der toward the left. Our observations on the position of the rectum in women are directly opposed to the usual statements of text-books of anatomy and surgery. . . .

"Another factor producing some slight asymmetry of the dilated bladder is the fact that the uterus is usually placed somewhat to the left of the median line and encroaches on the left upper posterior quadrant of the bladder. The influence of this factor is to lower the point of greatest outward bulging of the left lateral wall so that it is found to be on a lower level than on the right lateral wall. . . .

"With the patient in the knee-breast posture, and the rectum, vagina, and bladder all dilated by atmospheric pressure, it was found that the true pelvis was always completely occupied by these organs, and that the bladder and uterus tended to rise upward and forward. In multiparæ the uterus was found to be displaced so far upward and forward that its fundus could be felt within a few centimetres of the umbilicus.

"The ballooning of the rectum and vagina before the bladder was allowed to fill with air was found to be of great importance to the ease of examining the ureteral orifices, in the fact that the dilated rectum and vagina press from behind upon the base of the bladder, thus bringing the trigonum and ureteral orifices forward and into easy view of the speculum. Neglect of this point and failure to first allow the rectum and vagina to dilate is accountable in large measure for the difficulty found by so many gynecologists in catheterizing the ureters. . . .

"The bladder, as a whole, when dilated with air and observed *during operation within the pelvic cavity*—from abdominal section—was found to be ellipsoidal in form, flattened somewhat in its antero-posterior diameter and increased transversely. The transverse diameter was always the greatest measurement. Mathematical calculation of the cubic content of an ellipsoidal viscus of the dimensions of the bladder corresponded closely with actual air capacity obtained by expression" (Hunner and Lyon).

Abnormal Urine; Examination of the Urine.

Color.—The color of the urine in diseases of the bladder may vary from the almost colorless urine of hysteria to the reddish-black urine of hæmoglobinuria or of hemorrhage from the urinary tract. It may be of a pale yellow color, or opaque from admixture of pus.

The *odor* of cystic urine is usually ammoniacal, unless the reaction is very acid.

The *reaction* of the urine in cystitis, when due to the presence of the coli communis, streptococcus, tubercle, or typhoid bacillus in pure culture, is acid; but when caused by saprophytes, pyogenic bacteria, or both, with decomposition of urea, its reaction is alkaline.

Specific gravity in vesical disease is usually about 1.010–1.015, but responds to all the usual features which induce variations in the quantity of the urine.

Mucus.—Mucus in the urine is rarely of diagnostic import, being always increased in any vesical inflammation.

Epithelium.—Exfoliation of epithelium always takes place in cystitis, and microscopically we can determine from what layer of the mucous membrane it is derived and to what extent the vesical wall is involved. The superficial cells are large, round, or rectangular pavement cells; those from the deeper layers, caudate or spindle-shaped. The latter varieties resemble cells from the ureter. The deep vesical cells may be confounded with cells given off from the deeper layers of the pelvis of the kidney, though these are usually somewhat smaller in size and lighter in structure than the deep bladder cells.

Blood and Albumin.—Hæmaturia may be due to hemorrhage from any portion of the urinary tract. In acid urine the red corpuscles present a shrivelled, crenated appearance; in faintly acid, diluted urine the corpuscles are quite full from endosmosis. Hæmaturia accompanies acute congestion and varicose veins. From the free surface of the bladder the blood escapes either in a free state or in small clots. Such hemorrhages imply the presence of a calculus or a foreign body, or of some form of new growth, in the bladder. But they may also occur in connection with an ulcerated condition of the vesical mucous membrane or as a result of malaria. When the blood comes from the kidneys it is intimately intermingled with the urine.

From a study of nineteen cases of hæmaturia, David Newman (*Lancet*, July 2, 9, and 16, 1898) concludes that "the source of the hemorrhage is often determined by studying the character of the urine, or of the blood clot if such is present. The farther down the source of the hemorrhage, as a rule, the less is the alteration of the appearance of the blood; though this is not true when the hemorrhage has been from the bladder in cases in which there is residual urine, as the color is rapidly changed in such instances. Occasionally the clot encloses some of the tissue from the source of the hemorrhage, and then microscopic examination makes practically an absolute diagnosis. If clots are large, they cannot have come from high up near the kidneys. Renal hæmaturia is apt to appear very suddenly, and disappear quite as suddenly. In case of stone in any location, rest causes improvement, and exercise increases the trouble. The cystoscope often gives aid. The estimation of the quantity of hæmoglobin and comparison with the amount of albumin in the urine will tell whether the albumin present is due entirely to the blood or if there is also albuminuria. If there is excess of albumin, this indicates a probable renal source of the hemorrhage. Hemorrhage from renal calculus is usually slight, appears at somewhat long intervals, and is increased by exercise. Bleeding from renal tumors is profuse, is apt to be more continuous, and is very likely to come on while the patient is recumbent. Tuberculous disease causes hemorrhage which often occurs at long intervals, is of slight severity, and not usually increased by exercise; and the quantity of albumin is in excess of that attributable to the blood present. Hæmaturia may also be due to passive hyperæmia, or may follow reflex inhibition of the renal functions, due to some acute abdominal affection acting upon the solar plexus. Cases of hæmaturia are becoming more and more the subjects of surgical treatment."

Discussing the diagnostic differences between pyelitis and cystitis, G. Rosenfeld (*Berliner klin. Woch.*, October 4, 1898) notes that an alkaline reaction is not found in uncomplicated pyelitis; in cystitis, even of severe grade, the albumin in the urine does not amount to more than 0.1 per cent., this being the most characteristic point of differentiation, for in pyelitis it is often as much as three times greater than this; if most of the pus corpuscles present are crenated, the condition is probably pyelitis, which is also true in case the red corpuscles are decomposed; if any hemorrhage occurs, it is but slight.

Bits of tissue teased in glycerin and examined microscopically will sometimes lead to the diagnosis of a vesical tumor or an ulcer; pieces of cast-off membrane will indicate an exudative or exfoliative inflammation of the walls of the bladder; and débris removed from ulcers often contain tubercle bacilli and confirm the diagnosis of an invasion of those microbes as the cause of the cystitis.

It is advisable in many cases to excise a piece from a new growth and submit it to microscopical examination, in order to determine the exact nature of the growth and the best method for its removal.

Pyuria.—Pus in the urine may be derived from the vagina, urethra, bladder, kidneys or ureters, or its presence may be due to a rupture of a pyosalpinx or of an appendiceal abscess into the bladder. Urine retained within a patent urachus, a duplicate or sacculate bladder, a cystocele, or an urethrocele undergoes fermentative changes and shows the presence of pus corpuscles. When they are present in large quantity, the urine presents a gruel-like appearance; when in moderate quantity, a fresh-cider-like opalescence. In recent acute infection the pus is in proportion to the intensity of the inflammation; in old cases the urine is loaded with bacteria, but contains little pus.

Parasites.—The filaria sanguinis hominis is occasionally found in the bladder and induces chyluria. The urine presents a creamy appearance to the naked eye and under the microscope. The period of the parasite's activity is at night, the morning urine being milky, while that voided during the day is quite clear.

The heads and hooklets of the echinococcus have been seen in the urine; ulcerative action in the kidney or in a prevesical tumor having set them free.

Treatment of Cystitis.

Prophylaxis.—The prevention of inflammatory disease of the bladder involves the early recognition of urethral disorders, and the immediate employment of appropriate treatment. If any vesical, pelvic, rectal, ureteral, or renal disease which renders the bladder liable to infection is present, this should be relieved; and the injunction to observe the strictest surgical asepsis in all manipulations about the bladder cannot be given too often.

Treatment of Acute Cystitis.—During the acute stage active local interference is contraindicated; and the demands of the patient will direct our attention to the relief of pain, and to the restoration of the power completely to empty the bladder. To stimulate vesical contraction, apply heat or cold over the suprapubic region; failing these a sterile catheter must be introduced and the bladder emptied. The intense pain due to vesical irritability and tenesmus must be relieved by morphine, administered either by the mouth or by suppository. At the same time enough bromide and chloral should be given to insure ample sleep. Hot poultices, or in some cases an ice-bag over the bladder, affords considerable comfort; continuous rectal, not vaginal, irrigation of ice water through a Kemp double-current tube exerts an almost marvellous effect.

The Care of the Patient.—Absolute rest in bed; a strictly fluid diet of milk or milk preparations, with Vichy; active purgation by Hunyadi, Rubinat, or other salines, and oleum ricini at night to insure complete emptying of the intestinal tract—such are some of the simple measures which should be employed. From our study of the urine we learn what drugs to administer, correcting alkalinity by the use of sodium benzoate and boric acid, āā gr. v. to x. *ter in die*; or, in case the urine is excessively acid, we may prescribe the acetate, bicarbonate, and citrate of potassium, āā gr. v. to x., with ext. pichi fl., ♏ xxx. to xl., every three hours, in a liberal quantity of water. For their supposed antiseptic action on the urine, salol and urotropin are highly recommended. When there is painful, frequent urination, if the bladder is capable of emptying itself, Morton recommends instillations of twenty minims of a one or two per-cent. silver nitrate solution, repeated every second or third day. The bladder must be completely emptied before the injection is made.

The treatment of chronic cystitis depends upon the nature of the infecting organism, the character of the urine, the condition of the bladder walls, the nature of the predisposing cause, whether calculus, neoplasm, foreign body, etc. So far as general measures are concerned it is necessary to insist upon the following: Rest in bed, a light diet, the avoidance of condiments and of sweet and alcoholic drinks; regular, periodic, complete evacuation of the bladder; free movement of the bowels through the use of salines; moderate exercise; the avoidance of over-heating, and abstention from intercourse; the daily use of hot and cold baths, or of sitz baths; and, finally, seven or eight hours of refreshing sleep. In other words, everything should be done to bring the patient's general condition up to the highest point.

The treatment of the interior of the bladder is accomplished in several ways: by internal medication; by injections into the bladder; by direct applications; and by surgical procedures.

1. Certain drugs may be used, such as sodium benzoate or boric acid, to render the urine acid; others for the purpose of diminishing the growth of micro-organisms in the bladder, notably salol and salicylate of sodium in full doses, and quinine in moderate amount. Urotropin, gr. xxx. per diem, has been recommended by Morton for dissolving phosphatic concretions.

2. Injections into the bladder are used in four ways, viz.:

(*a*) Washing out the bladder after the manner of Kelly, by attaching a glass catheter and a glass funnel to either end of a piece of rubber tubing three or four feet long, and pouring the solution into the funnel, the rapidity of the inflow being in proportion to the height at which the funnel is held. The bladder is filled to the point of tolerance, when on lowering the funnel the vesical contents will run out. This plan of irrigating the bladder has the advantage of safety in that overdistention is not likely to be produced, for the bladder will contract and expel its contents through the funnel, unless it be held too high.

The same method of making injections may be employed when we desire to treat the entire mucous membrane of a bladder which contains pus, mucus, and non-coagulated blood—that is, one in which there is a condition of mixed infection. For this purpose weak solutions of potassium permanganate (of 1 to 5,000), of ichthyol (1 to 50), of silver nitrate (1 to 2,000), and of a saline solution (6 to 1,000) will be found useful.

(*b*) Irrigation with hot (100°–110° F.) solutions, by means of the double-current catheter, will be found efficient in allaying bladder inflammation, but for washing out thick pus or débris it is useless. Great care must be exercised when pursuing continuous irrigation not to overfill the bladder, and to see that the outflow is unobstructed.

For continuous irrigation, two-per-cent. boric acid, five per-cent. ichthyol, normal saline solution, or Thiersch's boro-salicylate mixture can be used with safety.

(*c*) Direct washing through a speculum in the urethra is of service when the bladder contains foreign matter, clotted blood, thick mucus, or shreds of tissue which would obstruct the outflow of urine and plug up a catheter. Insert a No. 8 or 10 cylindrical speculum, and through it introduce a straight glass irrigating nozzle of small calibre, and to this attach a rubber douche bag filled with a mild solution. Raise the douche bag high enough to insure a fairly strong outflow; direct the stream toward any collection of pus, etc., and in this way break up and wash out through the speculum, alongside the nozzle, such material as will pass out in no other way. Under no other circumstances ought hydrogen peroxide (two or three per cent.) to be introduced into the bladder. If it is applied, however, through a speculum, its action can be closely observed, and further it can be applied to any particular part of the organ. This plan of irrigation commends itself also in such cases as call for the use of the speculum for direct local application to the diseased mucous membrane.

(*d*) Instillations.—The introduction into the bladder of small quantities of a medicated solution, which is to be left in for from ten to thirty minutes, in order to secure a more protracted action, has been practised with success by Guion, of Paris. He uses for this purpose solutions of bichloride of mercury, 1 to 4,000 or 1 to 5,000, increasing the strength and quantity of the solution from time to time. From 2 to 5 gm. are slowly injected from a rubber syringe, and allowed to remain in the bladder for from fifteen to thirty minutes. Ten to twenty minims of pure ichthyol, or a two-per cent. silver nitrate solution, can be injected every fourth day in the same way. This plan is especially useful in gonorrhœal or other forms of trigonitis, or where there are localized inflammatory areas too large for local applications. Emptying and washing out the bladder must always precede instillations.

3. Direct applications to the diseased area through a speculum in the urethra affords a means of medicating localized inflammatory areas and circumscribed tuberculous patches and ulcers. A pledget of cotton is wound upon a slender applicator, dipped in the solution—moistened, not saturated—and applied directly to the diseased

spots. Silver nitrate, thirty grains to the ounce, will often cause considerable temporary pain or tenesmus; if it does, a ten or twenty grain solution must be used for subsequent applications, every four or five days. Pure ichthyol applied in the same way causes less burning, in many cases promotes more rapid healing of ulcers, has a very beneficial effect upon any portion of the mucosa to which it may be applied, and exhibits a marked effect in reducing pus formation.

Operative Treatment.

Emmet's Button-Hole Operation.—In some cases of cystitis which persist in spite of active treatment, and in others in which such treatment is impracticable, the bladder can be put at rest and perfect drainage obtained by the establishment of an artificial vesico-vaginal fistula.

Operation: Incise the bladder in the manner described for the removal of vesical calculi, and with a continuous catgut suture unite the vesical mucous membrane to the vaginal mucosa around the whole circumference of the opening. This will prevent spontaneous closure of the opening. Protect the vulva and thighs by an ointment, and give vaginal douches two or three times daily. If the thighs become excoriated, avoid the use of soap, and apply a two-per-cent. solution of silver nitrate once or twice daily.

When in the course of several months the cystitis has subsided, the edges of the fistula should be freshened and the fistula closed.

Clark's Vesical Balloon Treatment.—Kelly says that Dr. J. G. Clark's balloon treatment is applicable to all chronic cases in which the disease is not so far advanced as to render any active local interference dangerous, on account of the weakened condition of the patient. The plan, in brief (see Johns Hopkins Hospital Bulletin, February–March, 1896), consists of:

1. Cocainization of the external urethral orifice.
2. Introduction of No. 10 vesical speculum. Patient in knee-chest position.
3. Rolling the rubber bag into cigarette shape, and coating it with ichthyol-gelatin.
4. Introduction and dilatation of the bag, to the point of extreme tolerance; the bag to be allowed to remain in situation for from ten to twenty minutes.

Precautions.—The external meatus must be carefully cleansed, the hands of the operator thoroughly scrubbed and disinfected, and the solution sterilized.

The introduction and distention of the bag produce considerable tenesmus, and the after-pain necessitates the use of opium suppositories; but vesical irritation is said to diminish from day to day as the treatment is persevered in, and the bladder mucosa assumes a more nearly normal appearance.

Curettage of the bladder through the larger-sized speculum, through the vaginal incision, or through a suprapubic opening, has been successfully practised for the cure of a tuberculous ulcer and an intractable cystitis involving the superficial layers of the mucosa. It has also been used successfully in removing a limited area of diseased mucous membrane, which is afterward rapidly replaced by healthy tissue. First determine by previous cystoscopic examination just what portion of the bladder must be attacked. Place the patient in the dorsal position, insert the speculum, and thoroughly irrigate the bladder with saline or boric solution. Withdraw the speculum, introduce the curette into the bladder, and with the finger in the vagina for counter pressure, scrape the base and other predetermined areas. After curettage again irrigate the bladder, preserving shreds of the tissue for microscopic study.

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BLADDER OF THE MALE. (PATHOLOGICAL AND CLINICAL.)—Malformations.—The development of the bladder may be arrested at various stages in its progress. Occasionally the septum which divides the rectum from the bladder is wholly or partially wanting, so that they freely communicate with each other, or, in extreme cases, form together a large pouch (cloaca) into which the intestine and ureters open. This condition of things may be associated with imperforate anus. Entire absence of the bladder has been reported, in which case the ureters opened directly into the urethra.

The most common fault of development, however, is the absence of the anterior vesical wall. This deformity, known as *exstrophy of the bladder*, is far more common in males than in females. It consists in a failure of union of the two halves of the body along the abdominal surface. The anterior wall of the bladder, and the abdominal wall over it, are wanting, and the pubic bones are generally separated by a considerable interval. The posterior vesical wall is consequently exposed to the air, and is pressed forward by the intestines behind it, thus forming a prominent tumor which may reach the size of the palm of the hand. This bulging bladder wall, owing to the constant irritation to which it is subjected, is much reddened and inflamed, and is usually covered with stringy alkaline mucus. In the lower part of this protruding mass may be seen the openings of the ureters, which are revealed by the constant little jets of urine escaping from them. They are sometimes much dilated. The rudimentary penis, which is always in a condition of complete epispadias, usually exists merely as a slight prominence, but may be of considerable size. It sometimes even retains a considerable power of erection, a point to be considered in the fitting of an apparatus. In connection with exstrophy are associated not infrequently herniæ of one or both sides. In the female, exstrophy is generally complicated with prolapse or procidentia uteri.

If the fault of development be not so extensive as in complete exstrophy, the abdominal walls may unite entirely up to the umbilicus, which fails to close and leaves a fistulous communication with the bladder through the still patent urachus. An even lesser degree of the same deformity is represented by a prolongation of the bladder up into the lower portion of the urachus. Sometimes the canal may be shut off from the bladder and form a cyst, or a series of cysts.

The suffering in a case of complete exstrophy is usually very great.

The treatment may be briefly summarized under three heads:

I. *Treatment by Apparatus.*—This method is applicable to—

1. All cases in which the defect is moderate and the condition of the patient is not sufficiently distressing to lead him to desire operation.
2. Cases in which plastic operations have been tried and have failed.
3. Cases in which the coexistence of other disease makes any operation inadvisable.

The rubber urinals manufactured for these cases are unsatisfactory, as they press upon and irritate the mucous membrane. The best apparatus is a silver or German silver shield, which arches over and protects the bladder, with a dependent portion into which the urine runs, and which communicates by a tube with a rubber bottle strapped against the leg. In order to get a well-fitting apparatus, it is a good plan to have first made a flexible, metallic ring, large enough to encircle the bladder. This is then bent and adapted to the inequalities of the surface, and, finally, the edge of the shield is fitted and soldered to it. The whole is held in place by a belt and perineal straps.

II. *Treatment by Plastic Operations.*—The utmost that we can reasonably expect to gain by any plastic operation for the relief of exstrophy is the greater comfort of the patient and greater ease in fitting apparatus. A truly retentive bladder cannot be obtained, and while the mortality of these operations is commonly supposed to be insignificant, Martin and Taylor believe it to be as high as thirty to forty per cent., so that it is obviously unwise to expect brilliant results from operations of this class. Plastic operations may be divided into two classes:

1. Those in which the skin of the abdomen is used in making the anterior bladder wall.

The flaps may be taken from a variety of sources, but the most satisfactory is Wood's operation, by which a flap large enough to cover the defect is taken from above and turned down so that the skin surface is innermost,

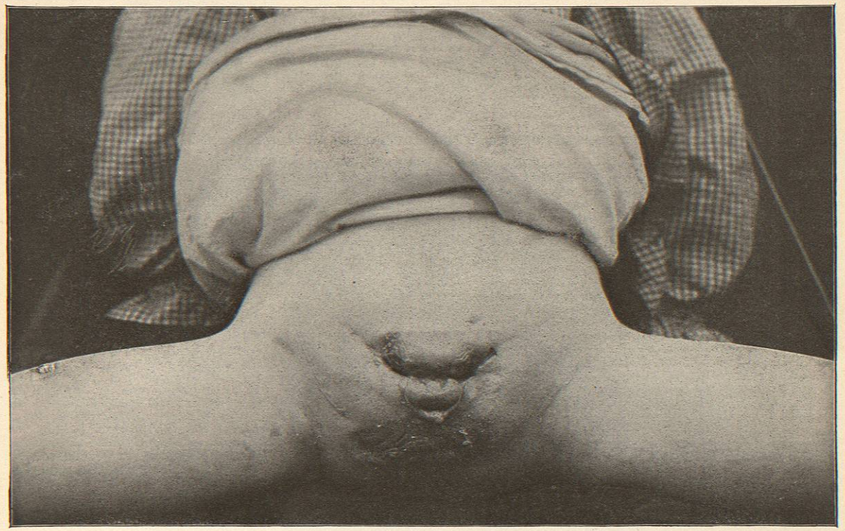

Fig. 496.—Exstrophy of Bladder in the Male (case of Dr. C. B. Porter). Boy of five years. Complete exstrophy. Penis rudimentary, showing condition of epispadias. Both testicles undescended and double inguinal hernia. Loose puckered skin below penis is the scrotum, and suggests the possibility of using it as a skin flap to cover the defect.

and stitched in position. The raw surface of this flap may be covered by flaps drawn over it from the sides, by skin grafts, or left to granulate.

The objections to all operations in which the skin is used to restore the defect are the great tendency to calculus formation and the danger of irritation from hair growing into the bladder.

2. Those in which the mucous membrane alone is utilized. These operations depend on the possibility of getting enough mucous membrane to make a continuous canal from the openings of the ureters to the base of the penis. The urethra is then restored by an operation for epispadias, and thus in some cases the problem of fitting a urinal may be greatly simplified and the discomfort of the patient proportionately lessened. In selected cases this is an excellent procedure.

III. *Radical Cure by Implantation of the Ureters into the Bowel.*—The unsatisfactory results obtained by plastic operations and the discomfort incident to all forms of apparatus have led to attempts at radical cure of the condition by the removal of all that remains of the bladder wall and suturing the ureters into the bowel. The advantage of such an operation is the entire relief from the discomforts incident to the condition. The bowel soon becomes accustomed to its new function and the urine is passed at intervals closely approaching the normal. The dangers are twofold: those arising from the immediate effects of the operation and those resulting from infection of the kidneys by intestinal bacteria. The immediate mortality of the operation is by no means small, and though the statistics on the subject are too meagre to warrant a definite opinion, it is probably not far from that of other operations involving resection of the bowel. The more remote effects are those resulting from infection of the kidneys, and it is upon this issue that the ultimate value of the operation must be decided. The protection of the normal ureter from infection from the bladder is largely due to the anatomical arrangement by which the distention of the bladder closes the orifices of the ureters. This cannot be reproduced artificially and it has proved the most serious stumbling block. The tendency of the operation to produce stenosis of the lower end of the ureter, resulting in dilatation of the ureters and pelves of the kidneys, probably favors infection in the same way in which retention of urine favors the occurrence of cystitis.

The procedure is still too much in the experimental stage to permit of a positive opinion being given, but we cannot but regard it as an operation so dangerous as to be applicable only to a limited class of cases. Children