Urethral and periurethral lithiasis / by Victor Cox Pedersen.

URETHRAL AND PERIURETHRAL LITHIASIS.*

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As in all other organs of the urogenital tract urethral and periurethral lithiasis rest on three general bases. The first factor is disturbances of the metabolism of urinary excretion by which the chemical reaction and specific gravity are occasionally without, but almost invariably with infection so changed that precipitation occurs of salts normally in solution. The second factor is disturbances in the hydraulics and physics of the act of urination through natural variations in the calibre of the urethra or through changes of disease, such as strictures, dilatations, old abscess cavities, fistulæ, and the like, or through the deformities of anatomical abnormalities, such as diverticula or through the deformations of operations, each in its own way leading to arrest, retention, decomposition, and precipitation of the urine, with infection as the rule and without infection as the rare exception.

These two forms of disturbance might be called the primary pathology or pathogenesis of urethral lithiasis. While the results upon the tissues locally, after the stone has formed or become impacted, might well be termed the secondary pathology or sequels of urethral lithiasis. It will be the endeavor of this paper to adhere to these points of view.

The third general basis of urethral and periurethral lithiasis is of extraneous origin and comprises foreign bodies in the urethra, such as spicules of bone, shreds of dressings, pieces of stitches, fragments of wood, or surgical instruments, and

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other elements artificially introduced in the course of disease, surgical intervention, and unnatural practices. Such foreign matter becomes the nucleus of the calculus through the excitation of the two factors in the pathogenesis of stone just alluded to, with secondary precipitation of urinary salts upon this nucleus.

From the foregoing general bases it follows that urethral and periurethral calculi are either migratory, with various degrees of impaction, or formative, otherwise called native—urethral stones, in the strict sense. Migratory concretions originate in renal, ureteral, and vesical pathogenesis through all the factors just laid down in the opening sentences of this paper to which is added migration of the stone from its seat of origin toward the outer world until arrested in the urethra at one of the natural narrowings in health, or at one of the pathologically altered points in disease.

The term encysted calculi is employed for stones in pockets and diverticula communicating with the urethra in either the anterior or posterior portion. Congenital diverticula of the anterior urethra usually occur between the glans and the scrotum, while acquired forms result from injury, such as rupture, cysts, scars, strictures, fistulæ, and the like. Prostatic urethral diverticula are also either congenital or acquired. Remains of the urogenital sinus constitute the congenital forms, while the acquired types are due to cysts, abscesses, etc., or, finally, to the secondary pathology of the stones themselves, leading to ulceration through the urethra and then to encystment. Some authorities maintain that these encysted stones have unusual and peculiar composition. Englisch,[1] in 100 specimens, found thirty-five percent of complex composition, twenty-seven per cent. phosphates, twenty-two per cent. urates, and sixteen per cent. oxalates.

[1] *Archiv für klinische Chirurgie*, lxxii, p. 487.

In 1904, Englisch[2] collated notes of 400 cases and averaged the sites of impaction as follows: Membranous urethra, forty-two per cent.; penile urethra, fifty-eight per cent.; distributed thus, naviculæ fossa, 11.2 per cent.; pendulous portion, 14.5 per cent.; scrotal portion, 13.7 per cent., and bulbous portion, 18.6 per cent. Englisch omits the prostatic urethra, perhaps through inclusion of this anatomical part under the term membranous, otherwise we could not understand why that very short portion which we term membranous should receive forty-two per cent. of his statistical impactions, whereas in common experience it receives, strictly speaking, none, because if the membrane arrests a stone it will necessarily lie proximal to it in the prostatic urethra.

Native urethral calculi occur through local formation by infection and alteration of the urine, so that precipitation of its salts is determined commonly around inspissated mucus or other products of inflammation, and occurs through changes in the hydraulics of urination so that retention, decomposition, and precipitation are favored. Unusually large bulbs, dilatations behind strictures, fistulæ, abscess cavities, and diverticula are the best types to mention of recesses favorable to such lithiasis.

From what has been said of the pathogenesis of urethral lithiasis it will be noted that such stones are also either endourethral, namely, originating in this canal itself, or periurethral, arising in tissues and organs physiologically or anatomically related with the urethra. Thus the prostate is the commonest source of such periurethral stones, and next, abscesses draining into the urethra, just as the kidneys, ureters, and bladder originate most migratory, endourethral calculi.

Strange as it may seem, urethral lithiasis affects child and adult alike. In children these stones are

[2] *Ibidem*

usually migratory, impacted, endourethral manifestations. In adults lithiasis may be endourethral, periurethral, migratory with impaction, or formative in origin. Likewise, the frequency in the adult of urethral disease permits a migratory, endourethral calculus with only moderate impaction and relative mobility to augment in a pouch made for itself by itself, set up inflammation and infection, and thus become a formative urethral stone which may, by ulceration, become finally a periurethral deposit.

The tendency of German authorities is to take the purely pathological viewpoint and classify urethral lithiasis into two groups: 1. The exourethral, which embraces those stones which arise from the upper urinary organs and from the prostate; and, 2, the endourethral calculi, including only those which strictly form within the cavity of the urethra itself. It seems wiser, however, to subdivide these pathological entities from the more practical standpoint of treatment into those of the anterior and those of the posterior urethra. Essentially each such subdivision embraces the classification of the German authorities. Let us consider each of these classes in turn as they appear in children and adults.

In small children practically all urethral concretions are of intrauterine renal origin, migrating outward and impacted at one of the normal anatomical constrictions, namely, at the bulb, penoscrotal angle, and meatus. In adolescents and adults, if the urethra has not been infected, the same facts are true as in children, but inasmuch as a very large majority of adults have, or have had, urethral and periurethral disease, the impaction occurs in relation with the sequels of such disease. The number of stones in children is usually solitary, occasionally a few, whereas in adults the number varies from one or a few to a dozen and even a urethra-

ful. The size of the stone decreases directly with the number, so that single large stones are the rarest and multiple small stones the commonest.

The results upon the urethra of the impaction of stones as the so-called secondary pathology, have already been explained. Like the symptoms, they are determined by the absolute or relative obstruction of the stone. Thus it is that in a healthy urethra a partially obstructing stone sets up all the primary pathological conditions which, if preëxistent, would have caused the stone and which, by persistence, augment the stone itself and its effects locally. In this manner a kind of cycle of vicious events is locally started and repeated.

The syndrome of lithiasis of the anterior urethra with impaction is in young children only objective and consists in outcries from pain and severe struggle, and strain to pass urine which is voided, if at all, only in drops. In adults, however, the cases fall into two groups: First, patients who give little history until the urethral obstruction suddenly appears; and, second, patients who present a logical and consecutive story of varying degrees and forms, separated by widely uncertain lapses of time, brief in some, longer in other individuals, of renal disorder, pain, pus, blood, ureteral colic during migration of the stone into the bladder, vesical irritation of its presence in the bladder, and finally the urethral obstruction, absolute or relative in degree. Sometimes such patients have noticed the passage of urinary sand and stones, too small to obstruct, on several or many previous occasions.

The immediate results of the obstruction provide the next syndrome of symptoms alike in character, but more severe in children than adults, namely, shock, anuria, retention of urine, distended and tender bladder, rupture of the urethra, and extravasation of urine, especially in children. These are variously related with absolute obstruction.

Slight or partial obstruction may give few symptoms so that sometimes stones may be retained with little inconvenience for years. Pluyette[3] and Jesjakaw[4] each report a case having retained calculi respectively fourteen and fifteen years. Inasmuch, however, as the degree of obstruction is rather high when not complete, dysuria, acute suppurative urethritis (distinguishable from gonococcic urethritis only bacteriologically), periurethritis with abscess formation, etc., rapidly ensue, more commonly in adults, because in children shock with total obstruction or anuria usually spells death for the patient.

Physical examination in anterior urethral lithiasis presents to inspection the stone lying at the meatus, or as a swelling at any point along the urethra, with or without signs of abscess; and to palpation, a hard mass, immobile or mobile, with crepitus if the stones are multiple, and with the stricture distal to the stone or with fluctuation if an abscess is present. Instrumental examination includes the use of a large *bougie à boule* to define the obstruction, a small one, or a sound, to pass through it and touch the stone, and requires the urethrascope and x-ray to verify these findings. Stones in diverticula may permit instrumentation without results altogether unless the stone is pressed toward the urethra in order to make contact with the examining sound.

I have had no personal observations of impacted urethral calculi in children, but have found in literature the subjoined case reports. I have endeavored to collect an illustrating and interesting series of cases in literature for both children and adults. It will be found that they are not complete in many instances, from necessity and from circumstances over which the contributors quoted doubtless had

[3]Report actually made by Guinard, *Bulletins et mémoires de la Société de chirurgie*, xxvi, p. 892, 1900.
[4]*Centralblatt für Chirurgie*, xxv, p. 565. 1898.

no control, but let it be known that omission from my paper of such scientific details in these citations from literature as uranalysis, urethroscopy, cystoscopy, radioscopy, and autopsy is due to their absence in part or whole from the originals.

In many instances the diagnosis and other knowledge of the case is quite complete without such an array of scientific data. On the other hand, as a matter of comparison and study it is to be regretted that such hiatuses are very frequent.

Advances in the diagnosis of lithiasis of the kidney, ureter, and bladder will henceforward make the occurrence of endourethral stones with impaction more and more rare, so that in medical centres they may almost entirely pass out of common experience. Endourethral and exourethral stones by formation, however, will be met with from time to time. It is for these reasons that illustrative cases in literature are not easy to meet, if due respect is had for careful selection.

Dugan,[5] probably before the Kentucky State Medical Association, notes four interesting examples of stone impacted in the urethra, with rupture and extravasation of urine in very young male infants—one four days old, one eight days, one a month old. The other two cases were in the same child, who was eighteen months old. He operated upon all four patients, doing five operations. The first two, almost newly born infants, died—one from the rupture of the urethra and extravasation of urine, the other from the operation or infection. No autopsies are described.

Case I. Infant aged four days, normal at birth. Night of third day was seen to be straining. The following morning the penis and scrotum were swollen. The doctor was called and made diagnosis of ruptured urethra. Peri-

[5] *Kentucky Medical Journal*, ix, p. 523, 1911.

neal section for stone, escape of urine. Flat, scalelike calculus the size of a grain of rice was found. Drainage; no sloughing; kidneys acted well; death in coma.

Case II. Infant aged eight days, normal at birth. History same as in Case I. Rupture of urethra, which became infected. Incision made in perineum; escape of urine; stone extracted from penile portion; suppuration; death from shock or infection.

Case III. Infant aged one month, stone recognized by palpation in penile urethra just in front of bulb; could not be moved; urethrotomy; recovery.

Case IV. Infant aged eighteen months, dysuria and greatly distended bladder. Fever; stone felt in deep urethra; incision, with much difficulty in removal; uric acid with phosphate outside; perineal wound left open. Sound passed for some time to prevent traumatic stricture. Eight months later the same symptoms reappeared from presence of a new stone which was larger than the first and seated in the prostatic urethra. Removed with a scoop after perineal incision. As there were no evidences of infection the wound was closed.

The composition of urethral stones in childhood Dugan dismisses by saying that they consist of uric acid. They sometimes have a phosphatic exterior when the bladder is infected as in Case IV just described. There is no mention of radiographs or uranalyses in his case reports.

Wathen, in discussion of Dugan's cases, noted four operations on the same patient; first at thirty months for stone in bladder and urethra. A fistula existed for some years. When twelve years old this child had a calculus removed from the perineum, which began apparently in an old fistulous tract. A third operation for stone in the perineum was necessary many years later, and one year later stones were removed from the membranous urethra and bladder. He is now about forty years of age, and the x ray shows no stones anywhere.

Willmoth also reported a stone in the urethra of a baby, aged five days, large and impacted, two inches back of the meatus. The stone was split

and extracted with mosquito forceps. The stone was three times the size of a cherry stone.

Fig. 1.—Impacted urethral calculus, external urethrotomy. Weight, 0.93 gramme. Composition, chiefly oxalate of lime, little uric acid.

I had a very interesting case of anterior urethral lithiasis with impaction in a Chinaman, who came to the genito-urinary clinic at the House of Relief, March 27, 1906, with an interpreter who spoke English imperfectly. This limitation may have been the reason why we could not obtain a history of renal colic, pyuria, hematuria, and other details going with lithiasis in the upper urinary organs, but only a history of sudden and almost absolute urethral obstruction. The diagnosis was easy by external palpation of the body of the stone which could be distinguished, but not separated, from a stricture in front of it against which a *bougie à boule* of full size lodged and through which one of small size passed and grated on the stone. Admission to the hospital was declined. A small opening was made down to the stone, which was delivered by gentle pressure. Congestion of the mucous membrane, however, from the irritation of the stone caused hemic oozing, so that he finally consented to stay in the hospital over night. The incision healed quickly and without sinus and the stricture was dilated. Unfortunately, urethroscopy and cystoscopy and radiography were refused. The patient ceased treatment with a free stream of clear urine. Many months later the man, with gratitude, celestial in more senses than one, hunted me up and presented me with a very beautiful tea set, which is in fragrant contrast with the ingratitude of the average hospital patient.

The literature contains the following very instructive case reports:

Abel[6] in commenting upon Dugan's contribution noted two cases in adults in which he crushed the stones with alligator forceps.

Peak, at the same meeting, reported a stone 1.5 inch long, funnel shaped, seated in both urethra and bladder from a patient suffering from multiple strictures of the urethra and the subject of several operations including suprapubic cystotomy.

Adrian[7] reports a case as follows: Patient, aged thirty-four years, never had gonorrhea, was married, potent, never ill, and had no history of trauma of perineum. Drank somewhat. Three years before had left sided renal colic, never repeated. Later difficulties in urination—twice complete retention (thirteen and ten hours). Spontaneous rectification. Much trouble subsequently, as if there were an obstacle in the urethra. One physician diagnosticated stricture. For six weeks past had been able to feel some object in the urethra which had increased in size. Object hard, round, and could be moved a few cm. For three months, in order to urinate, the patient had had to push back the object. On examination, the author felt the latter behind the scrotum, freely movable. The sound impinged against the object but gave no information. It was not thought wise to try to force it into the bladder. Endoscope showed a whitish gray object of smooth contour. Operation: Urethra dilated with Kollman-Oberländer instrument and with the latter in position the stone was forced forward through the length of the urethra, but could not be extracted until after meatotomy. Complete recovery from all symptoms, including glycosuria. The specimen was 2.2 cm. long and 3.8 cm. around, had a urate of sodium kernel, a secondary deposit, and a tertiary deposit of calcium phosphate. It lay in the dilated bulb and was clearly of renal origin whence it migrated to the bladder and thence to the bulbous urethra in which mobility had permitted concentric instead of eccentric secondary tertiary layers as is the rule in most urethral calculi by impaction.

Gérard[8] describes six cases of anterior urethral lithiasis with impaction, summed up as follows: Five had a single stone, one multiple concretions occupying both anterior and posterior urethra, and only one a specimen of noteworthy

[6] *Kentucky Medical Journal*, ix, p. 523, 1911.
[7] *Zeitschrift für Urologie*, iv, p. 481, 1910.
[8] *Echo médical du Nord*, xv, p. 600, 1911.

size. All six were migratory, had sojourned for some time in the bladder; two were urates with clear urine, three were phosphatic with infected urine, and one patient had renal tuberculosis. Stricture was a conspicuous factor, both physiologically and pathologically, preventing spontaneous expulsion. The urate stones gave sudden pronounced symptoms without antecedents, the phosphatic calculi involved symptoms of the primary urinary infection and less definite symptoms of obstruction.

Hayden[9] reports five cases of lithiasis of the anterior urethra with impaction:

Case I. Patient, aged thirty-eight years, was admitted for painful urination; had never had urethritis. History of renal colic (left) recurrent. About ten weeks previously a stone from the kidney seemed to pass into the bladder which expelled it some days later. No stricture. Olivary bougie touched a rough object in bulbous urethra which could also be felt from without. External urethrotomy with removal of a fifteen grain stone from the bulb. Stone probably from kidney, impacted later in bulb. X-ray had been negative.

Case II. Patient, aged forty-five years, admitted for painful and difficult urination. No history of renal colic. Urethritis in youth, "never fully cured." Had had both external and internal urethrotomy when in his twenties for relief from strictures. Five years ago litholapaxy under ether. Urinary troubles had been present constantly. Endoscope now showed a large stone in bulb with a tight stricture. External urethrotomy; stricture cut; stone of twenty-six grains extracted. Condition readily explained; a fragment of stone remained in the bladder after the stone crushing. Passing into the urethra this lodged behind the stricture.

Case III. Patient, aged forty-five years; urethritis in youth and urinary troubles ever since. No history of colic. Endoscope showed stricture 4 inches from meatus and back of this a stone which also could be felt from without. External urethrotomy, stricture cut, and stone (49 grains) removed.

Case IV. Patient, aged sixty-three years. No history of colic. Urethritis in youth and urinary troubles since. Stricture two inches from meatus and another at bulbomembranous junction. Behind the latter a rough body palpable through perineum. External urethrotomy.

Case V. Patient, aged sixty-three years. Neither renal colic nor gonorrhea; troubles of short duration only. Four

[9] *Transactions of American Association of Genitourinary Surgeons*, iv, 13, 1909.

hard objects in pendulous urethra. Urethra anesthetized and stones removed with urethral scoop and manipulation; infected bladder cured. Source of stones obscure.

Case VI. Patient, aged fifty years, gave history of colic but none of urethritis. Had just undergone a paroxysm of colic, followed by retention. Sound encountered a rough body in prostatic urethra. External urethrotomy; two stones removed with difficulty; escaped from the kidney that had been grasped by the prostate in attempts to expel urine.

The third general basis of lithiasis in the urethra was in this paper previously described as of extraneous origin and as of foreign bodies for nuclei. The following two cases in literature are of great interest, in that they concern anterior urethral cases:

Morton[10] reports the case of a man, forty-eight years old, perineal sinus. Probe encountered stone in urethra. Twenty-six years before he had had an attack of retention and introduced into his urethra a homemade wooden sound which broke off inside. He then got a metal catheter No. 4 and used it, knowing there was a piece of wood in the passage. His catheter struck an impediment which he took to be the piece of wood, but which in reality was a stone. At last an abscess formed and opened in the perineum. Pus and urine escaped. The author operated and found a large stone in a self-made urethral pouch. The fragment of wood had served as a nucleus for the stone.

Adrian[11] notes another case with a fragment of bone as nucleus in a man, fifty years old, once the victim of abscess in the sacrogluteal region with evidence of bone exfoliation. Vesical calculi with bone nuclei are common. Adrian removed this specimen by external urethrotomy. Caries of the tuber ischium was shown to have been the source of the abscess from which the spicule must have burrowed into the bladder and migrated into the urethra or it may have lodged in the periurethral tissues first and then have ulcerated into the canal. The stone when removed was the size of a cherry pit and occupied the bulbar sinus as in Case I (report of Adrian above). The shape of the stone corresponded behind to that of the sinus, while in front it projected into the urethra as a pointed segment. The mineral portion was phosphate of calcium and magnesium.

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[10] *Bristol Medicochirurgical Journal*, xxviii, 127, 1910.
[11] *Ibidem.*

Lithiasis of the posterior urethra, like that of the anterior urethra, involves impaction and formation as the two main causes and endourethral and periurethral sites as the chief locations, and affects children very rarely, but adolescents, adults, and the aged much more commonly as the sequel of antecedent disease processes. Its products may also be endourethral and exourethral calculi, exactly as in the case of lithiasis of the anterior urethra. The exourethral manifestations are almost invariably due to disease in the prostate or to operations upon this gland.

Endourethral calculi of the posterior urethra are strictly those of the prostatic urethra, as the membranous portion may obstruct, but does not harbor these concretions, which are almost always migratory with impaction in the normal urethra, but formative in the anatomically abnormal or pathologically deformed channel. They are, therefore, subdivisible into free, diverticular, and urethrovesical calculi, any and all of which may be solitary or multiple.

Free endourethral calculi of the prostatic urethra are most common; lie loose in the dilated urethra; are, as a rule, small and multiple, in apposition, and facetted, the greater the number the smaller the size and vice versa, and have weighed from 200 to 300 grains. These calculi have descended from the bladder and have conserved their mobility. In front, the membranous portion arrests them. Between this and the neck of the bladder they accumulate, the prostate undergoing dilatation. A sort of gutter for the passage of urine may be present.

Diverticular endourethral calculus of the prostatic urethra is more rare, the calculus being inclosed in a urethral diverticle, appearing in the endoscope as part of the urethral wall, the rest being hidden in the prostatic tissue, and possibly having the

shape of a gourd. These stones have either lodged in a natural diverticle or have formed a cavity for themselves, in which case they might be also regarded as periurethral. As they increase in size they tend to project into the lumen.

Urethrovesical calculi in certain cases may lie in both the urethra and bladder and project into the latter. There may be a groove or a construction which corresponds to the neck of the bladder and gives to the calculus an hourglass shape. It cannot be said whether these stones originate in the urethra or bladder. They cause various disorders of urination.

The symptoms of lithiasis of the posterior urethra of endourethral type may, as in the anterior portion, be very slight owing to tolerance of the normal canal, and give a negative or a doubtful history of the impaction of the stone. Another group of cases with a similar history present themselves with a chronic abscess and fistula at the bottom of which a probe will meet the stone. The largest number of patients, however, give a more or less definite history of recurrent or chronic and relapsing urinary disorder, punctuated with attacks of pyuria and hematuria, ureteral spasm, vesical irritation, etc. Then comes a crisis which commonly marks the passage of the stone from the bladder and its arrest in the prostatic urethra, soon followed by dysuria, infection, prostatic pain, and pain on defecation. A purulent, urethral discharge is an important feature, requiring bacteriological investigation to distinguish it from gonococcal invasion. Physical examination involves the use of the sound, urethrascope, cystoscope, rectal examination, bimanual examination with the sound in the urethra, etc. In these cases the condition of the prostate varies from congestive engorgement, due to infection, generalized, or focalized as an abscess, to absolute enlargement of chronic inflammation

and later atrophy. If the stone has resided long enough to ulcerate by pressure into the prostatic substance the gland may be much thinned to a mere abscess wall and the calculus passes into the periurethral class. Radiography is of more value in vesicoprostatic stone and periurethral stone, as the solitary endourethral concertions are apt to escape detection. Crepitus is present only with multiple calculi or when the condition is complicated with incrustations of the urethral wall.

The following more or less unique cases of endourethral lithiasis of the prostatic urethra are worthy of note. Muller[12] describes two:

Case I. Patient, aged thirty-seven years. Urinary troubles for six weeks. Imperative desire to urinate, painful urination, etc. *Bougle à boule* showed stricture and back of it a sensation of calculus. Perineal incision; stone size of large hazelnut in prostatic urethra; recovery uneventful.

Case II. Patient, aged eighteen years, history similar to that of foregoing case. Had gonorrhea two years before and urinary troubles ever since. *Bougie à boule* revealed stricture and back of it an obstruction thought at first to be stone, but later a second stricture of the prostatic urethra. Operation for relief of latter, the urethra being split to the prostate. Stone found imbedded at the neck of the bladder.

Spittel[13] reports a case, of a man, aged twenty years, with frequent micturition, scalding, and sense of "scraping" extending from anus to meatus; stream thin, weak and turbid from phosphates; could urinate well in lateral decubitus; some dribbling between urinations; bladder not distended; rectal examination gave crepitus, due to friction of two stones in prostatic region; confirmed on sounding. A third stone on the bladder. Suprapubic cystotomy and removal of the three stones, one from the bladder and two from prostatic urethra. The latter were drawn backward into the bladder; they were facetted so that their surfaces corresponded, and were composed of phosphates and carbonate of lime. Spittel believes that these stones had formed primarily in the prostate. The phosphaturia preceded the calculus formation and was evidently due in some manner to jail life, the patient

[12] *Lyon médical*, cxvi, 788, 1911.
[13] *British Medical Journal*, 1912, i, 8.

having served a year's sentence, with hard labor, limited to certain dietetic articles only, and had suffered flogging, etc.

One might comment on this case by saying that calculi do not pass from the urethra into the bladder except by artificial means.

Pepper[14] reports the case of a Maine lumberman, aged twenty-three years, with severe pain in scrotum. Mass therein had been slowly enlarging. Right testicle had been removed in childhood—reason unknown. Dribbling of urine so that he wore a urinal; hernia excluded and an abscess diagnosticated. Needle drew off pus; cut down on abscess and introduced finger; could then feel urethra and a hard mass therein, regarded as a calculus; urethra incised and large stone extracted, 1.5 inch long and 0.75 inch thick. Retention catheter left in. Capacity of bladder small.

Periurethral lithiasis of the posterior urethra embraces two common forms, viz., calculi of the prostate itself, and calculi of the periurethral tissues after injury and operation. The cause of these stones is commonly formative after infection, either by initial deposit or by increase in the size of a stone which has ulcerated out of the urethra after impaction. True prostatic concretions are multiple. Cameron[15] reports 300, Paulicki[16] 240. In composition they are usually calcium prosphate or calcium carbonate about albuminous nuclei. They are frequently not suspected until met during prostatectomy, having determined few antecedent symptoms, or they may be associated with chronic prostatitis. The laminated prostatic corpuscles, corpora, amylacea, etc., may, by apposition of a few dozen, become large concretions, of pea size for example, in color milky white, yellowish, or dark brown, of fatty lustre, translucent periphery, and brittle consistence. They may lie in the acini and excretory ducts in numbers of one hundred or more, migrate thence into the prostatic urethra, and be found about the colliculus. They appear at any

[14] *New England Medical Monthly*, xxix, 385, 1910.
[15] *Glasgow Medical Journal*, vi, 273, 1874.
[16] *Wiener medizinische Wochenschrift*, xviii, 1368, 1868.

period of life, but are most common in the prostates of old age. Through infection they may be covered with crusts of the lime salts and thus become true calculi of essentially prostatic origin, as distinguished from endourethral stones which may ulcerate into the prostate. The lime salts deposited are mostly basic phosphates, carbonates, triple phosphates, and sometimes oxalates, and change the appearance and consistence of these bodies so that they are hard and no longer translucent, white, brownish, or yellowish. On cross section they have a radiate striation. If single they may reach even the size of a hen's egg or be very numerous, small, and facetted. The prostate as a whole or in part may be involved or multiple stones may be individually encysted or occupy a common cavity.

Radiography seems to reveal two types, one diffuse and of hemp seed size, common in old age. The other shows the stones crowded together on both sides of the median line and appears at any period of life.

It is well recognized by all authorities that these concretions cause chronic prostatitis with destruction of the secreting portion, cyst formation, and atrophy, until only a thin wall of glandular structure or the capsule alone remains, or with abscess and sinus formation at any point.

The symptoms of true prostatic lithiasis may be insignificant and pass unnoticed during life. On the other hand, large, solitary, or multiple calculi with prostatitis may provoke such pronounced symptoms as difficult, painful, and frequent urination, pain in perineum, prostate, and rectum radiating down the penis and thigh, obstipation and painful defecation, purulent urethral discharge. Rupture of the stone into the prostatic urethra shows itself as acute posterior urethritis or as acute retention, through the size of the stone or swelling of the mucosa. If small, the stone may escape with the urine. Abscess and external fistulæ may result.

The diagnosis of true prostatic calculi may be easy by palpation through the rectum if the stone is large and the prostate atrophic, or if the gland is nodular through multiple calculi, which may also add crepitation. Or the diagnosis may be extremely difficult if the stones are small, centrally located, and individually encysted. The sound will detect any which project into the urethra or will aid as a means of bimanual examination, a procedure which should never be omitted. The acoustic explorer, designed by Poncet, the urethrascope, and cystoscope are very important. Radiography is also of use where other methods may not have been especially satisfactory.

I had the following interesting case of true multiple intraprostatic lithiasis, without operation, of which the notes are incomplete, because urethrascopy, cystoscopy, radiography, and other methods of examination were refused. The patient was a pensioner of Sailors' Snug Harbor, robust, florid,

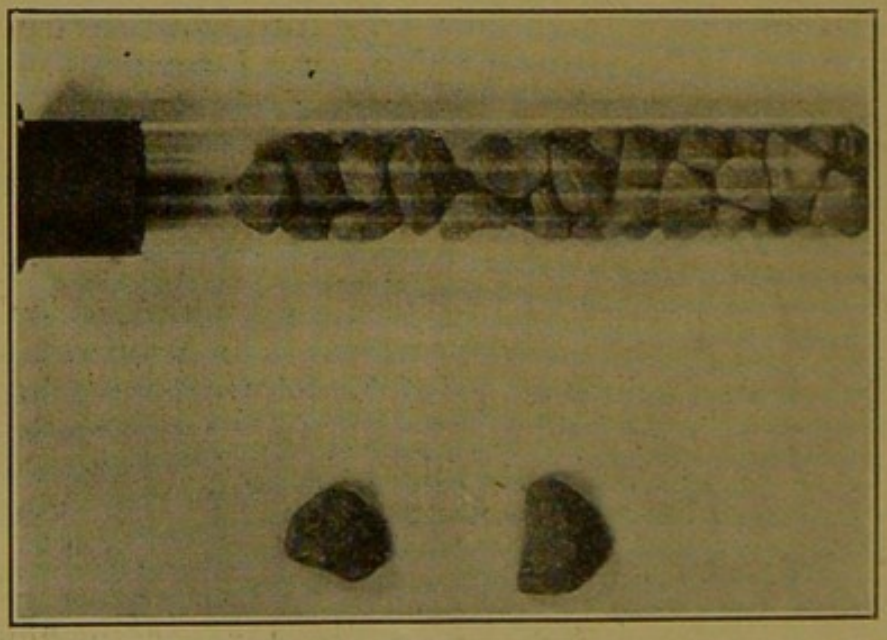

FIG. 2.—Prostatic calculi, voluntarily voided. Weight, 7.36 grammes. Composition, uric acid and urate salts. Specimen one-fourth of whole.

and jolly, with an enlarged, somewhat irregular prostate according to rectal palpation and pyuria, but hardly any urethral discharge. He brought a boxful of small stones, representing what he thought to be a fourth part of the total he had voided. They commonly appeared during urination, especially in the midst of exertion, such as swimming or defecation. The first stone he passed appeared during urination in the water while swimming and was accompanied by pain as it travelled to the meatus, where it lodged, almost blocking the stream entirely and whence he fished it with thumb and forefinger after retiring to a dressing room. He either pressed them from the urethra with the hand or fished them out with the fingers. He seemed to attach little importance to them as his manner of carrying the specimen and his indifference of medical examination and treatment show. Fig. 2 shows this collection of calculi very well indeed.

Jeanbrau[17] gives a case report of a patient troubled for six years previously with incontinence and difficult urination. Benefited at the time by irrigation of bladder. Troubles recurred from time to time. When seen by author symptoms first suggested old urinary tuberculosis. Vesical capacity was small and cystoscope could not be used; prostate small and hard; testicles healthy; no tubercle bacilli; no history of gravel; no hematuria. Animal inoculation; while waiting for result was treated for tuberculosis. In the meantime sounding chanced to detect calculi in prostatic urethra. Perineal section; no stone palpable in urethra; prostate split and stone found size of a hazelnut, lying "like a stone in a fruit"; recovery uneventful; no statement as to source of nature of stone; urine was alkaline, with large amount of mucus.

J. Lynn Thomas[18] gives descriptions of three cases:

Case I. Man, sixty-three years old, had 101 prostatic calculi and a rectourethral fistula. Had had an obstruction for twenty years and used catheters. For months had been passing fecal matter in the urine. Prostate enlarged and tender; a No. 6 sound could enter the bladder.

[17] *Montpellier médical*, xxxii, 303, 1911.
[18] *American Journal of Urology*, v, 224, 1909.

Suprapubic cystotomy; vesicourethral opening found contracted and rigid; incised and the finger introduced, thus entering a prostatic pouch filled with calculi; cavity infected so that author made a counter opening and expelled 101 stones through one or the other avenue; on drain through both openings. Rapid recovery.

Case II. Man, aged sixty-two years. Urinary disorders for twelve years. Used catheter at times. Diagnosis had been enlarged prostate with septic cystitis. Suprapubic cystotomy; a stone extracted from the bladder; finger in rectum found enlarged prostate; inspection of bladder showed a sacculation between bladder and rectum containing a stone to extract which it was necessary to open the prostatic urethra, whereupon eight small facetted calculi were found.

Case III. Spiculated calculus imbedded in the prostate. This was accidentally discovered in the course of an exploratory suprapubic cystotomy. The prostatic urethra was dilated with the finger and the stone recognized and removed; perineal drainage; recovery.

Lund[19] gives an account of two interesting cases:

Case I. Man, aged sixty-nine years, had had frequent micturition for years; prostate per rectum found to be the seat of a hard nodular formation; bladder slightly trabeculated; no cystitis; diagnosis "malignant prostate." Prostate enucleated through median perineal incision; many little black concretions seen; in certain cases these stones caused irritation and abscesses.

Case II. Man, aged sixty-five years, had had for years frequent, urgent micturition, with recent attacks of retention. An enlarged, smooth prostate was discovered per rectum, enucleated, and found to contain numerous prostatic stones of reddish hue. The presence of these stones apparently caused an edematous swelling (the organ was actually small). The prostate was inflamed and a small abscess had formed. The calculi lay in part free in the urethra, but were also distributed throughout the prostatic gland and ducts.

Dugan[20] presented a collection of seventy-nine stones all from the prostate of an old man. The gland had been transformed into a pouch. Two physicians had examined the patient very carefully, under ether, and had decided that calculi were absent. The sound should have been passed and then with the finger in the rectum presence of the stones would have been recognized. The man, already in a coma, was operated on and death resulted in forty-eight hours.

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[19] *Boston Medical and Surgical Journal*, clxv, 170, 1911.
[20] *Ibidem*.

Professor Pousson[21] relates the following two cases of intraprostatic calculi:

Case I. Male, fifty-two years old. Troubled for several years with frequent micturition, getting up several times nightly; urination painful with terminal hematuria; sense of weight and discomfort in perineum and anus, aggravated to pain during defecation; patient became very nervous, getting no relief. On examination the urine was found to be normal; olivary bougie No. 18 revealed two projections in the bulboperineal region; no membranous spasm; on rectal touch there could be felt a little to the left of the middle line two small indurations included by the parenchyma. There was no protuberance. Pressure with the finger caused much pain. Diagnosis of intraprostatic calculi. Perineal incision and division of prostatic tissue disclosed two whitish concretions each as large as a large pea, very irregular in shape and bristling with sharp points. They were dry and friable, went to dust upon compression between the thumb and finger and were composed entirely of calcium phosphate.

Case II. Man fifty-four years old. Diagnosis had been made of probable vesicoprostatic tuberculosis; pyuria; on the other hand, his general condition was excellent. No. 20 olivary bougie passed easily, causing no pain. Capacity of bladder not diminished. Rectal touch perceived two nodules, very sensitive to pressure. The author sought to scratch possible concretions with his finger nail and obtained the desired sensation. His diagnosis, therefore, was intraprostatic calculi. As the bladder was already infected suprapubic cystotomy was performed; bladder free from stone; a few ulcers in the trigonum were curetted and cauterized with the red hot iron; posterior urethra incised and concretions found and extracted with difficulty; bladder drained with Guyon-Perrier tubes; the wound became infected and a retention catheter caused orchitis. Ultimate complete recovery. The calculi were similar to those reported in the first case.

The second class of periurethral lithiasis of the posterior urethra concerns deposits in deformities through anatomical abnormalities or operative procedures.

The following very significant case of lithiasis after prostatectomy focalized in the deep operative field is reported by Webb.[22] Patient, aged sixty-eight years, seventeen years ago had undergone perineal prostatectomy (one of the first done in America, by the late Dr. Samuel Alexander). Was free from prostatic trouble for several

[21] *Association française d'urologie*, xv, 725, 1911.

years; symptoms then reappeared and continued; never used the catheter but wore a urinal all the time for the dribbling urine. When examined found to have infected urine and ascending nephritis; only a filiform bougie could enter bladder at first; when a follower was passed a sensation appeared to indicate a stone in the bladder; radiography showed large oval mass, apparently in the latter. Rectal touch showed hard, insensitive mass in prostate. It was thought latter could not have been removed. Suprapubic cystotomy found the bladder empty. Seemingly a large indurated prostate was still present, in attempting to remove which it was found that the supposed gland was a mass of thirteen stones, the facets of which were adapted to one another. Stones were phosphatic, and were removed easily with relative recovery.

The relation between radiography and lithiasis of the anterior and posterior portions of the urethra has already been alluded to. It is a procedure not often employed on at least two grounds, first because the diagnosis may be fixed without it, and, second, because competent radiography is so expensive in time and means that it is usually omitted when the case may be otherwise decided.

This subject is definitely brought out by the following case report from Pasteur.[23] Man, fifty-odd years old, consulted author who took a radiograph and got multiple spots in the pelvic oval; patient had had gravel and renal colic; radiographs at that time negative (save for possible ureteral shadow) as far as kidney was concerned; lower down certain shadows led to probable diagnosis of vesical calculi. The author, to confirm the diagnosis, passed an explorer and got friction in the posterior urethra, while the bladder was found empty. Diagnosis of prostatic calculi was made. The prostate was hypertrophic with residual urine in the bladder. Retention catheter worn and condition improved. By means of a large sound the prostatic stones were then forced into the bladder which, when filled with liquid, was able to expel them. Cystoscopy showed that nothing remained behind.

This case was one of extraprostatic stones which, having migrated from the bladder, were arrested in an enlarged prostate. As an example merely of this common occurrence the case would not be

[22] *Journal of the American Medical Association*, lvii, 2082, 1911.
[23] *Paris chirurgical*, iii, 1036, 1911.

worth reporting. The point of interest is that the arrest of stones in a prostate, the seat of simple glandular hypertrophy, the indication might by some be regarded as perineal prostatectomy. In this particular case operation of any kind was refused. Could radiography have made the correct diagnosis? For this purpose the bladder would have to be cut out of the field by filling with bismuth, suspension, etc. On the other hand, as far as this case went, the exploring olive was amply sufficient. For exact diagnosis it is never well to reply too much on a single test, like radiography, to the exclusion of all others.

A shadow of stones in the posterior urethra and prostate would necessarily be more or less associated with the shadow of the symphysis pubis and perhaps at times difficult to distinguish from it.

TREATMENT.

The treatment of urethral and periurethral lithiasis is preventive and curative. Preventive measures imply the management of errors in general and urinary metabolism characterized by intestinal autointoxication, which almost invariably invites colon bacilluria, and by excess of crystals if not actual presence of gravel in the urine. Prevention also regards careful aftertreatment in any uro genital surgical condition, so that foci and pockets of precipitation may be properly dealt with.

Curative treatment acknowledges two classes of cases, those of emergency and those of election type. Emergency cases are characterized by acute, severe symptoms of obstruction, anuria, infection during a few days or even hours, and they naturally belong to childhood and old age. In other words, urethral lithiasis is another condition which the extremes of life tolerate badly with a fatal issue all too common.

In adolescents and adults other than the aged emergency cases arise in the same manner and

from the same causes, but usually as an addition in the form of urinary crisis during a longer or shorter history of antecedent disorder. Such crises also create emergency cases for immediate operation.

On the other hand, a very large group of cases are of the election type and permit the surgeon to proceed more or less at his own choice as to time and means. In this sense, therefore, the treatment of such cases of lithiasis of the urethra rests on the presence or absence of complications. If the stone is mobile, recently impacted, and without total obstruction to the urine, most authorities will agree that an effort should be made to pass it forward out of the anterior urethra or backward into the bladder out of the posterior urethra by instrumental or digital manipulation. Delivery from the anterior urethra may often be made through the aid of meatotomy, crushing with alligator forceps, and dilatation of the obstructing stricture with the straight sound. Large, blunt pointed sounds may be used to retire stones into the bladder, where they may be crushed and pumped out. The disintegration of stones may be easily accomplished with the fulgurating wire through the cystoscope in the bladder or through the open end urethroscope in the urethra. Almost all uncomplicated cases will yield to the foregoing rational measures. The complicated cases, however, which almost always have infection as the primary cause of the complication, require open operation, removal of the stone, and drainage of the infected field, which necessarily embraces, secondarily, the anterior urethra, the posterior urethra, and often the bladder.

If some of the important points touching urethral and periurethral lithiasis have been even partially covered by this paper, the author will feel repaid many fold for time and labor.

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