounding portions of the posterior wall are spoken of as the *floor*. The ureters pierce the floor of the bladder obliquely and open at the angles of the trigone (p. 469).

The *arteries* of the bladder are the superior, middle, and inferior vesical. They anastomose freely. The *veins* are numerous and lie in three planes—the subserous, the intermuscular, and the submucous. They anastomose freely with one another and with the prostatic plexus, and the plexus of Santorini above the neck of the bladder. They empty into the hypogastric veins. The *lymphatics* of the bladder wall were overlooked by the older anatomists, but their existence has been repeatedly verified of late years. They run chiefly beneath the mucous membrane and empty into several small groups of glands lying about the bladder itself and thence into the iliac glands along the internal and common iliac vessels. These iliac glands are commonly infected by vesical neoplasms. The lumbar glands are less frequently involved, the inguinal glands very rarely (Pasteau [1]).

The fetal bladder is connected with the allantois by the *urachus*, and this canal, closing at the time of birth, persists as a fibrous, subperitoneal cord connecting the fundus of the bladder with the umbilicus. This canal very exceptionally remains patent throughout the whole or a part of its length.

[1] État du système lymphatique dans les maladies de la vessie et de la prostate, Paris, 1898, p. 48.

PHYSIOLOGY

Capacity.—The capacity of the bladder is physiological, not anatomical (Guyon). Although in actual size the healthy bladders of different individuals do not differ materially, the actual capacity of the organ depends upon its sensitiveness, and this sensitiveness varies at different times and with different individuals. The physiological capacity of the bladder, the amount of urine an ordinary bladder holds when the desire to urinate is first felt, is about 250 c. c. (8 ounces).

Sensitiveness.—The healthy bladder is quite insensitive to touch, but very sensitive to tension. Thus a sound may be poked about in the bladder and cause no sensation whatever except in the prostatic urethra. On the other hand, the torture of "holding water" requires no comment. The sensitiveness of the bladder may be diminished by habit; beer-guzzlers and diabetics do not urinate more often than those who pass perhaps only half as much urine. The sensitiveness is, on the other hand, increased by nervousness and by inflammation.

Absorption.—Although the point is disputed, it is probable that the mucous membrane of the healthy bladder is practically as impervious as the skin. But fluids are rapidly absorbed through the mucous membrane of the posterior urethra, and also through the bladder epithelium when inflamed.

Contraction: Urination.—"Man urinates with his bladder, not with his urethra," says Guyon; but, though all are agreed thus far, there are diverse explanations of the mechanism of urination. (*Cf.* Rehfisch,[1] Ultzmann,[2] Guyon,[3] Versari.[4]) The known facts upon which we may depend are: 1. The vesical sensitiveness to tension. 2. The more marked sensitiveness of the posterior urethra, and the desire to urinate and the sensation of urination provoked by passing an instrument into it. 3. The presence of only one voluntary muscle to guard the outlet—viz., the external sphincter or cut-off muscle. 4. The incontinence of urine that results from distortion of or injury to the internal sphincter. Upon these may be built up the following plausible theory: The internal sphincter is the true guardian of the bladder. It remains closed, or at least sufficiently contracted to keep the urine out of the prostatic urethra while the bladder slowly fills. When the bladder has become distended to its physio-

[1] Virchow's Archiv, 1897, cl, 111.
[2] Deutsche Chir., v. Billroth. u. Lücke, 1890, lii, 8.
[3] Leçons cliniques, 1ière édition, 1896, ii, 379.
[4] *Op. cit.*

logical capacity the desire to urinate is felt, the bladder begins to contract, and, by means of a reflex carried out in the lumbar portion of the cord and comparable to similar reflexes in the other hollow viscera, as it contracts its sphincter opens and the urine penetrates the posterior urethra. A sharper desire to urinate is felt, and if this is acceded to by voluntary relaxation of the external sphincter, the bladder slowly contracts and empties its contents through the open channel, the last drops being ejaculated by the piston-stroke spasm of the deep urethra, or the stream cut off by a sharp contraction of the voluntary muscle. But if the desire to urinate is not acceded to, the outflow of urine is prevented by a conscious, voluntary contraction of the external sphincter and the desire for a time passes over, perhaps because the internal sphincter closes again, drives the few drops back into the bladder, and holds out a while longer. Then the desire returns, each time more imperiously, until it is satisfied.

EXAMINATION OF THE BLADDER

In most cases examination of the bladder is confined to examination of its contents. The patient is made to urinate in two glasses (p. 83), and from the contents of the second glass the nature of the contents of the bladder is inferred and some estimate of its condition obtained. To ascertain the *capacity* of the bladder a warm solution of boric acid is slowly introduced through a catheter until the bladder can hold no more. The amount of *residual urine* is learned by making the patient urinate, and then measuring the amount of urine obtained by catheter. The strength of the bladder muscle, the presence or absence of *atony*, is learned by watching the force of the stream thrown from the penis or the catheter. Special manipulations are employed to determine the presence of stone, tumour, rupture, distention, etc. The only instrument besides the catheter that is applicable to diagnosis of most bladder diseases is the cystoscope.

Cystoscopy

Cystoscopy is inspection of the interior of the bladder. Without entering into the historical aspect of the subject we may say that cystoscopy is performed to-day by two varieties of instruments. The one, a German product, perfected by Nitze, Leiter, and Casper, consists of an instrument shaped more or less like a metal elbowed catheter. In its beak is a small electric lamp connected through the shaft with a battery, and in its shaft an optical apparatus by means of which the operator, looking into the butt of the instrument, sees through a window near the beak the surrounding objects illumined

by the light of the incandescent lamp. The other form of instrument we owe to Dr. Howard Kelly. It consists of a straight metallic tube into which the operator looks by means of reflected light (Chetwood has adapted his urethroscopic lamp to Kelly's instrument in a very satisfactory manner). This instrument, which is employed with the patient in the knee-chest position and the bladder filled with air, is admirably adapted to the female, but not generally applicable to the male bladder, and therefore requires no description here. We may confine our attention to the first class of instruments.

Choice of Instrument.—For a simple cystoscope I know none better than the old Leiter. Its beak is too long and angular, its shaft too short—defects which are overcome in Fenwick's modified instrument (Fig. 88)—but the inside of a bladder can be seen better

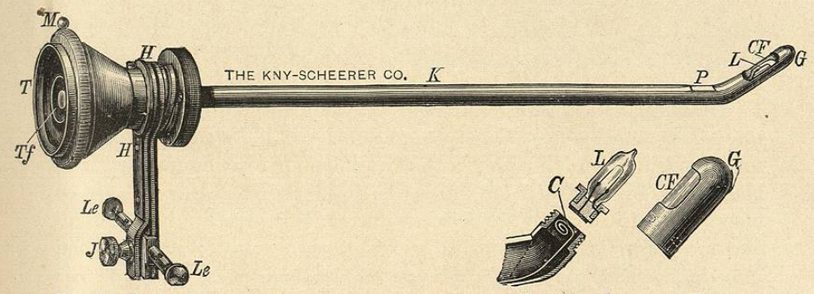


Fig. 88.—Fenwick-Leiter Cystoscope.
Le, electrical connections; *Tf*, telescope; *P*, prism; *L*, lamp.

Fig. 88*a*.—Detail of Beak.
L, lamp; *C*, connecting wire: *G*, metal hood; *CF*, window.

through it than through any of the newer instruments that have come into my hands (Nitze's, Albarran's, Casper's), with the exception of Nitze's photographic cystoscope, which is too large for general use. For an irrigating cystoscope the choice lies between Nitze's and Albarran's, and perhaps Boisseau de Rocher's new megaloscope, which I have not employed. For ureteral catheterization I prefer Nitze's instrument to Casper's or Albarran's. I have found no advantage in the various aërocystoscopes.

When the cystoscope was first introduced great pains were taken to show how two instruments were necessary for the inspection of the whole bladder, one with the window on the concave, and one with it on the convex side. Experience has shown that a satisfactory inspection may be made with the former kind alone, and the latter instrument (the original Nitze No. 2) is but little employed. The

operating cystoscope of Nitze I have never employed, nor has it gained any wide popularity.

Cystoscopic batteries are obtainable of every important electrical company. To use the street current a rheostat must be interposed.

Preparation for Cystoscopy.—The instrument is prepared by soaking several hours in a 5% carbolic-acid solution, after which it is carefully washed with sterilized water before using. The newer instruments may be boiled.

The patient requires no great preparation unless his prostate is sensitive or his bladder inflamed. In the former case the gentle passage of sounds at intervals of three or four days for several weeks before the operation may materially blunt the prostatic sensibility. In the latter case it is proper to attack the inflammation in the hope of clarifying the contents of the bladder before employing the cystoscope. It is also prudent to administer urotropin for three or four days before operating to diminish the danger of infection and of urethral chill (p. 373).

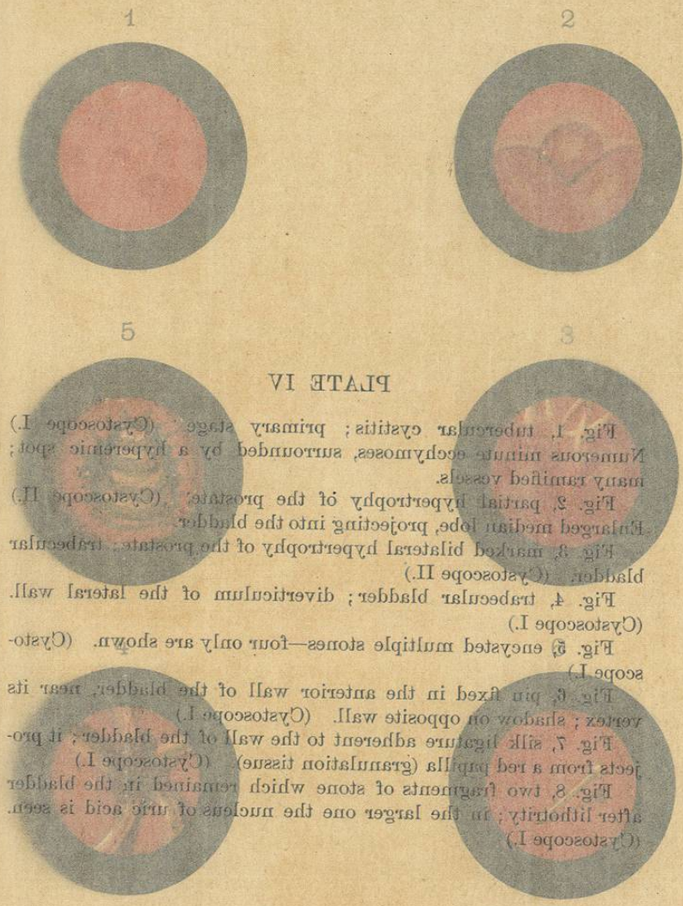
Cystoscopy may almost always be performed under local anesthesia, and accordingly some local anesthetic is injected into the posterior urethra and bladder a few minutes before operating. The bladder is first washed out until the fluid returns clear of pus or blood, then 150 c. c. of 1% cocain solution is injected into the bladder and a few minutes later 10 drops of a 5% solution are instilled into the posterior urethra.[1] The patient is then made to remove his trousers and drawers and placed upon an ordinary gynecological office table with his buttocks on a low cushion and his feet spread apart and in the foot-rests. All is then ready for the operation. (The remote possibility of cocain-poisoning must be borne in mind. It happened once in my experience.)

The Operation.—The cystoscope is attached to the battery and the electricity slowly turned on until the lamp is at a white heat. Noting the amount of current necessary, the electricity is turned off, and the cystoscope, greased with a soluble lubricant, such as glycerin or lubrichondrin, is slowly introduced into the bladder. The instrument enters like a steel sound, but as it has a short beak it is often

[1] Eucain B. has not proved as satisfactory in my hands for bladder use as cocain. Nirvanin has a disagreeable property of irritating for a few moments before it anesthetizes. Guyon employs as an anesthetic injection into the rectum, forty-five minutes before operating—

℞	Antipyrin	gm. 150
	Laudanum	gtt. x
	Water	gm. 100

PLATE IV.



CYSTOSCOPIC PICTURES.