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LECTURES

ON

THE SURGICAL TREATMENT OF STONE IN THE BLADDER.

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LECTURE III.

Advantages of Suprapubic Lithotomy.—Disadvantages.—Application. Lithotripsy.—Operation.—Causes of Death.—Litholapaxy in Children.—In Adults—in the Aged.—Recurrence of Stone after Lithotripsy.—Choice of Operation.—Conclusion.

Advantages of the Suprapubic Operation.—These are considerable. 1. It is easier of performance than perineal lithotomy, or, in many cases, than litholapaxy; and this is a point of no small importance, especially to those who are not frequently called on to operate for stone. The high operation, as formerly practised, was by no means free from difficulties, due chiefly to the greater proximity of the peritoneum, to the sinking of the bladder, when opened, into the depths of the pelvis, and to the consequent inability to reach it. Now, with the bladder brought well into the abdominal cavity, and retained there by the rectal bag, it needs only common skill and prudence to operate. In this, however, as in most other operations, much facility will be acquired by previously practising it on the dead body. 2. By it, stones of the greatest magnitude may be removed. Dr. Cayley, in India, Dr. Morison, of Hartlepool, and Mr. Rivington, have removed stones weighing 25 and 23 ounces. These could never have been extracted through the perineum, and it is not to be supposed that their removal by the high operation was easy. Mr. Rivington found it necessary to break up the stone with a chisel and mallet, and withdraw it piecemeal, and M. Guyon mentions a case in which he had to do the same. Both these cases, however, recovered from the operation. Dr. Morison found it impossible to extract the stone with any lithotomy forceps, but managed cleverly to deliver it—if I may use the term—with a pair of small midwifery forceps. 3. Infiltration of urine, it is said, should not occur after the high operation. Anatomically considered, the loose cellulo-adipose tissue covering the bladder would, I think, induce one to fear the permeation of it with urine and blood, and consequent mischief; and it must be admitted that some deaths from this cause have already been reported, while, by the old method of operating, fatal infiltration was by no means uncommon. 4. Freedom from troublesome bleeding ought to be, and probably will be, found to be greater than after perineal lithotomy. There are no arteries lying in the knife's course, but there are some considerable veins coursing over the bladder, and the bladder-wall itself is vascular; notably, there are two veins which I have repeatedly observed (best in thin people) running parallel with each other from the apex down the front of the bladder, to join the plexus around the prostate; the line of incision would usually run between, but close to them, and they might, without care, be easily wounded. In several cases recently reported, sharp bleeding has occurred, checked in one case by a timely ligature, and in another by a firm plug and compress; so that on this point, as on others, we must suspend judgment for the present. 5. The suprapubic is certainly less liable than the lateral operation to various subsequent drawbacks, such as fistula, wound of the rectum, impotence, etc. 6. There should be but little risk of leaving stones or fragments of stone undetected. In certain cases of lateral litho-

tomy, where the prostate is enlarged, and the bladder not within reach of the finger, this is a very real risk; but, in the *sectio alta*, the finger will almost always be able to explore every part of the cavity; and, as less force is required to extract the stone, so there will be less liability to break it.

The risks and disadvantages of the operation are, happily, not great. The chief one is the possible opening of the peritoneal cavity, leading to peritonitis from urinary extravasation; or to hernial protrusion of the intestines. With the present plan of operating, this danger is remote, but it has occurred. It is not easier to recognise the outside of the serous membrane in this operation, than it is in ovariectomy, or in dividing the coverings of a hernia; should it be opened, it may be well to consider what is the best course to adopt. M. Polakoff, in one case, closed the wound, and postponed the further steps of the operation. Dr. Tremaine, of Buffalo, having removed the stone and partially closed the wound, was called to the patient in less than half an hour; and found that, under the stress of vomiting, a quantity of small intestine had escaped through the wound. He at once clipped the sutures, returned the bowel, and stitched the anterior wall of the bladder to the abdominal wound, so as effectually to close the aperture in the peritoneum, and the patient made a good recovery. Some surgeons contend that the contact with, or entrance of, healthy acid urine into the peritoneal cavity, would not necessarily produce peritonitis; but I know of no evidence to justify this opinion; and, moreover, the urine in stone cases is seldom quite healthy. The safest course, however disappointing, would probably be, if the accident were immediately discovered, to close the wound, and postpone further proceedings for a short time. Rupture of the bladder from over-distension is not likely to occur, if the injection of fluid be arrested as soon as real resistance is felt. Violent straining of the bladder and rectum, with extreme rigidity of the abdominal muscles, are apt to come on, but they will subside in a short time. In the case, lately, of a girl whose bladder contained a stone, this straining, I found, came on before three ounces were injected, and the water was expelled with great force when the catheter slipped out. The quantity of fluid used varies with the retaining power of the bladder; in children, probably not more than a few ounces; and in old men, with atonic bladder, twelve to fifteen ounces, or more, may be introduced. Similarly, injury to the coats of the rectum will not happen in future, if the quantity of water introduced into the bag be limited to twelve or fourteen ounces. Petersen and Guyon speak of larger quantities; but a larger quantity is neither necessary nor safe. The only instance of this accident that I know of occurred in my own practice, in the case of an old man, into whose rectum I injected, slowly and easily, nearly eighteen ounces; he died of kidney-disease and suppression of urine five days after the operation. All the surroundings of the bladder were healthy; but there was a rupture of the mucous membrane and of the circular muscular fibres of the rectum, to the extent of an inch, near the bladder. The report of published cases would seem to show that recovery is rather slower after suprapubic than after lateral lithotomy; the urine resumes its natural route more tardily, and the operation-wound takes a long time to heal; and this, not only after the removal of very large stones, but even when they have been small. This, however, will not deserve much consideration, if it can be shown that the cure is more certain and more complete than after other methods. It must be admitted that the suprapubic wound is unfavourably placed for thorough drainage of the bladder; it is at the least, instead of the most, depending part, as the patient rests on his back; and, to obviate this difficulty, it is well to place him on his side. Trendelenburg tried the prone position; but this evidently could not be long maintained, and did not answer.

Application.—The cases for which, and the limits within which, the suprapubic operation is applicable, cannot at present be confidently stated. All are agreed that it is to be preferred to other methods for very large stones; those, namely, which exceed the size of a hen's egg; but how, it may be asked, should a stone, which is just too large to be amenable to lithotripsy, be dealt with? by perineal or by suprapubic lithotomy? Should the advantages claimed for the latter be made good

(and there are strong grounds for the expectation), then the lateral method, however reluctant we may be to relinquish it, must yield the field to its newer rival.

It cannot be denied that lateral lithotomy has, in most hands, for stones weighing over 2 ounces, proved fatal in the proportion of 40 to 45 per cent. The record of the Norwich Hospital gives, for stones of 2 to 3 ounces, 54 cases with 20 deaths; of 3 to 4 ounces, 14 cases and 9 deaths; of 4 to 5 ounces, 9 cases with 3 deaths; of 5 to 6 ounces, 3 cases with 2 deaths; of 6 to 8 ounces, 2 cases with 1 death; total, 86 cases (males) of stones over 2 ounces with 39 deaths, being 1 in 2.20, or about 45 per cent. The death-roll of four of the large London hospitals for similar cases is, I believe, somewhat larger than this; whilst the mortality of the suprapubic operation for stones weighing over two ounces is, according to Dr. Dulles, somewhat less: namely, 62 cases with 22 deaths, or 1 in 2.8, being 35½ per cent. It would not be safe to put too much trust in these statistics; the conditions are not equal. The Norwich tables are fairly taken; they include all the cases, successful and unsuccessful alike, which have occurred in one institution, and it may be conceded that the large majority of them were done by fairly competent hands; but the suprapubic cases were gathered from all sources, and were done by many hands, competent and incompetent. They include those only which the various surgeons choose to publish, and we know how reluctant many are to put forward unsuccessful cases. This inference would, of course, tend to reduce the success of the suprapubic operation; on the other hand, we may confidently expect that, with our improved methods, with our increased knowledge of abdominal surgery, and with the partial use of antiseptic measures, the results obtained will be far better in the future than they have been in the past.

There is a class of cases for which the high operation will probably become more and more applicable; namely, the combination of stone with considerable enlargement of the prostate gland. Looking back at my own experience, I perceive that these cases constitute a very large proportion of the whole, and they furnish also a large proportion of the unsuccessful, incomplete, and fatal cases. They are more difficult to cope with than any other class; the bladder often cannot be reached; stones, or fragments of stone, are apt to be left behind; hæmorrhage is frequently serious, and is difficult to deal with; in short, a full-sized stone associated with a large prostate constitutes, as I have before said, the maximum of difficulty in lateral lithotomy. Those surgeons who, like Mr. Reginald Harrison, believe that it is good practice to try, not only to remove the stone, but also to cut away portions of the prostate gland, or to make incisions through obstructing parts of it, will still prefer the perineal route. For my part, with all respect for these views, I am disposed to treat the enlarged prostate with forbearance and respect, and to leave it absolutely untouched. The pain, cystitis, and misery which these patients endure, are due, not so much to the prostate, as to the added trouble of the stone; and, in my experience, the entire removal of the stone will, in almost all cases, place the patient in comparative comfort. The high operation in these cases would present no unusual difficulties; the bladder is usually large and dilatable, and the stone would be within easy reach. An awkwardly enlarged prostate not only impedes the lithotomist; it equally frustrates the lithotritist, and renders his efforts unsatisfactory, as I shall presently show; and so, should the high operation have anything like the success which is predicted for it, not only will it supplant the lateral operation in such cases, but I can conceive that it will sometimes take the place of lithotripsy also.

In all cases, the stone is much more within reach by the high operation than by any other; therefore, if the stone be encysted, it will probably offer some decided advantages. The distance between the surface of the perineum and the entrance to the bladder is always considerable; but, in many cases of encysted stone, the distance is increased by reason of hypertrophy of the prostate, and so the entrance to the enclosing cyst can seldom be got at with precision or safety, so as to extricate the stone; but, in the high operation, this would probably be more practicable.

In children (boys), the suprapubic operation has hitherto found its best success. The abdominal position of the bladder, the higher position of the anterior fold of the peritoneum, and the slight liability of children to urinary infiltration, are strong inducements to its adoption. On the other hand, lateral lithotomy is also very successful; still it is not always an operation free from difficulty, and occasionally it fails altogether, even in experienced hands. When the stone is of any considerable size, the high operation is preferable to the lateral; and, when the stone is quite small, lithotripsy, even in young children, has much to recommend it; but, in the average run

of cases of stone in the young, results alone can decide which method is the safer.¹

Lithotripsy.—In discussing the subject of lithotripsy, we stand on much firmer ground than in speaking of suprapubic lithotomy. There are facts and experience in abundance, on which to ground a reliable judgment, although there are still some points of detail requiring further elucidation. Like the high operation, it has recently undergone a remarkable development, but this development has already stood the test of time and trial enough to justify its general adoption.

The history of Bigelow's brilliant innovation on the old method is too well known to need detailed notice. It is curious how near some of the earlier lithotritists approached it. Heurteloup certainly seized the true idea, but had not the instruments wherewith to carry it out. Sir Philip Crampton used suction to extract fragments of stone from the bladder, and Clover contrived the rubber aspirator and large-mouthed catheter, which differ but little from those which are now in constant use. It is with a feeling almost of chagrin and regret, that I recall the fact that, as regards the suprapubic operation and litholapaxy, with Garson's plain hints as to the one, and Clover's helpful appliance in the other, English lithotomists and lithotritists should have overlooked the true meaning of these hints, and have left it to Petersen and Bigelow to recognise their intrinsic principles, and to adopt and fully introduce them into practice. It is true that Brodie, more than forty years ago, removed fragments of stone by suction, but he only advised it for the final fragments in a paralysed bladder. It is also true that, with Clover's rubber bottle and catheter, some of us have tried to clear bladders that could not clear themselves; but none of us had realised or thought of the possibility of attacking and removing at one sitting an ordinary stone from a healthy bladder. Otis's discovery, if I may so describe it, of the full dilatability of the urethra without injury, paved the way for the introduction of litholapaxy. Bigelow saw clearly enough that, without a full-sized evacuating catheter, the removal of any but small stones could not be effected at one sitting, but that with it, and with lithotrites of adequate strength, the field covered by lithotripsy would be greatly extended. This anticipation has been abundantly proved; the principle of the proceeding is good and sound, and the practice is brilliant and successful. But, while admitting and maintaining this position, I am not unaware that there is some drawback to this picture; that it is held by many surgeons, and, amongst them, some of the most eminent, that the success of lithotripsy is, in too many cases, temporary, and not permanent; palliative, and not radical; that, while the immediate result is good and satisfactory, the future history of a patient relieved by lithotripsy too often is full of trouble, caused by persistent bladder-disease and frequently recurring stone. I cannot deny that there is some ground for this adverse opinion; how much, I will endeavour to show. In the meantime, let me say a few words as to the operation, and then as to its application to children, to adults, male and female, and to the aged.

Litholapaxy.—I have followed the usual method of operating. The urinary organs and urine are first brought into as favourable a condition as possible, by rest and appropriate treatment. I invariably begin an operation with a fenestrated lithotrite of adequate size. The stones most frequently met with in the eastern counties are generally composed of pure uric acid, and are of intense hardness; so hard are they, that it has sometimes required my utmost strength of wrist, and the help of a towel folded round the handle of the instrument, to accomplish the first break of the stone. Dr. Freyer, in India, where very large stones are frequently crushed, has experienced this difficulty, and has suggested the addition to the handle of the lithotrite of a cross-bar, which would give great power, would save one's hand, and could be removed when not required for large and very hard stones. As the fragments diminish in size, the un-fenestrated instrument comes to be the best; it holds, crushes, and pulverises the fragments better, and makes quicker work. It is desirable that all lithotrites should have the female blade made rough, so as to prevent slipping of the smooth round or oval stones when

¹ The rate of mortality of suprapubic lithotomy, since the introduction of Petersen's method in 1879, is, according to M. Garcin, of Strasbourg, 94 cases with 23 deaths, or 24 per cent.

Age.	Cases.	Ratio.	Percentage.
1 to 10	1	1 in 4.40	22.2
10 „ 20	26	1 „ 2.6	38.4
20 „ 30	8	1 „ 4	25
30 „ 50	7	1 „ 7	14.28
50 „ 70	16	1 „ 2.8	43.75
70 „ 90	11	1 „ 2.75	36

M. Tuffier, of Paris, gives more recent cases, including the above, namely, 120 operations, with a mortality of 27 per cent. (*Vide Ashurst's International Encyclopedia of Surgery*, vol. vi, article on Stone, by Dr. Keyes.)

caught. These stones are apt to slide out of the instrument and escape when the male blade is pressed down on them, but this rough surface enables the blades to grip at once. Great care should be taken to raise the stone towards the centre of the bladder before using the screw, so as to avoid contact with, and injury to, the mucous membrane. The evacuating catheters have varied but little from those first introduced by Bigelow. I have always used the curved, because it has seemed to me that the straight tube, when pressed down into the bladder, is not quite free from the risk of injuring, or even perforating, its walls, especially if they be thin and weak. It is important to keep the curved end of the catheter slightly pressing down the fundus of the bladder during the evacuation of *débris*; this is done with the left hand, while the eye of the experienced operator will ceaselessly watch and wander over the whole apparatus. If the aspirator do not quickly expand, this may be due to blockage from fragments, in which case the characteristic click will be heard, or it may result from a portion of mucous membrane becoming entangled in the aperture, or from the end of the tube having been inadvertently withdrawn into the prostatic urethra.

The aspirators are of various shapes. Bigelow, Otis, Berkeley Hill, Morgan, and Sir H. Thompson, have all separate patterns. I have tried most of them, and I must give the preference to Bigelow's last (*Lancet*, January 6th, 1883), or to that made by Down, with the addition of a funnel for easy filling; both have the glass receiver below the aspirator, and this has the decided advantage, that the water in it does not become quickly coloured with blood, and you can see at a glance how the evacuation is progressing and when fragments cease to fall into it. That which Sir H. Thompson prefers answers very well, but I have found it open to two objections. Some patients are apt to bleed, especially old prostatic cases; and small clots, with minute fragments of stone entangled in them, or shreddy mucus, become fixed in the hanging wire valve, and block, wholly or partially, the return stream into the bladder; moreover, the slightest stain of blood immediately reddens the fluid in the receiver and obstructs the view, so that it is not easy to see how the evacuation is going on. It is surprising how little water is required to be forced into the bladder at each squeeze of the aspirator; a tablespoonful is almost enough; much more than this will only disturb the bladder unnecessarily and hurtfully, and will not assist in extracting fragments.

It is very desirable that the entire stone should, if possible, be removed at one sitting. At one time, and with the habit, according to the old method, of dividing the treatment into several sittings, I was not unwilling to leave a portion of the stone for a second operation; with a full-sized stone, the proceeding is very fatiguing to the surgeon, and, moreover, as the stone diminishes in size, the smaller fragments are less and less easily met with, so that the inducement to make two sittings is strong. This, however, is a mistake; the bladder and urethra, injured and bruised to a slight extent as they necessarily are by the prolonged use of instruments, are far more likely to recover tone and health if there be no sharp fragments present to excite or keep up cystitis; therefore, there should be entire clearance if possible, even if this should require another half-hour of endurance on the part of both patient and surgeon.

Of immense importance is it not only to secure the removal of the chief bulk of the stone, but especially of the very last atom or final fragment, so that no starting point or nucleus may exist for recurrent stone or phosphatic deposit. This has always been the difficulty and defect of lithotomy by the old method; but it is claimed for the new that, with the evacuating catheter and a good aspirator, there is no difficulty in removing the last fragment. I can fully coincide with this view when we are dealing with a healthy, smooth, and vigorous bladder, but it is far otherwise with a half-paralysed, hypertrophied bladder, in which the muscular columns stand out, and the mucous membrane is pocketed, as it were, between them; where the prostate projects backwards, and pouches are formed on one or both sides of or below it. In such cases as these, and they are frequent in practice, I do not hesitate to say that no evacuating catheter, and no aspirator, even in the most skilful and experienced hands, can with certainty ensure the extraction of every minute fragment; the suction-action of the aspirator extends but very little distance from the opening in the evacuating catheter; and we cannot explore all these recesses, pockets, and pouches. Tiny atoms become hidden; they mingle with small clots of blood, and with mucus, and cling around and amongst these irregularities of the lining membrane; and although clots and mucus are readily drawn up through the catheter, we can never be sure that all are removed. Even Bigelow, who is certainly not willing to admit any defect in the operation, and whose manipulative skill is perfect, confesses that "we fail to discover a last fragment in some bladders, even by repeated washing" (*Lancet*, January 1st, 1883).

Advocate as I am of the new lithotripsy, I feel constrained to admit this difficulty with the final portions of stone, and further to admit that to it is due, as I shall presently show, the great tendency to recurrence of stone and phosphatic deposits which are lamentably prone to follow lithotomy in a certain class of cases.

The causes of death after lithotomy deserve the closest attention; they point out the dangers which beset the operation, and the accidents which may happen; and, when fairly described, they convey a great amount of information. In my own practice, I have seen eighteen deaths; the list is a long one; but as in lithotomy, when I remember the large number of old, neglected, and otherwise diseased patients I have had to treat, men who will only apply for aid when they can no longer work, with complications of various kinds and broken-down constitutions, I can almost wonder that the list is not longer. Sir H. Thompson, in speaking of the early detection of stone, says he has treated 100 cases of these small stones, with only one death. I can only say that I see but few of these desirable cases, and the recital of them almost excites envy.

The following table, giving the salient points of these eighteen fatal cases, show that, in four, the cause of death was independent of the treatment, and ought, perhaps, to be omitted from the list: namely, one each from angina pectoris, erysipelas of the head and face, apoplexy, and chronic bronchitis. In four at least, pyæmia was the cause, all being hospital-cases. Peritonitis occurred in five, in four of which there were sacculi, and the inflammation spread from them, and, in three of these, a stone, or fragments of stone, were found in the sacculi; in two, the bladder-wall was injured by the catheter; and in one there was pelvic abscess, caused by a false passage in the prostatic urethra. In more than half the deaths, kidney-disease was either the sole or, to some degree, a contributory cause of death.

Lithotomy in Children.—Until recently, lithotomy has been assumed to be unfit for quite young children; but our brethren in India have lately opened new views on this subject. I cannot mention Indian surgeons without bearing my testimony to the great and excellent work they are doing in the surgery of stone. They possess, especially those who reside in the north-west provinces, unrivalled opportunities of observation in the vast number of stone-patients who seek their aid; and it is a pleasure to recognise the sound and practical character of their published papers, while their operative skill is abundantly proved by the great success they have obtained. The papers of Dr. Freyer and Dr. Keegan are well known; while Drs. Beaumont, Anderson, Saunders, and others, have contributed much information. Dr. Beaumont, at Indore, I believe, first applied lithotomy to young children. In his early cases, he says: "I used no evacuating catheter at all, breaking the stones up very small with the small hand-lithotrite (No. 5), and the *débris* were passed safely, without the use of any evacuating instrument." He was succeeded at Indore by Dr. Keegan, who, at first, hesitated to apply litholapaxy to children, because of the great success of lithotomy; but, at the close of 1881, he began, and, in the *Indian Medical Gazette* of May, 1884, and June, 1885, he has reported forty-two cases, with only one death. The ages of the children varied from 2 to 11 years; the weight of stone from 5 to 308 grains, the average being 128 grains; the average stay in hospital was a little less than a week. In his first paper, he deprecated litholapaxy for stones composed of oxalate of lime; but, in his last, he has given three cases of mulberry stones crushed, which weighed respectively 308, 230, and 200 grains, in boys of 11, 11, and 10 years of age. Keegan always uses fenestrated instruments, for fear of clogging by *débris*, and only those lithotrites and catheters which will readily pass without undue stretching. As in the adult, so in children, it came almost as a surprise for English surgeons to learn that proportionately large instruments could be easily passed into the bladder. English surgeons, and even Dr. Freyer, in India, have hitherto objected to the operation, because of the small urethra, the undeveloped genito-urinary organs, and the tender and sensitive mucous membrane in children, as well as the generally successful results of lithotomy. Keegan found that, in boys, there is great difference as to the size of instruments that are admissible. Speaking generally, boys of 4 to 6 will bear No. 7 or 8 lithotrite, and No. 8 or 9 evacuator, and boys of 8 or 10 will admit No. 8 or 10 lithotrite, and No. 10 or 12 evacuator. A No. 8 fenestrated lithotrite will easily crush a stone of two to three hundred grains. It is necessary to break up the stone very thoroughly. The evacuator, though proportionately large, is actually small; and the operation, therefore, in children, occupies a longer time than in the adult, the average being rather over an hour. He contends that the bladder and urethra in children will bear rough handling quite as well as or better than in adults. They recover easily from the operation, as a rule. Some had swelling of the penis and prepuce, and some had pain in micturating for a few days; but these

Deaths after Lithotripsy.

No.	Age.	Sittings.	Remarks and Cause of Death.
1	72	2	Cystitis; retention twelve days after last sitting; prostate size of orange; mucous membrane of bladder dark in colour.
2	76	1	Feeble man; enlarged prostate; alkaline urine; stone hard; eleven lines; fever and cystitis; abdominal pain; died in twelve days; bladder small and contracted; thick walls; mucous membrane dark; a sacculus at lower and right side larger than bladder itself; pieces of stone in it; thin walls; intensely inflamed and pelvic peritonitis around it; prostate enlarged; ureters dilated; kidneys coarse and dilated.
3	75	1	Feeble man; three stones; death in fifteen days; abdominal pain; fever; cystitis; peritonitis spreading from sacculi at back of bladder; sac walls thin, almost sloughy; bladder large and dilated; sacculi everywhere; mucous membrane inflamed; median lobe of prostate large; kidneys healthy.
4	63	2	Came in with cystitis, having been crushed by surgeon a month before; bad stone; great pain; fetid urine; crushed once or twice, but he failed, and died in two months. Bladder inflamed; sacculated one full-sized sac at apex contained two pieces of stone; kidneys not unhealthy.
5	59	3	Stone and stricture; dilatation up to No. 11; crushed twice, phosphatic stone; urine alkaline, with mucus; bladder improved, but he became ill with pleuro-pneumonia, and died five weeks after first crushing. Bladder small, mucous membrane inflamed; a small piece only of stone remained. Prostate not enlarged. Kidneys congested; right contained two small abscesses; left a cyst with clear fluid. Right pleura contained three or four pints of turbid serum. Right lung collapsed, not inflamed; left lung healthy. Pericardium universally adherent, thickened, and contained two large plates of bony matter, some inches in diameter; at one part, the edge of this bony plate was the seat of a sloughy abscess, probably pyemic.
6	59	3	Favourable case, crushed easily; no bladder-irritation; passed debris freely; death from chronic pyemia and suppurative nephritis six weeks after operation. Bladder healthy; mucous membrane pale, a few small fragments of stone remaining; abscess in both kidneys, in one lung, and in sterno clavicular joint.
7	62	3	Cured by lithotripsy in 1871; recurrence; crushed again three times 1874; retention; peritonitis; death three weeks after first sitting. Peritonitis chiefly in pelvic region. Bladder thick, not large. Mucous membrane not much inflamed, sacculated; one sac at apex was sloughy, and communicated with peritoneal cavity by small round hole; catheter, which was used every few hours by the house-surgeon and dresser, had evidently entered sac, and perforated its thin walls. Prostate enlarged, especially median lobe. Ureters dilated.
8	65	8	Tall, florid, free living man. In April, 1875, four sittings; cured, but still an irritable bladder. Came again in February, 1876, with cystitis; felt stone fixed at upper fundus, crushed with difficulty. Two or three sittings, under anaesthetics; improved greatly; suddenly attacked with alarming dyspnoea; recovered; another attack a week after, fatal. No post mortem examination.
9	74	5	Crushed five times; all stone removed. Slight phlebitis of leg during treatment; passed off; was going home cured, when erysipelas of head and face came on; proved fatal. Bladder healthy, no stone left. Prostate enlarged.
10	74	2	Multiple stones; chronic retention; foetid, purulent urine; feeble health; rapidly declining. Two trivial crushings; improvement in urine followed, but anorexia and debility went on, and he died of inanition in about a month. Bladder small, but not over thick; mucous membrane dark in colour, and inflamed; a sacculus as large as the bladder itself behind it, having an aperture of communication on the post-wall opposite the urethra; its walls were composed of mucous membrane and peritoneum; the former black and sloughy, and the peritoneum even looked dark and purple; the sac filled with thick pus and urine. Six small stones, some of them broken, found in bladder. Prostate moderately enlarged.
11	67	1	Several stones; all urine by catheter five or six years. For two years, pain and cystitis, with alkaline mucus-purulent urine. Hesitated whether to cut or crush. Litholapaxy; removed some debris, but left more. In few days, fever, cystitis, and nephritis; died two weeks after crushing. Right kidney atrophied; three ounces; ureter dilated. Left enlarged; eleven ounces; pelvis and ureter inflamed, and filled with offensive bloody urine and pus. Prostate large as an orange, median lobe projected far into bladder, deep pouch behind it. Bladder inflamed; hypertrophy with dilatation; numerous small sacculi, one large, one near left ureter, filled with calculus as large as walnut. Orifice of sac would just admit tip of forefinger; stone projected through it into bladder, and was rubbed smooth by contact with stones there. In bladder, two broken stones, and one larger unbroken one. Lithic acid covered with phosphates.
12	66	1	Multiple stones. Litholapaxy; 220 grains lithic stone, easily removed. Peritonitis, death in four days. Extravasation and sloughy tissue round the bladder, with pelvic peritonitis. Bladder rather small and thin; at back part of lower fundus was a hole, through mucous and muscular coats, large enough to admit tip of finger; margin of it covered with sabulous matter. Prostate enlarged.
13	66	1	Litholapaxy, stone of moderate size; in ten days, seemed almost well. Then had rigor, swelling of arm, acute pleuropneumonia, and died in four days. Pyemic infarctions in kidneys and lungs, no actual pus, death came so quickly. Bladder hypertrophied

No.	Age.	Sittings.	Remarks and Cause of Death.
14	68	1	with dilatation, honeycombed, mucous membrane pale; a few minute pieces of stone left. Large hard lithic stone; enlarged prostate; litholapaxy; 400 grains red lithic debris removed; a good many fragments left, 150 grains passed, some impacted in urethra, and had to be picked out; fever ensued, swelling of one hand, urinary abscess in perineum, death in twelve days. Bladder hypertrophied, mucous membrane not much inflamed, piece of stone remaining. Prostate large, especially median lobe, which projected into bladder, like a large walnut; ureters large and convoluted; kidneys large, congested, and riddled with disseminated abscesses.
15	77	1	Hard lithic stone; 290 grains; litholapaxy; prostate large, tendency to bleed on slightest touch; bladder sensitive; abdominal pain; fever; bloody urine; death in four days. Over left kidney signs of inflammation, patch of lymph, and vivid injection on intestinal peritoneum adjacent; kidneys showed black hemorrhagic infarcts; bladder of moderate size, but thick; mucous membrane injected and red, but not plum-coloured; no sacculi; some old clots, and a few small fragments of stone; prostate much enlarged, especially right lobe, which projected into lumen of bladder, and impeded use of instruments; very distinct and prominent "bar" at vesical orifice, and in front of it a deep prostatic sinus; mucous membrane on the bar slightly abraded.
16	73	1	Multiple small stones, easily removed by litholapaxy; some cystitis and retention; quickly removed by catheter and washing, but some vesical irritability remained. Seized with apoplexy on the morning of his going home; died quickly; enormous clot in corpus striatum. Bladder pale and healthy, free from stone; at apex was a malignant tumour, size of a walnut, in the bladder-wall; puckering peritoneum over it, and just showing through the mucous membrane; this was undetected in life, and caused the slight irritability left after the operation.
17	46	1	Large hard stone; crushed with large lithotrite and 18 tube, and removed 470 grains, leaving a few fragments, which were removed shortly after; only slight cystitis, and he was nearly well; then pain about the bladder came on, but not in micturating; fever and acute abdominal pain, and he died a month after operation. Peritonitis, beginning in pelvis; bladder perfectly healthy; no stone left; no cellulitis, but there was a large circumscribed abscess below it, on one side of rectum, containing healthy pus; this was set up by a false passage, leading into it from the prostatic urethra. Prostate rather increased in size; very deep prostatic sinus; lacuna by side of vera-montanum very large. Into one of these the catheter, or some instrument had passed, and coursed under the mucous membrane, and led to the abscess; a small fragment of stone was entangled in the passage.
18	72	1	Red-faced man, with bronchitis and chronic cystitis; very ill, and getting worse; under chloroform, removed a soft phosphatic stone; bladder washed out daily, and urine became acid and clear; but he gradually became choked with bronchial phlegm, and died three weeks after operation. No post mortem examination.

symptoms yielded readily; while in some, as in adults, it was requisite to slit the orifice of the urethra slightly, to gain admission for the proper instruments. Keegan concludes his observations by insisting on the following rules: "Use small fenestrated lithotrites; if possible, crush the stone into fine powder; and you will not then require large-sized catheters to evacuate the debris. Never use a lithotrite or catheter which will not pass readily in and out of the bladder and urethra; be extremely gentle and careful in practising all manipulations on the urinary passages; do not be in a hurry to complete the operation; use the aspirator freely; and never, if possible, leave a single grain of debris behind in the bladder; and rest assured that, if all these conditions are fulfilled, you may count on a very large average of success. Some cases you will meet with where no lithotrite, however small, can be employed with safety, and these are the cases which should be dealt with by lithotomy." As I have quoted Keegan's figures, I have also thought it due to him to give his conclusions; he speaks after full experience, and not from a few cases only.

The advantages of lithotripsy in children over perineal lithotomy may be thus stated. 1. It is probably more successful; the mortality of lithotomy is about 5 or 6 per cent.; of litholapaxy, probably not more than 2 or 3 per cent. 2. There is no risk from bleeding, or from wound of the bowel or of the seminal ducts. 3. The recovery is much quicker. 4. It is probably easier of execution than lithotomy. In female children, there can be no question that, for small stones, it is the proper operation. Dr. Freyer, who has objected to lithotripsy in boys, has adopted it in girls in several instances with success; and in them it has not, as in boys, to stand the test of a rival lateral lithotomy. At the Clinical Society, lately, the subject was discussed, and the general tone of the speakers was one of cautious expectancy and reluctant assent. Personally, I have no experience of lithotripsy in children; I do not often see stone cases in the very young, having ope-

rated on only thirty-one cases under 10 out of 360, and those were treated by lithotomy.

Lithotripsy in the Adult, by which I mean the middle-aged adult, before the prostate begins to enlarge, and unfavourable bladder-changes occur, is capable of great things. In this period it achieves its greatest triumphs and its best results. In such cases, the kidneys are probably sound, and the bladder healthy; it is smooth, fairly capacious, its contractility and nerve-power are unimpaired, and, above all, there is no impediment to the outflow of urine. The operation is easy of execution; the complete removal of all the fragments can be accomplished almost with certainty, and, if any small portions be left, the patient will expel them with ease in a day or two. It is under these conditions that stones of full, and even great size, have been successfully removed. In this connection, the Indian surgeons take the lead. Dr. Keegan reports the case of a man aged 67, from whose bladder he removed a stone weighing about $3\frac{1}{2}$ ounces. He used a No. 15 lithotrite at first, and for half an hour the stone was too large for the lithotrite to act by its screw; during this time, he nibbled at its surface, and at length so diminished its size, that the screw came into action, and the stone was broken, and easily dealt with. He introduced the lithotrite fourteen times, and the largest catheter an equal number. On the third day, he extracted a small piece which had been left, and, on the fourth day, the urine was quite clear, and the patient went home. The operation lasted four hours, and the surgeon adds that, once or twice, he was on the point of relinquishing it through fatigue.

Dr. Freyer also gives two cases in which he removed stones, each weighing over three ounces, one composed of lithic acid and the other of oxalate of lime. In these cases the calculus was single; and I need not say that it is more difficult to break up and remove a large single stone than to deal with double the weight of small multiple stones, which are generally laminated and friable. There must, I conceive, be some difference between the texture and composition of these large Indian calculi, and those pure red uric acid ones, which I often meet with. I can hardly believe that any instrument capable of being introduced could break up an uric acid stone of three ounces, unless, indeed, these large stones should be found to yield more easily in proportion than smaller ones. These very large stones, however well they may exhibit the scope and power of Bigelow's brilliant operation, can only be considered as exceptional. They require not only a healthy and capacious urethra and bladder on the part of the patient, but also great skill, and not a little strength and endurance on the part of the surgeon.

I cannot help thinking that the Indian patient, with his frugal mode of living and generally spare habit, is a less inflammatory and safer person to deal with than the beer and spirit drinking, and often hard living Briton. It is true that lithotomy in India is not more successful than in England; but this operation is probably done by the many, skilful and unskilful, whereas litholapaxy is only practised by the few and the able.

Litholapaxy in the Aged requires a more qualified statement as to its merits, chiefly because, in them, stone is frequently accompanied by complications of one kind or another, which often lead to trouble, or imperfect results. When no complications are present, the operation is quite as successful in the very old as in the middle aged; indeed, I think they bear the use of instruments better, and are less sensitive and resentful of interference.

The most common of all complications is prostatic enlargement. When slight, this is of little importance, but when it is considerable, it leads to changes in the bladder of a serious kind; it may impede the free and efficient use of the lithotrite, and render the removal of all the calculous fragments difficult. There is generally some impediment to the escape of urine; this necessitates increased action of the bladder, but the necessity comes at a time of life when the nervous and vital forces are declining; and, as a result, we see, not the hypertrophy with contraction and thickening of the bladder, common in obstruction from stricture in early adult life, but hypertrophy with dilatation and thinning, and consequent inability to contract and empty itself either of urine, or of fragments of broken stone.

Prostatic hypertrophy seldom affects equally the entire gland; it may be of one or other lobe, or of the median portion almost exclusively; and, in this way, the urethral canal may be so displaced, that its devious course is not easily followed by instruments of a definite and awkward shape. But this irregular enlargement may, and generally does, project into the cavity of the bladder, and lead to the formation of deep hollows or pouches, not sacculi, on each side of, or behind and beneath, the prostate, in which broken fragments of stone will hide where it is most difficult to follow them, and from which it is sometimes impossible to dislodge them by any means, or by any instrument.

Again, prostatic hypertrophy, as I have already described, induces hernial protrusions of the mucous membrane between the muscular fibres, and sacculation in all its degrees and varieties. When a stone is broken in such a bladder, some trifling piece, or fine debris, may, at moments when the bladder is distended, find their way into one of these sacs, and lay the foundation of encysted stone and frequently recurring symptoms. The imprisoned fragment first fills the cyst; then, by continued accretions of phosphates, it grows up into the bladder like a mushroom, and is probably again and again nibbled off by the lithotrite, each time with temporary benefit to the inflamed bladder, until the patient dies, worn out with chronic cystitis and pyelitis.

This is no fancy picture, nor is it so rare as some lithotritists would have us believe. I have met with a considerable number of cases, some of which have been reported; and increasing experience proves to me that prostatic enlargement is a very real source of failure in lithotripsy.

The risk of this entanglement of debris in sacs or pouches is probably lessened by the removal of the stone at one sitting, but it is by no means certainly abolished. By turning the aperture in the evacuating catheter towards these pouches, and by the free use of the aspirator in all directions, the fragments may be washed out of them and all removed; but it cannot be denied that it is always a serious matter to shatter a stone into innumerable fragments in a bladder of this description. On the other hand, lithotomy, either suprapubic or perineal, is an operation of magnitude, and of greater and more serious risk than lithotripsy, so far as immediate results are concerned.

Recurrence of Stone after Lithotripsy.—Although the immediate and direct mortality of lithotripsy is small, the recurrence of stone is lamentably frequent. In my own list of 133 cases, there were eighteen in which recurrence, one or more times, took place, being about 1 in 7. Sir H. Thompson, with a much larger number of cases, gives about the same proportion. I am disposed to infer, however, that recurrence is more frequent even than this, because it is not likely that all who get relapse apply to the same surgeon again. Living, as I do, in a local centre, and drawing cases chiefly from a limited area, I am probably more able to trace, and more called on to treat, those who suffer a second or third time, than he who lives in the metropolis, and draws his cases from great distances. Patients may, and frequently do, apply to the same operator once or twice; but, after a time, they either apply to their own surgeon, or they decline further treatment; and too often their subsequent history is one of painful endurance of chronic bladder-disease and gradual exhaustion. If, moreover, there be added to the list those numerous cases of phosphatic deposit or concretions so frequently noticed after lithotripsy, the relapses would, I believe, reach to nearly 20 per cent. This seems a heavy indictment to bring against lithotripsy, but I am afraid there is no gainsaying it; and, if so, it would be wrong to pass it over, or make light of it. Many of these relapses might be prevented if the patients would observe directions, and persevere with treatment. It certainly is so with the unenlightened and uncomplaining hospital patient. Feeling himself well, or what he considers well, he goes to his work, and neglects the use of the catheter and other means; and, instead of returning in a month or two to have his cure certified, or a minute remaining fragment removed, he toils away as long as he can, and returns, perhaps in a year or two, with a fresh uric acid stone, or with chronic cystitis, and a phosphatic one. The educated, sensitive, private patient, on the other hand, will watch his symptoms narrowly, and return if the slightest indication of the old trouble should reappear. It is this difference which makes lithotripsy in hospital practice sometimes disappointing and unsuccessful.

This frequent recurrence must be due either (1) to the descent of a fresh stone from the kidneys, or (2) to a fragment of stone having been left at the first operation. As to the descent of a fresh stone: there can, of course, be no doubt as to the occasional occurrence of this cause, just as we see it occur after lithotomy. The bladder being entirely cleared of stone, there will be the same liability to the descent of a fresh renal calculus after one operation as after the other. What, then let me ask, is the fact as to lithotomy? I have already shown that there were only 21 cases out of more than 1,000 of lithotomy at the Norwich Hospital, in which recurrence was clearly traced to perfectly fresh formations coming like the first, from the kidney, or about 1 in 50; whereas, in Sir H. Thompson's list of about 600 persons treated by lithotripsy, he mentions 61 cases in which he operated twice, 9 three times, 3 four times, and 2 five times; 75 in all, or about 1 in 8. The inference from these data seems to me to be inevitable, that relapse of stone after lithotripsy is chiefly due to other

causes than the descent of a fresh renal stone. To my thinking, the majority of recurrences is caused by the great difficulty in insuring the complete removal of all the *débris*; I have already referred to this in old persons, with enlarged prostate and feeble atonic bladder, and it is this class of patients who are especially liable to relapse. I have traced this in my own cases, and, I may also add, in cases of other and better lithotritists than myself, too often to have any doubt in my mind.

It is frequently said, and it is quite true, that lithotritry is often followed by a tendency to phosphatic deposit in the bladder, and this tendency constitutes one of the chief objections to the operation. Thus, Sir H. Thompson says, "many who submit to lithotritry, become afterwards the subjects of chronic cystitis and phosphatic deposit, sometimes to a distressing extent" (*Medico-Chirurgical Transactions*, vol. lxi, p. 175). Dr. Freyer also says, "In prostatic enlargement, the disease (stone) frequently recurs, owing to the fact that the bladder is never completely emptied of urine during micturition" (*Lancet*, March, 1885). Why, I would ask, should this special tendency to phosphatic deposit ensue after lithotritry? Not, I think, as Dr. Fryer would have us believe, because of vesical incompetence and residual urine.

It is admitted that, in ordinary cases of prostatic hypertrophy, with atony and "catarrh" of the bladder, when no stone has ever existed, there is little or no proneness to phosphatic deposit. However fetid, alkaline, and loaded with mucus the urine may be, no phosphatic deposit will take place in the bladder, except on some pre-existing nucleus. In such a bladder, we know how soon a catheter becomes encrusted; and similarly, if a clot of blood, or any foreign body, or even an abraded surface or a new growth exist, phosphatic deposit will soon take place. Without some kind of nucleus, no deposit will occur. The mucous membrane with its epithelial covering has probably some inherent vital power, which seems to guard it against deposit of calculous matter; remove the epithelial covering, and deposit may occur at once on the rough surface. After lithotomy, how often do we see this phosphatic deposit along the tract of the wound, but it is not found on the mucous membrane, unless some ulceration or abrasion has taken place.

I think I am justified, therefore, in saying, that when phosphatic deposit (call it concretion or call it stone) follows lithotritry, it is, in the large majority of cases, engrafted by aggregation on a fragment which, notwithstanding all the skill and care taken, has been overlooked at the first operation. This consideration should make us pause before breaking up a stone in an atonic bladder; I have often felt some misgiving in doing it. With the aspirator and evacuating catheter, we may hope to succeed in clearing out all the *débris* from these bad bladders better than we could by the old method; but even with this improvement, as Bigelow says, "we fail to discover a last fragment in some bladders even by repeated washing."

On the other hand, what better alternative is open to the surgeon? Lateral lithotomy is a harsh proceeding and more immediately perilous to life; and, moreover, it is not itself wholly free from the danger of leaving a portion of a broken stone behind. Suprapubic lithotomy, should it prove to be, in its modern form, more successful than it formerly was, may come to supplant not only perineal lithotomy in this class of cases, but lithotritry also.

Selection of Operation for Stone.—This is a subject of no small difficulty in many cases. The size of the stone, or, if more than one be present, the total amount of them; the condition of the kidneys, bladder, and prostate; the temperament and general health of the patient; his class in life; co-existing diseases and complications, if any; the surgeon's own experience and facility in manipulation; all these have to be duly weighed. An experienced hand will generally make a tolerably accurate estimate on these points, but mistakes are not unrequent. For example, measurement of a stone is sometimes apt to mislead. A month or two ago, I introduced a No. 12 lithotrite into a man's bladder, and found a stone which measured over two inches, while the screw reached only two inches exactly. I hesitated, and for a moment felt inclined to do lithotomy. Finding, however, that the bladder was healthy, and the prostate not large, the urethral orifice was incised a little so as to admit a full-sized instrument; the stone was quickly and easily disposed of, and the *débris* weighed only 480 grains. No doubt this was a flattened oval stone which had been seized in its long diameter. Again, when two or three stones of unequal size co-exist, it is easy to pick up the smallest over and over again. We are thus led to think that only a moderate amount of calculus is present, whereas, when the small one is disposed of, surprise, and even dismay, are felt when a still larger one is grasped. Again, when more than one stone is suspected, it is customary to seize one, fix it in the instrument,

and proceed to sound afresh; this, however, may mislead; for, a stone having been grasped by the tips of the blades, and moved about in the bladder, it will sometimes rotate a little in the blades of the lithotrite, and communicate a grating feel to the hand which is very like touching a second stone. A glance over the recently reported cases of the high operation will show how repeatedly the operators were mistaken on some point, either as to the size of the stone, or the condition of the bladder, or their ability to seize the stone. All this demonstrates, not that there was any want of skill, for the skill was of the best, but that, in not a few cases, there are inherent difficulties in coming to a correct conclusion as to the proper choice of the operation. I confess to having sometimes felt regret that I resorted to lithotritry when some unforeseen circumstance showed me that lithotomy would have been the better operation; and I have not seldom seen patients subjected to the risk of lithotomy when the milder plan by crushing might easily have been adopted.

Permit me to summarise the views, as to choice of operation I have attempted to enforce in these lectures, in a few propositions, which, if they are somewhat indefinite, are still the nearest approach to rules of practice which our present knowledge on some points seem to me to admit of.

1. In children, litholapaxy should be more adopted than has hitherto been the custom.

2. In male children, when the stone is at all large, the suprapubic will probably prove to be easier to do, and safer than, the perineal operation.

3. In female children, litholapaxy should be the rule for small stones and the high operation for all large ones.

4. In adult females, litholapaxy, or dilatation and extraction, should be adopted for stones of moderate size; vaginal lithotomy for those somewhat larger; and the high operation for those decidedly of large size.

5. In adult males, litholapaxy should be the rule for stones up to an ounce or an ounce and a half; above that size, lateral, or possibly suprapubic lithotomy—certainly the latter for all stones over three ounces.

6. In the aged, the same rules apply when the urinary organs are healthy; but when the prostate is large and the bladder atonic, suprapubic lithotomy should be more adopted, until its success or failure is demonstrated.

Conclusion.—I cannot close these lectures without thanking you, Mr. President and gentlemen, for your courteous attendance. No one is more sensible than myself of the imperfect and halting way in which much of this important department of surgery has been treated. This is due, not alone to my deficiencies, but, also, to the transition state in which we seem to be with regard to some questions relating to the operative treatment of stone in the bladder. There are some amongst us, and those fully entitled to guide professional opinion, who prophecy that the old and historic operation of Cheselden will shortly disappear, and be no more witnessed in our hospitals; that this will give place to newer methods, or older ones in a new form. Should this prophetic view of what the next generation of surgeons are likely to achieve be true; should the time-honoured lateral operation become obsolete, and all its literature merely a curiosity of history, and should the life's work of men of my standing be thus proved to have been more or less wrong, and should come to be replaced by other and better methods—we shall submit to the inevitable; shall even, with open minds, adapt ourselves, in what remains for us to do, to the new order of things; shall, perhaps, bear a part in shaping or correcting these new proceedings, and shall rejoice greatly if the result be that suffering is diminished and life prolonged. At present, however, this is but a prophecy, waiting for fulfilment or failure; and, while waiting and watching, I am thankful that I have been permitted to cast a retrospective glance at what I have seen and done in the surgery of stone in the bladder, uncomplaining if it should prove to be merely a record of bygone work, but abundantly content if it should afford a few useful hints for the guidance of my younger brethren.

DR. EASTWOOD.—A resolution was unanimously passed at the last monthly meeting of the Darlington Rural Sanitary Authority, on the proposition of Mr. W. A. Wooler, J.P., "That the best thanks of this body be tendered to Dr. J. W. Eastwood, J.P., who for twelve years had ably and assiduously presided over the business of the authority, and as a special acknowledgment of the vast amount of labour he freely gave to sanitary matters generally, and particularly to the settlement of the authority's by-laws, in agreement with the Local Government Board." Dr. Eastwood is an ex-President of the North of England Branch of the British Medical Association.