

into relief; in this depression the calculus is usually found. Thus, the manœuvre so successful in the male, of elevating the pelvis so that the stone rolls backward to a point at which the angle of the lithotrite must necessarily strike it in gliding down the trigone, is not so readily accomplished in the female. In a woman who had borne children it would be necessary, more likely, to reverse the beak of the lithotrite, and engage the calculus between its open jaws by means of a finger in the vagina, by which the floor of the bladder could be lifted up. Another, and more trifling impediment, is the unfavorable situation and narrowness of the urethral orifice, which, less easily managed than that of the male, often refuses to admit the beak of the lithotrite without special care in manipulation. On the whole, then, the female bladder, having no prostate at its outlet to serve as an impediment, and no trigone at its base with external attachments to form a fixed floor, contracts more uniformly upon its contents, and expels them, through the short, large urethra, more fully and promptly than the male bladder, especially in early life. Later, however, it is liable to become irregularly dilated, especially at its base, to lose contractile power, and possibly to incur displacement; thus, the finding of small calculi and last fragments is not unlikely to be attended with difficulty. But for the large calibre of the female urethra, impaction of fragments would frequently happen, for the uniform and continuous expulsive effort resembles that of the male before puberty, where there is no prostate to interrupt it; and, by reason of the greater nervous excitability and liability to paroxysms of spasmodic contraction in the female, this accident does occur more often than would be thought probable. In such event the manipulation required for the removal of the fragment would be attended with less difficulty than in the male. For obvious reasons the employment of anæsthetics in lithotomy, in women, offers advantages which, in the hands of the judicious surgeon, are counterbalanced by no dangers which would justify their rejection.

CHAPTER XVIII.

LITHOTOMY.

Preventive Treatment of Stone, General and Local.—Solvent Treatment of Stone.—Electrolytic Treatment.—Lithotomy.—Selection of Cases based on Statistics; the Condition of the Patient; the Condition of the Stone.—Choice of Operation.—Description of Operations.—The Lateral Operation.—Instruments employed.—Modification required for very Large Stones.—After-Treatment.—Lateral Operation in Children.—The Median Operation.—Supra-pubic Operation.—Complications of Lithotomy.—Relapse after Lithotomy.

As has been already amply set forth, there are two methods of formation of stone in the bladder: one, where a kidney-stone lodges and grows in the vesical cavity; the other, where from obstruction

(enlarged prostate, stricture), or other cause (atony), there are stagnation of urine, partial decomposition, with precipitation of crystals and amorphous salts, and a consolidation of the latter by mucoid pus at once into a nucleus of stone. As both of these causes are readily detected by the skilled surgeon, the question naturally arises, What can be done in a prophylactic way to prevent the formation of stone in the bladder, where the tendency is believed or known to exist? Very much can be done; an attempt will be made in the present section to show how much, and in what manner. The prevention of stones forming upon a nucleus (foreign body) which has been introduced from without is hardly worthy of consideration. A foreign body of this sort, when known to exist, should be at once extracted.

Stone, as found previously to advanced life, is, for all practical purposes, always a stone of uric acid. Thompson¹ says: "Nineteen out of every twenty of such stones have uric acid for their basis, the remaining one in the twenty being oxalate of lime;" hence it is evident that, to prevent stone of this class, such measures should be brought to bear upon a patient, who is known to have a calculous tendency, as militate against the formation of uric acid in the kidney. This formation of uric acid is the result of imperfect assimilation of food, coupled with faulty elaboration of the blood, such as exists in all patients having the gouty diathesis. In this way stone becomes hereditary, and the tendency to gravel is transmitted from father to son, from generation to generation. The connection between gout and calculus is more strongly made by noticing the other maladies from which patients with gravel suffer, and by observing the occasional well-marked instances of interchange in the type of the symptoms in a given case; as, the disappearance of habitual gravel being marked by an outbreak of the gout. Not every patient with gout has stone, but the tendency to over-acidity of urine in gouty individuals is very marked, and habitual deposits of urates, uric acid, or even attacks of gravel, are by no means uncommon. Hence in patients, where the gouty diathesis is marked, care should always be particularly bestowed upon the condition of the urine.

Such patients will often be found to suffer from nephralgia, to have pink deposits, or red sand, in the morning urine, perhaps throughout the day. The alkaline tide, which should be observed two or three hours after each meal, will be feeble, perhaps inappreciable, on account of its mixture with the strongly-acid urine already in the bladder in small quantity when the tide comes on. Such a patient is ripe for stone. After a profuse sweat on a hot day, after a dinner out, with a free supply of wine, after some passing febrile disturbance, or hepatic congestion, leading to an increased supply of uric acid, already present in excess, a few crystals, larger than usual, start into existence in the heavy mother-liquid in the pelvis of the kidney, become joined together,

¹ "Preventive Treatment of Calculus," 1873, p. 10.

rapidly increase in size, and the patient has kidney-stone, liable at any moment to pass into the bladder, and, remaining there as a nucleus, to be built up into a calculus of large dimensions—a monument of neglect of prophylaxis.

The methods of treating over-acid urine, and battling against the tendency to the formation of stone in the kidney, will be detailed under the head of *nephralgia* from over-acid urine, and when describing the treatment of *kidney-stone*. The same rules hold good here. What prevents kidney-stone, prevents bladder-stone as well. The habitual use of Vichy or other alkaline water as a daily beverage in moderation (the harmlessness and efficiency of citrate of potash have been especially demonstrated by Roberts's experiments noticed page 367); the free imbibition of fluids of all sorts; a draught of water between meals, and on retiring, to dilute the acid tide of the urine of fasting—these means, habitually employed, aided by intelligent hygiene, and attention to all the functions, will serve in a marked manner to keep the urine normal. Muscular exercise should be encouraged in every possible way, and life in the open air. Where the patient's pursuits in life are of a sedentary nature, dry friction of the skin with hair gloves, exercise with Indian clubs, or even dumb-bells, practice in a gymnasium, or with a lifting-machine, are all substitutes of great value, where nothing better can be obtained.

When, from any cause acting temporarily, there seems to be a sudden tendency to aggravation in the morbid condition of the urine, when the liver seems to be torpid, and especially if the bowels are a little sluggish, nothing is more useful than a course of a few weeks of some mineral water containing the sulphate of soda. This salt has the power of sweating the intestine, and relieving the kidney from overwork, while it freshens the activity of the great abdominal glands, and, serving as a laxative, still proves at the same time a tonic, not being followed by any prostration, but, indeed, aiding digestion.

The best method of administering sulphate of soda is in a natural mineral water. Thompson¹ has proved by experiment that the solutions prepared by Nature far surpass, in effect, the same draughts concocted by the apothecary. He evaporated down slowly in a water-bath a purgative dose of one of these waters, and found the effect of the dried residue to be far inferior to the original solution; nothing more, in fact, than what would be produced by the same drugs mingled by the chemist.

The mineral water which seems to be the most useful is the Friedrichshalle water, of which the active ingredients are sulphate of soda (gr. 58) and of magnesia (gr. 49 to the pint). The proper dose of this is about seven ounces, with two or three ounces of hot water, enough to make the whole pleasantly warm—to be taken an hour before breakfast in the morning. This will usually produce one or two pleasant stools,

¹ "Preventive Treatment of Calculus."

an effect far out of proportion to the quantity of the drug taken; while another agreeable feature of this water is, that its effect usually remains the same while the daily dose is being gradually diminished. The hot water is added to bring the draught up to the natural temperature of the spring, as well as to dilute it slightly, as the water is condensed to a uniform standard for exportation.

This morning-dose may be continued indefinitely without detriment, and when intermitted does not leave constipation behind. Thompson advises that, after having taken this water for several weeks, it should be mixed with Carlsbad water and hot water in the proportion of five or six ounces of Carlsbad to three or four each of Friedrichshalle and hot water—this to be continued for several weeks, and then the course to be terminated by a couple of weeks of Carlsbad alone ($\frac{3}{4}$ v-viiij) raised to a temperature of 90° or 100° Fahr., by placing the tumbler which contains it in hot water.

These expedients are all useful, and most excellent to meet emergencies, in the prevention of kidney-stone, but final reliance in all cases must be placed upon intelligent hygiene, in which exercise, air, and elimination by the skin are to be primarily considered. The food should be rather light, plain, mixed, containing a large share of green vegetables and fruit, as well as cereals, from the fact that the latter contain a large amount of alkaline phosphates. Alcohol and sugar should be avoided—as well as an excess of fat (Thompson). Attention to the above expedients constitutes the preventive treatment of stone due to blood-conditions.

Local Preventive Treatment of Stone.—The second class of stones, as ordinarily encountered, are due to local origin. They depend on stagnation of urine, and inflammation of the mucous lining of the bladder, attended by decomposition of urine. Such stones are found in old men, with enlarged prostate and atony, in cases of old stricture, etc. They are composed of the mixed phosphates (fusible calculi), and often grow very rapidly.

The subject of their prevention has been already mentioned at length, in connection with the different morbid conditions liable to give rise to atony, with stagnation, and the means to avert the threatened complication, stone, have been amply detailed. To recapitulate, these means are:

1. To overcome all obstruction to the free outflow of urine, if possible, as in the removal of stricture by dilatation.
2. To reduce vesical inflammation, empty the bladder periodically, and wash out its cavity by means of the regular gentle use of the catheter in all cases where, from atony, or paralysis, or obstruction (large prostate), the viscus cannot empty itself; employing warm water in injection, and any of the medicated fluids suggested at page 197). If the stone has been already crushed, an injection of two or three drops of dilute

nitric or hydrochloric acid to the ounce of warm water, during and after the treatment, is advisable to oppose any continued precipitation of the phosphates.

Solvent Treatment of Stone.—This method, undoubtedly effective in many cases of kidney-stone, is practically powerless to contend with vesical calculus. If stone in the bladder is large, it would be folly to attempt to dissolve it either by internal medication or vesical injection. Efforts in both of these directions have been made for centuries, but in no single reported case with demonstrated success. In all of the cases reported cured, where calculus was detected by a competent authority, before the treatment, when an examination after death could be obtained, the bladder was still found to contain stone. The most brilliant example of this kind is found in the fact that the four patients, whose cures were certified to by the trustees appointed by government to examine into the merits of Mrs. Joanna Stephens's remedies, were each found to have stone in the bladder when they died.¹ Mrs. Stephens's remedies, which were purchased by the English Parliament in 1739, for £5,000, consisted chiefly of snails, ashes, egg-shells, and soap—that is, the alkalis, potash, and lime. If a stone is small enough to be managed by any solvent treatment, it is much more speedily and effectively dealt with by one or two crushings.

Electrolytic Treatment of Stone.—Efforts in this direction, although effective for small calculi, are utterly unpractical. It must require more time and give more pain to find the small stone, get it between the poles, and act upon it by electricity, than it would to crush and destroy it in one or two sittings.

LITHOTOMY.

In the consideration of the treatment of stone, the subject of lithotomy is introduced last, because it is an operation of far less importance than its powerful rival lithotrity: to the latter it is yearly yielding more and more of the cases which, by common consent, formerly fell solely within its own domain. That lithotomy is an important operation, and eminently surgical, is undoubted; that it requires a cool head and steady hand for its proper performance, none will dispute; that it is often brilliant in its results is equally self-evident; but the function of the surgeon is not to perform brilliant operations, but to cure disease and relieve pain with as little risk to life as possible, and this lithotrity accomplishes far more certainly, in many cases, as has been shown when dealing with that subject. As the means of diagnosis improve, and become more widely spread, stones are detected earlier, and yearly the number of calculi is greater which come within the scope of lithotrity—an operation which, carefully and gently performed, upon a proper subject, is nearly as harmless as passing a catheter. Lithotrity owes its present

¹ Quoted by Thompson, from Alston's "Lectures on Materia Medica," 1870.

exalted position largely to the untiring, honest, and able efforts, during the present century, of Civiale and Sir Henry Thompson.

But not all stones and not all patients are suitable for lithotrity. Lithotomy still holds its place as one of the grandest operations of surgery, and still has no rival in at least fifty per cent. of all cases of stone, taken collectively, at all ages.

Lithotomy is respectable for its longevity; but it is idle in a text-book of the present day to discuss the unfavorable opinion of Hippocrates, who believed that wounds of the bladder were deadly, or the barbarous method of "cutting on the gripe," the "apparatus minor," or the "apparatus major" of musty antiquity. Nor, again, does space allow a detailed description of the many cutting operations which have been proposed and successfully performed for the removal of stone from the bladder—operations bearing the names of many illustrious men, and modifications of these the names of many more, to whom all honor is due. Practically, the surgeon requires but three operations to meet the necessities of all cases, and these three only will be described at length—they are the lateral, the median, and the high operation for stone.

SELECTION OF CASES.—After the thorough discussion of this subject in connection with lithotrity, already given (p. 273), but few words are necessary here. If the patient's condition will allow any operation, and it is not considered wiser, on account of the size of the stone, the age of the patient, or other circumstances, to palliate and make life comfortable, without the risk of an operation, which indeed may often be done for those who are wealthy and surrounded by ease and luxury—if, then, an operation is decided upon, lithotrity is to be practised, when feasible; otherwise one of the operations of lithotomy. The age of the patient assists largely in arriving at a conclusion. As a rule, all children under the age of fourteen are to be cut, unless the stone is so small that it can be reduced to powder at one, or, at most, two crushings, under ether. This rule is founded on the universal experience of practical surgeons as well as upon a study of statistics. Statistics, as a rule, are utterly false guides, as far as showing the true state of affairs in lithotomy is concerned, and their collection does not demonstrate absolute truth. The statistics of one man are all selected cases; another surgeon, though distinguished, may, for that very reason, have had an exceptionally large number of difficult cases to attend to, and consequently his results might be defective guides. Statistics, again, are sometimes largely of hospital, at others of private patients. In the same way the statistics of special operations are not free from chances of error. The excellent showing of the median operation in America (especially the successes of Markoe, Little, and Walter, the statistics of which, as recently published,¹ give 139 cases with five deaths, one in 27 $\frac{1}{2}$), forms a brilliant contrast with the results of Dupuytren's bilateral operation, having a

¹ J. W. S. Gouley, *op. cit.*, p. 347.

mortality of one in $4\frac{1}{2}$ cases,¹ or of the recto-vesical one in 5, or the supra-pubic, one in $3\frac{1}{2}$ (Humphrey). These statistics are none of them finally conclusive; for, as a rule, small stones are selected for the median operation, and the largest for the recto-vesical and the high operations, and, had the cases operated on by these latter methods been subjected to the median section, the mortality would undoubtedly have been enormous; while, if the patients who recovered under the median operation had had their small stones removed by other and severer methods, many more of them undoubtedly would have died.

The general statistics of all operations, at all ages (of which several have been collected, numbering thousands of cases), give a general mortality of about one in $6\frac{1}{2}$ to one in 11. Statistics of the lateral operation alone are much better, and of the median best of all—except the brilliant results obtained by our countryman Dudley, of Kentucky, who, out of 207 cases of lithotomy, only lost six, or one in $33\frac{1}{2}$ cases. The late Valentine Mott was also a very skillful and successful operator, but he has left no record of his results. Gross, in 115 operations of his own, has a mortality of one in $11\frac{1}{2}$.

The most valuable statistics, however, possessed by the profession, are those of Thompson.² They include 1,827 cases. These cases, collected from English operators, show a general mortality of one in eight cases, and that, too, although the reports of certain eminent gentlemen were refused, as containing sources of error. But, that this estimate of one in eight is utterly useless for practical purposes, Thompson shows, by an analysis of the cases according to their ages. He found that one-third of the cases occurred during the first seven years of life, one-half before the end of the thirteenth year. The average mortality under twelve years was one in sixteen cases for all operators, a result which lithotripsy, viewing its difficulties in the young, could scarcely equal. Between twelve and sixteen, puberty comes in to increase the mortality to one in $9\frac{1}{2}$ cases, after which it again decreases. Hence it becomes a matter of personal judgment in cases between twelve and twenty—the stone itself being suitable—whether it would not be better to crush. After twenty, in all cases, where neither the stone nor the condition of the patient contraindicates it, lithotripsy is to be preferred. Between twenty-one and forty-eight inclusive, Thompson's statistics of lithotomy show a mortality of one in $8\frac{1}{2}$ cases; and, from forty-nine to eighty-one inclusive, one in $3\frac{2}{3}$ cases.

To briefly recapitulate: the conditions of the *patient* requiring (with the rarest exceptions) lithotomy, when his age, and the size and character of the stone, would seem to call for lithotripsy, are only four:

1. Peculiar susceptibility, where the patient is liable to have a chill after the introduction of any and every instrument into his bladder.

¹ Eve, of Nashville, only had eight deaths in eighty-seven operations, one in $10\frac{1}{2}$.—*Transactions of the American Medical Association*, 1871.

² *Practical Lithotomy and Lithotripsy*, second edition, 1871.

2. Where the grade of vesical inflammation is high, and gentle manipulations with instruments seem to increase it, or to produce much hæmorrhage. Here the lateral operation will usually put the bladder at rest at once.

3. Tight, *unmanageable* (resilient) strictures complicating stone.

4. Certain conditions of enlargement of the prostate, making it impossible to introduce instruments.

The conditions of the *stone* calling for lithotomy are four: size, number, composition, position:

1. *Size*.—If a stone is decidedly over medium (one inch diameter) size, and at the same time composed of any thing except the phosphates, if any operation is called for it is lithotomy.

2. *Number*.—Most cases of multiple stone do better if cut.

3. *Composition*.—If the stone is small, its composition is a matter of not much importance; if much over an inch, it is all-important. The constant appearance in the urine of uric acid, oxalate of lime, or the mixed phosphates, or the examination of gravel or small stones previously passed by the urethra (if any), will often throw great light on this subject, as will also the quality of the click when the exploring instrument strikes the stone, the sound being sharp and clear for hard, dull for soft stones.

3. *Situation*.—Encysted stones, if molested at all, require the knife. Severe general or local disease (especially cancer or Bright's disease), unnatural size of stone, advanced age, and debility, make it often advisable to palliate rather than assume the risk of any operation, especially among the wealthy, who can command every comfort. With large stones, in broken-down patients, Thompson estimates that cutting operations kill one out of three.

Choice of Operation.—Having now decided what cases of stone require lithotomy, it remains to discuss the circumstances calling for one or the other operation.

Young children do well by any operation, but the lateral is undoubtedly the best, as the incision is not liable to injure the seminal ducts and a free outlet is afforded for the extraction of the stone. If the latter is quite small, the median operation is perhaps as good; but, where it is large, the violence done in dilating the vesical neck is objectionable. It is exceedingly rare for children to have infiltration of urine, although the limits of the prostate are undoubtedly often surpassed by the incision in the lateral operation. Peritonitis from violence is what is to be feared in children, and there is little danger of this (even with large stones) from the lateral operation. The median section, however, in children, has the advantage of being generally attended by less hæmorrhage, and is useful for small stones; the older the child, the less objectionable the operation.

With the adult, the same rule holds good—the median opera-