

with punctate hemorrhages if the inflammation has been of considerable intensity. Streaks of viscid mucus cover to a greater or less degree the inflamed surfaces. These appearances may be confined to the neighborhood of the urethral opening (partial catarrh, catarrh of the neck of the bladder), or may be diffused over the whole mucous membrane (universal catarrh). Even in this latter case, however, the evidences of inflammation are usually most marked about the urethra and trigone.

A loss of the superficial epithelium (erosion) sometimes occurs, and this is occasionally associated with the formation of false membrane (croupous inflammation). A severe inflammation sometimes leads to ulceration which may be diphtheritic in character. Rarely sloughing of considerable portions of the mucous membrane, and also of the muscular coat, follows long retention. When inflammation extends to the deeper layers of the bladder, the tissues are much thickened and infiltrated with pus, which may lead to the formation of abscesses. These may extend outward through the surrounding cellular tissue, and open spontaneously into the vagina, rectum, neighboring coil of intestine, or into the peritoneal cavity. Occasionally, however, they perforate the mucous membrane, and open into the bladder itself.

Dr. Samuel Alexander has described a condition known as nodular or follicular cystitis. It is characterized by intense congestion and the appearance, especially in the region of the trigonum, of hyperplasia of lymph nodes, somewhat resembling the condition of the ileum in typhoid fever.

A long-standing catarrh causes a brown or gray discoloration of the mucous membrane, often with considerable dilatation of the veins, especially about the urethral opening. The surface is covered with muco-pus which is often extremely viscid and adherent. The mucous membrane and parts beneath are much thickened and infiltrated. If an obstruction has been the primary cause of trouble, the muscular coat of the bladder is greatly hypertrophied and forms interlacing bands which stand out like the columnæ carneæ of the heart (*cessie à colonne*). At the same time that the bladder is thus thickened, it is often also dilated (eccentric hypertrophy). Little herniæ of the mucous membrane, between the fibres of the muscular coat, are not infrequent. Lastly, inflammation of the bladder may be tuberculous in character, in which case the mucous membrane of the bladder, the prostate, ureters, and even the pelves of the kidneys may be the seat of characteristic ulcerations.

Clinical History.—In cystitis the most prominent, almost unailing, symptom is a *frequent desire to urinate*. This varies greatly in degree, from a slightly increased frequency of micturition which escapes notice to an almost constant, painful tenesmus of the bladder, compelling straining efforts which accomplish only the voiding of a few drops at a time. This symptom is in no sense pathognomonic, as it is common to all affections which increase the irritability of the neck of the bladder. The symptom next in importance is *pain*. This may be very slight, and felt only just before and at the end of micturition. It may, however, be almost constant and severe in character. The pain is ordinarily referred either to the hypogastrium, the perineum, or the end of the penis, but when severe assumes a lancinating character, shooting down the thighs, through the lumbar and sacral regions, and to the testicles. Pain referred to the hypogastrium, especially if accompanied by tenderness in that region, is usually indicative of inflammation affecting the body of the bladder. When the neck of the bladder is especially affected, the pain is referred to the perineum and to the end of the penis. These two prominent symptoms are usually accompanied by some *fever* in cases of acute universal cystitis. In inflammation of the neck of the bladder fever may be present, but is often slight or entirely wanting. In chronic cystitis there is ordinarily no febrile reaction. *Retention of urine* occurs rarely as a complication: it is most common in cystitis following gonorrhœa, when a deep urethritis ex-

ists, and it is then due to a spasmodic contraction of the constrictor urethræ muscle.

Constipation is almost always present, and not only do the difficult movements of the bowels greatly aggravate the pain in the bladder, but experiments would suggest that the condition may favor a fresh supply of infectious organisms from the intestine.

Cases of chronic cystitis, dependent upon conditions which cannot be removed, run a protracted course with many ups and downs. Errors in diet, exposure to cold, over-exercise, or any excess in alcoholic liquors or in sexual excitement, bring fresh accessions of inflammation, which are recovered from with ever-increasing difficulty, especially at an advanced age. Finally, some serious complications, such as inflammation of the pelvis and secreting portion of the kidney, ulceration, possibly diphtheritic, of the bladder wall, formation of an abscess, septicæmia or uræmia, appears and quickly closes the scene.

The character of the urine is of great importance in supplying information as to the condition of the bladder. In a mild case, the urine may be acid and but slightly cloudy. When the urine is allowed to stand for some time a light sediment separates, consisting of muco-pus, with usually a considerable number of flat epithelial cells. As the cystitis increases in severity, the urine becomes more and more turbid, from the increasing amount of pus; and in addition to the squamous surface epithelium, rounded cells, derived from the deeper layers of the bladder mucous membrane and from the prostatic urethra, make their appearance. If, finally, alkaline fermentation occurs, the urine acquires a pungent ammoniacal smell, and the pus assumes a thick rosy consistency. Bacteria are also present in great number, giving a cloudy appearance to the urine even after the pus has settled out of it. Strongly ammoniacal urine causes the pus cells to swell to several times their natural size, and finally to dissolve. Casts, if present, are similarly dissolved, a fact which should be borne in mind when examining for evidence of coincident kidney disease. Blood corpuscles may be present in cases of cystitis of some severity, but in ammoniacal urine are quickly dissolved. The blood-pigment in this case imparts a brown or smoky color to the urine, which is quite characteristic.

Occasionally blood in considerable quantities may be passed and easily recognized. Besides these cellular elements many crystals are found in the urine of cystitis. In strongly acid urine, crystals of uric acid or oxalate of lime are not infrequent. If they are in considerable quantity, and especially if of large size, they may be suspected as the possible predisposing cause of the inflammation. In ammoniacal urine, the crystals usually found are those of triple phosphate and urate of ammonia, with which are often associated amorphous phosphates in a finely granular form. If the bladder inflammation takes on a diphtheritic character, bits of discolored diphtheritic membrane may appear in the urine. Gangrenous inflammation of the bladder wall, which is usually the result of severe injury, long-continued pressure, or of the breaking down of a new growth, gives the urine an excessively fetid character. The admixture of blood more or less decomposed gives it a brownish, smoky, or green color, and the sediment contains much granular matter and large granular corpuscles, besides the various cells and crystals found in severe cystitis. Occasionally, especially as a result of long-continued pressure, considerable portions of the mucous membrane are thrown off, and may be recognized as such in the sediment. In the case of a sloughing new growth, characteristic forms (villi) can frequently be found under the microscope.

Interstitial (parenchymatous) cystitis causes a train of symptoms much more severe than those occasioned by a simple catarrhal inflammation. There is ordinarily high fever, sometimes accompanied by chills. The inflammatory infiltration of the bladder walls stiffens them, and by hindering their contractions makes complete expulsion of the urine impossible. The ureters, or the urethra, may be obstructed by abscesses, or by inflam-

matory swelling about the orifices. If an abscess breaks into the bladder, the appearance of a greatly increased quantity of pus in the urine is followed by a decided improvement in symptoms. If the opening takes place into the intestine, the symptoms also improve, although they may speedily resume their serious character if the intestinal contents get into and infect the abscess cavity. If the pus finds its way into the perivesical connective tissue, it may work outward and point either above the pubes or in the perineum, in which case its approach to the surface is heralded by preceding œdema and induration. Occasionally, perforation takes place into the peritoneal cavity, and speedy collapse and death is the consequence. Infiltration of urine is a very rare consequence of inflammatory rupture of the bladder wall, and its spread is limited by the attachment of the pelvic fascia along the brim of the pelvis. A localized pelvic abscess may thus be formed and require drainage.

Diagnosis.—The diagnosis of a cystitis is usually a matter of tolerable ease, if the symptoms and the condition of the urine are carefully inquired into.

Pure neuroses of the neck of the bladder, which may cause similar subjective symptoms, do not cause the alterations in the urine which accompany inflammation.

Pyelitis, which also gives rise to pus in the urine, is to be distinguished by pain and tenderness in the kidney region and by a temperature higher than that of an uncomplicated cystitis. The presence in the urine of small caudate cells from the pelvis of the kidney is important, but their identification is a matter of some difficulty. The discovery of casts is always extremely suggestive, especially in the presence of other symptoms of pyelitis. Cystitis occurs, however, not uncommonly with pyelitis, so that the symptoms of the two diseases may complicate each other.

Urethritis is usually to be distinguished by the symptoms and by the presence of a urethral discharge. Occasionally, however, an inflammation in the deep urethra may present features of similarity with cystitis. If, in such cases, the urine is passed in two portions, which are received in different vessels, the pus will be contained in the first part if the urethra alone be affected.

Prostatitis resembles in many symptoms a partial cystitis. The pain of prostatitis is, however, referred to the rectum more than is the case in cystitis. The test of passing the urine in two or even in three portions shows that the inflammation is anterior to the bladder, and, finally, palpation of the enlarged hot and tender prostate through the rectum completes the diagnosis. The coincidence of prostatitis with cystitis is not uncommon and should always be considered.

The character of the urine gives, as has been shown, valuable information as to the severity and character of the inflammation. Croupous, diphtheritic, and gangrenous cystitis can generally be merely suspected, although shreds of tissue may sometimes be obtained and put the matter beyond doubt. Interstitial cystitis may sometimes be definitely made out when the posterior bladder wall is affected and can be felt through the rectum. The bladder may even form a defined tender tumor which can be felt from without. Usually, however, this condition can be surmised only from the history and the severity of the general symptoms. The formation and opening of an abscess would be confirmatory.

Prognosis.—Acute cystitis, when not dependent upon some previously existing chronic condition, may with proper care run its course in from two to three weeks. It is rarely severe enough seriously to threaten life. Chronic cystitis, if dependent on some curable condition (stone, stricture, etc.), may be recovered from after the removal of the predisposing cause, provided that the long duration of the malady has not induced permanent organic changes in the bladder wall.

Advanced age and a weak constitution render the prognosis much less favorable. When the disease is the result of some condition which cannot be removed (enlarged prostate, tuberculosis, inoperable tumor, etc.), recovery cannot be expected, although a considerable

amelioration of symptoms may be accomplished by appropriate and thorough treatment. The appearance of phlegmonous, diphtheritic, or gangrenous inflammation, with or without the formation of abscesses, makes the prospect of recovery extremely doubtful.

Prophylaxis.—Many cases of cystitis could no doubt be avoided by intelligent care. Careful management of an acute gonorrhœa, or of a stricture or enlarged prostate, would often enable the patient to escape the cystitis which they so frequently induce. The most important prophylactic measure, however, is a thorough observance of aseptic precautions in any and all operative procedures upon the bladder. All metal and rubber instruments should be thoroughly cleaned and boiled immediately after using, and should then either be kept in an aseptic case or cleaned again immediately before using. The problem of cleaning gum elastic and webbing catheters is more difficult, and they can rarely be used with safety more than a few times. They should be cleaned with soap and water to remove the oil and then washed carefully with corrosive sublimate 1 to 1,000. Recent methods of sterilizing catheters with formaldehyde vapor appear to be satisfactory and if further experience proves such to be the case, it will add much to the safety of urethral surgery.

In all cases in which there is any doubt as to the healthy condition of the urethra it is wise to give it a preliminary washing with some mild antiseptic, and in cases in which urethritis exists, it is well to repeat this after the use of any instrument.

Of the great variety of lubricants one should be selected which is aseptic and non-irritant. Most of the antiseptic lubricants, and especially those containing carbolic acid or eucalyptus oil, are irritating. Simple vaseline put up under aseptic precautions in collapsible tubes is perhaps as useful as any. If it is desired to have a lubricant which will remain sterile even though exposed to the air, boric acid may be added in the proportion of 5 i. to 3 i.

Treatment.—In acute cystitis, whether universal or partial, the thing of first and greatest importance is rest. Rest should be absolute in bed, in a horizontal position, or with the hips slightly raised. The bladder, irritated and intolerant of its contents, should be soothed by full doses of some anodyne to lessen as much as possible its over-excitability, and to quiet its constant spasmodic activity. The anodyne is usually best administered in the form of a suppository, a favorite combination being opium or morphine, with either hyoscyamus or belladonna. Not infrequently, however, it will be found wise to give the anodyne by the mouth, as rectal absorption is slow and sometimes unsatisfactory. If the pain is due mainly to the spasmodic action of the bladder, hyoscyamus or belladonna sometimes suffices to relieve it, and when either of these is efficient it is preferable to opium, which is objectionable from its constipating properties, even when it does not disagree with the stomach. Codeine will also be found useful, especially in the less severe cases. If, however, hyoscyamus, belladonna, or codeine do not control the pain, opiates should at once be resorted to; and these should be given in full doses, as a really curative effect is to be expected from the relief of spasm.

Heat, wet or dry, over the hypogastrium and perineum will often be of use, and if well applied will accomplish more than a hot hip-bath, which is commonly used, but which has only a transient effect. A hip-bath, if given, should be very hot, and the patient should be in it but a few minutes (four or five at the outside), as the necessary position, if maintained for any length of time, favors congestion of the pelvic organs, and to a great extent counteracts the otherwise good effects of the heat.

Medicinal treatment intended to modify the condition of the urine may be beneficial in two ways: first, by increasing the amount and consequently diluting the urine; and, second, by affecting the reaction and rendering it a less favorable medium for the growth of bacteria.

The most simple and generally an efficient method of

increasing the amount of urine is to urge the patient to drink at least two quarts of water or milk in the twenty-four hours; if more can be taken, so much the better. To this may be added cream of tartar water, or citrate of potassium, both of which are mild diuretics and tend to stimulate the action of the kidneys. In this way the amount of urine can generally be kept sufficiently large markedly to dilute it. The vegetable diuretics, buchu, triticum repens, uva ursi, etc., are less used now than formerly, and they are not notably more efficient than the milder measures above mentioned.

Of the drugs which owe their power to the fact that they are excreted in some form in the urine, benzoate of sodium, boric acid, sandalwood oil, and urotropin are the most valuable. If the urine is ammoniacal, as is not infrequently the case, its irritating properties are thereby much increased, and the use of some drug to render the urine acid is distinctly indicated. The most efficient are benzoate of sodium and boric acid in doses of from gr. v. to x. every three to four hours, according to the reaction of the urine and the tolerance of the patient. Sandalwood oil has a soothing effect, especially when the inflammation is most marked about the neck of the bladder, but it is taken with difficulty by some patients and should always be given in capsules.

The introduction of urotropin is so recent that a definite opinion in regard to its value cannot be given. It owes its value to the fact that it is excreted in the urine as formaldehyde and thus inhibits the growth of bacteria.

The work of M. W. Richardson has shown that it is very efficient when used against the typhoid bacillus in the urine, and a somewhat limited clinical experience suggests that it may prove a valuable addition to the list of urinary antiseptics.

Besides this strictly medicinal treatment, the diet should be carefully regulated, only bland, unirritating articles of food being allowed. Alcohol in every form should be interdicted, and tea and coffee should be avoided or taken very much diluted. The bowels are to be kept gently open, and especial care in this direction is needed when opiates are being used.

When the inflammatory process is being combated in this manner, the predisposing cause of the cystitis should be sought for and if possible removed. If an irritating diuretic is being taken it should be stopped. A rheumatic or other constitutional cause should receive appropriate treatment. Retention of urine, if it exists, should be relieved by the use of a catheter. When, however, the cause of the cystitis is one which requires an operation for its removal (calculus, stricture, etc.), it is usually best, unless in case of emergency, to defer interference until the acute stage of the disease is past.

If the inflammation is so severe as to involve surrounding parts and to give rise to pericystitis, the appearance of abscesses must be watched for with great care, as their early detection and evacuation is of cardinal importance.

Ordinarily an acute cystitis yields to careful treatment, and recovery is complete. If, however, the acute condition does not subside under treatment an examination should be made to discover whether there is not some underlying cause, as calculus, tumor, stricture, or enlarged prostate, which must then receive the appropriate treatment.

Almost all cases of subacute or chronic cystitis, especially when associated with foul, decomposing urine, are to be greatly benefited by thorough irrigation; and this measure may even be employed in acute cases if the urine assumes a fetid character.

When properly performed this washing out of the bladder usually does much good, but if done carelessly or improperly it may cause serious harm.

Sir Henry Thompson directs that no more than two ounces of fluid shall be thrown into the bladder at one time. This rule is a good one in cases of acute cystitis, or when the bladder is greatly contracted or especially irritable. In many chronic cases, however, it is not only

safe, but wise to somewhat distend the bladder with the injected fluid, the object being to spread out the folds of the mucous membrane so as to insure the thorough removal of fermenting mucus and the contact of the irrigating fluid with all parts of the bladder wall. If the injection is made slowly, the bladder ordinarily tolerates the distention well.

With regard to the injecting apparatus, a syringe forces the fluid in with irregular, intermittent force, and imperfections in the valves make it often a matter of uncertainty whether the proper amount has flowed into the bladder or not. These disadvantages are avoided by the use of a fountain syringe; and if a clear glass bottle is used as the reservoir, it can be easily kept clean, and the exact amount of the fluid which flows into the bladder can be readily seen and exactly measured by a scale fastened upon the side of the bottle. The force of the stream is to be regulated by adjusting the height of the reservoir above the bladder. This should never be greater than from one to two feet, or the bladder may be subjected to a dangerous strain. It is also important to stop injecting the moment the patient feels the least desire to micturate.

The simplicity of this apparatus is of great advantage in point of cleanliness, and patients quickly learn to manage it for themselves.

The catheter used should be of soft rubber, if such can be introduced; if not, that form which passes with least irritation is the best, whether bulb-pointed or coudée, gum-elastic (English) or silver. A double-current catheter is less good than one with single calibre, for the continuous stream does not cleanse the bladder so quickly as is done by alternate filling and emptying, and the necessarily small size of the escape tube in a double instrument prevents the ready exit of thick pus or mucus. The bladder may also be irrigated without the use of a catheter by means of a fountain syringe with an olive-tipped nozzle. This is held tightly against the meatus and the fluid allowed to distend the urethra, which will "balloon" out as far as the triangular ligament. In this way the anterior urethra may be thoroughly washed, and then by raising the douche bottle higher, sufficient pressure may be obtained to overcome the resistance of the compressor muscle and the fluid will run back into the bladder. The whole operation is carried out without introducing any instrument beyond the meatus, and this method of irrigation has of late found considerable favor among surgeons in some parts of the country. Many drugs are added to the injection fluid, either with the object of disinfecting the contents of the bladder or of acting topically upon the mucous membrane.

The most useful solutions with which to irrigate the bladder are a solution of borax (biborate of sodium), a drachm to the pint; boric acid one per cent., and chloride of sodium two drachms to the pint. The stronger antiseptics, as corrosive sublimate and carbolic acid, are too irritating to be often useful. Occasionally when the secretion of pus and mucus is very abundant, and especially in chronic cases, permanganate of potassium 1 to 5,000 to 1 to 10,000 will be found useful for its astringent action.

In phosphaturia very dilute hydrochloric or nitric acid (one or two drops of strong acid to the fluid ounce of water) may assist by their solvent and astringent action.

Lastly, we come to speak of nitrate of silver, which if properly used is productive of much good, but if abused or improperly employed may do decided harm.

An obstinate chronic cystitis which does not yield to milder measures is sometimes greatly benefited by the use of a weak solution (one-tenth to one-fifth per cent.) of nitrate of silver. This gives the best results when it is used every second or third day, some milder injection being substituted on the intermediate days. The amount of pus is usually very decidedly diminished by these applications.

Occasionally, it happens that adhesive mucus so clogs the eye of the catheter as to prevent the escape of the urine. This may be removed by attaching a rubber tube full of water to the catheter and then dropping it

free end into a vessel upon the floor. The weight of this column of water usually exerts sufficient suction to draw out the obstructing mucus.

In chronic cystitis, the local treatment is more to be relied upon than medication.

In the majority of cases the measures that have been suggested will accomplish, if not a cure, at least a palliation of symptoms which brings comparative comfort to the patient; occasionally, however, a case is met with in which the bladder has suffered such decided organic changes that the passage of urine through it, with its alternations of expansion and contraction, is sufficient to keep up an aggravated inflammation. In spite of every care the patient begins to suffer from septic absorption, and death seems imminent.

Under such circumstances, constant drainage by means of a catheter should be tried. This will often have the effect of giving the bladder the desired rest and allowing the reparative process to begin. If this is not successful, cystotomy holds out a last hope. An opening through the perineum, by providing drainage and rest to the bladder, allows it time and opportunity to recover itself. This treatment was first applied to a case of this sort by the late Dr. Willard Parker, of New York, in the year 1850.

The necessary opening may be made either laterally through the prostate, as in lithotomy, or may enter the membranous urethra through the middle line, and through this opening the prostatic urethra may be readily dilated with the finger so as to admit the introduction of a good-sized tube. The latter method has the advantage of injuring no important structures, whereas the former promotes more thorough drainage. Whenever an incision through the perineum is practised it should be made the opportunity for a thorough exploration of the bladder, as an unsuspected cause for the cystitis may sometimes be found.

STONE IN THE BLADDER.—The stones which are commonly found in the bladder may be roughly divided into uric acid, oxalate of lime, and phosphatic calculi. A stone composed wholly of any one of these constituents is, however, not common, the usual condition being a mixed form, in which a uric acid or oxalate of lime nucleus is covered by a phosphatic crust; sometimes a succession of layers may be formed by alternating deposits of different components. The phosphates are almost always combined with alkaline urates and carbonates. Other substances, such as cystin and xanthin, in rare instances form concretions in the bladder.

For purposes of surgical classification, calculi may be divided into those which form in an acid and those which form in an alkaline urine. The former class includes the uric acid and oxalate of lime stones, while the soft concretions, composed mainly of phosphates, belong to the latter.

The researches of Rainey, Harting, Ord, Ebstein, and others, indicate that the formation of stone is not a simple process of deposition of salts existing in excess in the urine. Indeed, instances are of everyday occurrence in which uric acid, the urates, oxalate of lime, or the phosphates are present in solid form for long periods of time in the urine without leading to stone formation. The investigations of these observers have shown the crystalline substances of the urine to follow the law of 'molecular coalescence' laid down by Rainey and elaborated by later observers; which is briefly, that 'in the presence of colloid or albuminoid substances crystalline materials become spheroidal in shape and coalesce in rounded form.' Following this law, in the urinary passages crystals of uric acid in their usual rhomboidal shape may for long periods be thrown down, washed along, and passed out with the urine without showing any tendency to form concretions. Finally, the irritation of the urinary tract leads to the exudation of albuminoid material, which, acting on the crystals, changes their molecular form and creates in them the tendency to coalesce. The necessary albuminoid material may be supplied in other ways. Necrotic bits of tissue are, as is

well known, likely to be encrusted with lime salts. Masses of bacteria and bits of blood clot are also found in stones, but what part they play in the formation of the stone is not clear. The concretion, once started, continues to act as an irritant to the wall, and so continues to be supplied with an albuminoid envelope, in which successive layers of spheroidal crystals are deposited."*

The formation of phosphatic stones is almost invariably the result of inflammatory conditions in the urinary tract leading to alkaline fermentation of the urine.

Calculi may form in any part of the urinary apparatus. When they originate in the kidney they usually find their way, sooner or later, into the bladder. This may be accomplished painlessly, or may be accompanied by severe pain (nephritic colic).

After reaching the bladder they either pass out through the urethra and cause no further trouble, or they remain and gradually increase in size until their presence is revealed by the symptoms to which they give rise. Their detention in the bladder is rendered extremely probable when some obstruction to micturition has caused dilatation with residual urine, or when sacculation of the bladder exists. A stone thus retained in the bladder continually grows by accretion. So long as the urine remains unchanged, the character of the stone continues the same; when, however, the urine, formerly acid, becomes alkaline from the occurrence of fermentation, the soft salts (phosphates, etc.) are deposited on the hard basis of calcic oxalate, or uric acid.

Stones usually occur singly, but sometimes many, up to several hundreds, are found in one bladder.

Single calculi are moulded into a more or less oval form by attrition of the vesical walls. The surface may be tolerably smooth, as is often the case with uric acid calculi, or rough and granulated, as is more commonly seen in phosphatic stones; and finally, those composed of oxalate of lime are usually covered with rough, often sharp projections, giving them a knobby, irregular outline, which has suggested their distinctive name of mulberry calculi. When many calculi exist together in the bladder, they are usually smoothed and faceted by mutual attrition.

Stones vary greatly in size and consistency. Very large concretions were much more common formerly than now, when they come earlier to operation.

Phosphatic stones are usually soft and friable, though they may sometimes have considerable hardness. Uric acid makes firmer calculi, which are, however, tolerably brittle. The hardest stones are those made of oxalate of lime, and they may occasionally resist any but the most powerful lithotrites.

Stone in the bladder is often hereditary. A gouty or rheumatic diathesis, by favoring the production of acid urine, fosters the tendency to stone.

The habitual use of liquids or articles of food that easily ferment and give rise to acidity may increase the chances to stone formation. That the quality of the drinking water (presence of lime salts) has any influence, is not proved.

The geographical distribution of stone seems to be independent of any climatic or geologic influences.

Dr. Keyes believes that the prevalence of stone in certain localities is to be in great measure accounted for by the hereditary nature of calculous disease, fostered by more or less close intermarriage.

Thompson states that stone is common in the children of the poor, but rare among old persons; whereas among the rich this state of things is reversed and the children are exempt, while their elders are oftener afflicted.

Symptoms.—The symptoms of stone in the bladder are: First, pain. This is especially severe at the end of micturition, when the bladder wall closes down upon the rough surface of the calculus. The pain is referred either to the end of the penis, or to the perineum and

*From author's article in Morrow's "System of Genito-Urinary Diseases, Syphilology, and Dermatology," vol. 1.

rectum. It is usually much increased by violent movements or jolting, as in riding. Secondly, *frequency of micturition*, which may or may not be diminished by rest in bed. Thirdly, *hematuria*. The presence of blood in the urine is intermittent. The water may be of a wine-red or smoky color, or the blood may be contained in the last few drops of urine passed. Hemorrhage is likely to appear after exercise or jolting. When these important symptoms are present, inquiry will often discover a history of previous attacks of renal colic, or of the appearance of gravel in the urine.

As confirmatory symptoms may be mentioned, sudden stoppage of the stream in the midst of micturition, caused by the stone falling against the urethral opening, and in children an elongated prepuce, owing to constant pulling in the effort to relieve pain felt at the head of the penis.

A bimanual examination between the hand over the pubes and the finger in the rectum will often reveal the presence of a stone of any size.

The diagnosis is rendered complete by a thorough exploration of the bladder with a sound. For this purpose a metallic instrument should be used, with a short beak curved to an angle of about 135°, which, by allowing freedom of motion in the bladder, makes a much more thorough examination possible than with an ordinary curved catheter. Sometimes a stone that evades the sound may be caught with the lithotrite and its presence thus demonstrated. The lithotrite also affords the most accurate method of determining the size of a stone; and by dropping it and seizing it again several times the dimensions may be measured in several diameters. When a stone is caught in the lithotrite, it should be firmly held and the instrument with the stone in it should then be used for a further search, to determine whether more than one stone be present.

It is well during an exploration, especially in a difficult case, to vary the amount of water in the bladder, as a concretion, difficult of detection in a full bladder, may be easily found in an empty one, and *vice versa*.

Occasionally it happens that in a sacculated or otherwise misshapen bladder a calculus will evade detection by most thorough and skilful sounding. For these cases Professor Bigelow has pointed out the value of the litholapaxy pump and tube. The current of water searches out and brings the calculus to the tube with a characteristic click which cannot be mistaken or overlooked.

Examination by the sound may be rendered difficult by stricture of the urethra, which if not passable for an instrument of fair size will require dilatation, divulsion, or urethrotomy.

Enlarged prostate may greatly increase the difficulties of sounding, both by the resistance it offers to the entrance of the instrument and by reason of the sacculation of the bladder behind the prostate in which the stone may escape detection. This source of error is usually to be avoided if a sound with a short beak be used and so rotated that the point sweeps the base of the bladder. To accomplish this manœuvre the handle of the sound or searcher must be well depressed between the thighs, as otherwise its point catches on the floor of the bladder. The finger in the rectum may materially assist in this investigation. A bar at the internal urethral orifice may cause difficulties similar to those incident to an enlarged prostate.

Sacs and diverticula of the bladder occasionally make the detection of a stone by the sound alone very difficult, though often a careful search will finally carry the instrument into contact with some part of the calculus.

Extreme sensitiveness will often make an examination impossible without the aid of an anæsthetic.

The sources of error which must be considered in sounding are prostatic concretions, rough projections of the bladder wall, which may be covered with phosphatic deposits, and new growths which may be similarly incrustated.

A practised touch will usually lead to a decision between these conditions. The grating over a prostatic concretion is felt before the bladder is reached, and in a

case in which the doubtful sensation is felt within the bladder, a conclusion may usually be reached by the passage of a lithotrite and grasping of the stone if one exists.

Prophylaxis.—Soft phosphatic stones are, as has been said, dependent usually upon a local condition of inflammation of the bladder, and any treatment, by irrigation or otherwise, which reduces this inflammation lessens the chances of stone formation. Uric acid and oxalate of lime stones, on the other hand, are of constitutional origin, and indicate faults of assimilation and tissue change which are in a degree amenable to constitutional treatment.

When a tendency to uric acid formation is evinced by the appearance of crystals in the urine, or by any symptoms indicating a gouty diathesis, efforts should be made to counteract this tendency by strict attention to the patient's habits with regard to food and exercise. Sugar in every form is harmful in these cases, as are also all fatty articles of food, and these should accordingly be avoided. Over-indulgence in stimulating, highly seasoned dishes should be interdicted. Wine should be given up, and if the stimulant effect is needed, spirits, largely diluted, should be preferred. Systematic exercise should be taken—if possible, sufficiently violent to excite moderate perspiration, and the skin should be cared for by regular bathing and vigorous rubbing. If the patient be constipated, his bowels should be regulated, and this may well be done by a morning glass of Friedrichshall or Carlsbad water. Thompson recommends a long course of saline waters for these patients with uric acid tendencies, and regards their effect as due to a stimulant action on the liver. Whatever the *rationale* of their use, they are of undoubted benefit when a constipated habit exists.

Lastly, general tonics, such as strychnine and quinine, may be of great service when the general health is debilitated. Alkaline diuretics, by correcting the over-acidity of the urine, relieve local symptoms; but without the addition of general treatment the acidity returns quickly upon their disuse.

Treatment.—After the formation of a stone too large to pass through the urethra, its removal can be accomplished only by some mechanical expedient. The solvent action of alkaline or other remedies has never been shown to destroy a stone that had been proved to exist.

The choice of the operation appropriate to each case is to be decided both by the character of the stone and by the condition of the urinary organs.

Children stand the operation of litholapaxy very well. Occasionally the small size of the urethra makes this operation impossible, but, except in these cases, it is to be preferred to lithotomy.

The crushing of stone—lithotripsy—became a recognized operation in 1824 through the efforts of Civiale, who, although operating with inferior instruments, obtained successes which demonstrated the possibility of pulverizing stones with instruments introduced through the urethra.

After that time the operation was greatly improved in technique, and largely displaced the earlier operation of lithotomy. (For the history of its development, see under the head of *Lithotripsy*.)

In 1879 Prof. Henry J. Bigelow published a paper introducing the operation of litholapaxy (lithotripsy at one sitting, rapid lithotripsy), and so quickly did this procedure gain in favor that within a year or two of the publication of his first article it was a generally established practice; and the old operation of lithotripsy, without complete evacuation, had become a thing of the past.

Professor Bigelow showed that the tolerance of the bladder to instrumentation is much greater than had been supposed, and demonstrated the fact that there is less danger in an operation, even long and tedious, which results in the complete evacuation of a stone, than in the usual short and repeated sittings for its more gradual removal. In short, he proved that the greatest danger of lithotripsy is not from the use of instruments, but from the subsequent irritation of the mucous membrane by

the fragments left in the bladder. To facilitate the rapid crushing and removal of stones, he also introduced improved instruments, which will be described under the head of *Litholapaxy*.

With these instruments it is now possible to dispose of many stones that would formerly have been thought beyond the reach of lithotripsy, and it suffices to say that litholapaxy should be employed in all stone patients, except in cases falling under the following exceptions:

1. A very large and hard stone may resist every attempt at crushing.

2. A stone may have as a nucleus a foreign body, such as a piece of necrosed bone or a bullet, too hard to crush and too large to come through a tube.

3. An encysted stone may be out of reach of the lithotrite.

4. Some writers consider that stricture of the urethra may prohibit litholapaxy. This cannot often happen, for strictures, however close, yield readily to divulsion, which may be immediately followed by the crushing and evacuation of the stone. We have so often seen these two operations successfully done together upon an etherized patient that we cannot but think this the best practice. While it economizes time, it saves the patient much needless manipulation. When an impassable stricture exists, perineal section followed by perineal lithotripsy must be done.

5. The small size of the urethra in children may prevent the passage of instruments.

6. Hypertrophy of the prostate may occasionally render the passage of the lithotrite impossible and render lithotomy necessary.

7. False passages may exist, which so interfere with the introduction of instruments that the dangers of the operation are greatly enhanced, and the question of lithotomy is to be entertained.

8. The hip may be ankylosed in a position which interferes with the use of instruments.

In any of these exceptional cases, a cutting operation may be required, and a consideration of the various methods of performing such operations will be found under the head of *Lithotomy*.

Arthur T. Cabot.
Hugh Cabot.

BLADDER-WRACK.—*Sea-wrack*. *Kelp-wares*. *Black-tang*. The plant *Fucus vesiculosus* L. (fam. *Fucaceæ*). This peculiar coarse sea-weed grows in the greatest abundance on the rocky Atlantic shores of both this country and Europe. At low tide it covers the rocks thickly with its prostrate greenish-yellow fronds, while, when the tide is full and the plant is enabled to float by the aid of its numerous air vesicles or "bladders," it covers the bottom with a forest of weeds. This is one of the plants which have been most extensively employed in the manufacture of kelp. It has also been considerably used in medicine as a deobstruent and alterative. Neither its composition nor its properties have been made well known, and its value is problematical. It contains one-fifth per cent. or more of iodine, in combination with potash. Rarely, considerable quantities of tannin have been observed in it. It has been loudly proclaimed as an agent to reduce obesity, and proprietary articles sold for this purpose are said to contain it. The dose is 2 to 15 gm. (3ss. to iv.). Most manufacturing

houses prepare both fluid and solid extracts. The dose of the latter is 0.3 to 2 gm. (gr. v. to xxx.).
H. H. Rusby.

BLADON SPRINGS.—Choctaw County, Alabama.

POST-OFFICE.—Bladon Springs. Hotel and cottages.

ACCESS.—Via Mobile and Birmingham Railroad to Carson Station, thence twenty-nine miles by hack to springs; also, by Mobile and Ohio Railroad to Buckatunna, Miss., thence twenty-eight miles by stage or hack; also by steamer from Mobile, Tuesday and Saturday service. There is also a bi-weekly south-bound steamer service from Demopolis. The springs are four miles from the steamer landing on the Tombigbee River.

For upward of thirty years the Bladon Springs have been a favorite resort for the best people of Alabama and the neighboring Gulf States. The steady influx of visitors of late years renders it necessary to keep the hotel open all the year.

The location is about eighty miles from the Gulf as the crow flies, and about one hundred and seventy feet above tide water. The climate is mild and equable, the mean annual temperature being 75° F. The nights are delightfully cool, averaging about 65° F. after eight o'clock during July and August. The surrounding country is hilly and heavily wooded with pines, and excellently adapted for thorough drainage. The resort offers abundant inducement for those wishing to escape the rigors of a Northern winter. Game is abundant during the fall and winter months, and it is said that deer are killed within a mile of the hotel.

We are indebted to Dr. Showalter, of the Springs, for the following analyses:

ONE UNITED STATES GALLON CONTAINS:

Solids.	Vichy Spring.	Branch Spring.	Sulphur Spring.	Old Spring.
	J. L. & W. P. Riddell. Grains.	J. L. & W. P. Riddell. Grains.	J. L. & W. P. Riddell. Grains.	R. P. Brumby. Grains.
Sodium carbonate	46.33	41.21	34.93	32.89
Magnesium "	.61	.65	.65	1.36
Calcium "	.87	2.14	2.42	2.75
Iron "	.49	.23	.76	.62
Calcium sulphate	2.25	2.79	2.96	...
Iron	...	...	...	.24
Sodium chloride	...	...	...	7.69
Strontium	...	...	...	.32
Silica	...	...	...	2.10
Organic matter	2.26	1.90	1.25	...
Crenic acid	...	...	...	.75
Hypocrenic acid	...	...	...	.60
Total	52.49	48.88	42.97	48.72

Gases.	Cubic inch.			
	Vichy Spring.	Branch Spring.	Sulphur Spring.	Old Spring.
Carbonic acid	65.44	59.20	52.88	32.56
Sulphureted hydrogen	...	...	.56	...
Chlorine	1.84	1.84	1.84	...
Total	67.28	61.04	55.28	32.56

The waters are of the alkaline type, quite plentifully charged with carbonic acid. They are useful in chronic indigestion, in syphilitic cachexia, in advanced nephritis, in diabetes mellitus, and in rheumatism.

James K. Crook.