AN ACCOUNT OF 500 CASES
OF
OPERATION FOR STONE IN THE BLADDER
OF THE MALE ADULT.

COMPRISING HIS ENTIRE EXPERIENCE OF SUCH CASES
TO JANUARY, 1877;

*With Remarks on the most important Incidents which have occurred in
connection with them.*

BY

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I PROPOSE to record briefly the leading particulars of five hundred cases of operation for stone in the bladder, occurring in male patients only, of twenty years old and upwards. The calculi removed in all these cases are, with a few exceptions, also laid before you.

I have said that the patients were of "twenty years old and upwards;" but it is worthy of remark that there is one only of the age named, and only twelve patients in the entire list are below thirty years.

This group includes every adult male whom I have treated

either by lithotomy or by lithotrity between September, 1857, when my first case occurred, and January, 1877. It comprehends therefore all my patients at University College Hospital and my private practice.

I purposely exclude all cases below twenty years of age, and all cases in the female sex at any age. I do so because the risk from stone operations on boys and women is exceedingly slight as compared with the risk in the adult male; and no true judgment can be formed in regard of the results of lithotomy and lithotrity, if female cases and males at all ages are indiscriminately included in the same group. Thus, for example, during the whole of that period, I have met with but one death in a male below twenty years of age, and that in a boy with extreme deformity of the bones of the pelvis; and with but one in a woman, and that from pyæmia.

I wish first to refer to the experience of the chief operators before my time who have published their results. Not one in this country has had the good fortune to treat a number approaching that which furnishes the subject of this paper. And perhaps I may be permitted to add that there is no record with which I am acquainted that has been kept with such scrupulous care. For I possess full notes of every case from the first to the last, made at the time, in books arranged on a methodical plan at the outset, and continued without change of system to the present day.

The first trustworthy numerical record we possess is that by Cheselden. That famous surgeon, at the close of his career, reported as follows. Telling us first, "of his private practice he kept no account," he states that "he cut 213 cases at St. Thomas's Hospital," pertinently adding, "but what is of most consequence to be known is the ages of those who recovered and those who died." Of these 213 cases, no less than 135 were under ten years of age, and 3 died; 62 more were between ten and twenty years, and of these 4 died. *Only 46 were above twenty years of age, and of these 13 died.*¹

Long after this comes Martineau's remarkable and excep-

¹ Cheselden's 'Anatomy,' &c., 5th edit., London, 1740, p. 333.

tional series of successful cases, viz. 84 operations with 2 deaths; although this did not represent his entire experience, which I have heard at Norwich was by no means equal to the published cases, being indeed not above the usual average. Of those 84 cases, however, 6 were females, and 36 of the others were under twenty years of age, leaving 42 cases of twenty years and upwards, among which were the 2 deaths.¹

Sir Benjamin Brodie reported at the close of his career 115 cases of lithotrity in the adult male; adding, "I do not mean to say that these occurred in the same number of individuals," and mentioning one patient "on whom the operation was performed as many as eight times in the same number of years, always with complete success;" and also a second case resembling it. Among these were 9 fatal cases or "somewhat less than 1 in 12½."²

Sir William Fergusson in 1867 reported the total of his cases at that time as 271. Of these, 219 were adults (but certainly some were females), and 110 of them were treated by lithotomy, with 33 deaths; while 109 were treated by lithotrity with 12 deaths; total, 219 cases with 45 deaths, a mortality of adults treated by both methods, of 20 per cent. The remaining 52 cases were in children with 2 deaths; an illustration as Sir William also points out of the need to report them separately.³ I have already written to Mr. Henry Smith for any information he might possess relating to Sir William Fergusson's subsequent experience. He replies that he does not possess any, and believes that probably "his additional cases would not amount to very much."

The total number of adult cases reported by these four operators is 422 cases.

I will now proceed to analyse the 500 adult male cases before you. Four hundred and twenty-two were operations by lithotrity, and 78 were by lithotomy; the relative propor-

¹ 'Trans. of the Royal Medical and Chirurgical Society,' vol. xi, p. 402.

² *Ibid.*, vol. xxxviii, p. 169.

³ 'Lectures on the Progress of Anatomy and Surgery, 1867.' By Sir Wm. Fergusson, Bart. London. P. 220.

tion being 2 cut for every 11 crushed, or 1 cut in every 6½ cases.

The mean age of the 500 cases is no less than sixty-one and a half years; the youngest being twenty years of age, the oldest eighty-four years.

The number of individuals is 440. Several of the lithotrity patients have been operated on twice; 5 as many as three times, and there is one very remarkable instance of four operations on the same individual. In all these cases of operation repeated on the same person, there has been a considerable lapse of time between each performance; and full evidence of the existence of a fresh formation has been present, or the case would not have been so registered.

The removal of some phosphatic concretions, a by no means infrequent circumstance, from the bladders of elderly men who do not empty the organ naturally, has never been admitted into the category of operations for stone. They form a class by themselves to be referred to hereafter, in which the lithotrite is of the highest value in preventing the formation of large phosphatic calculi. But in constitutions which are strongly disposed to excrete a large amount of uric acid by the kidney, it not infrequently happens when the first calculus has been removed, that after an interval of two or three years of freedom from all vesical symptoms, they again appear and a second formation is detected, and lithotrity is again resorted to. A third formation is not very common, nevertheless in exceptional instances the process may be even again repeated. Thus in the one case referred to, the patient formed three large uric acid calculi consecutively, with several years of good health between each, and finally, a large phosphatic one, and each of these was successfully removed by lithotrity. This is a history nearly unique in my experience, and those four large calculi may be seen in a group, all belonging to Case No. 62 in this series. They occurred in a gentleman who passed all his time in London, where he was well known, and who died at an advanced age some time after the last operation.

The nature of the calculi is a matter of interest, and not without importance.

Of the 500—

313 were uric acid and the urates, in the ordinary sense of the term; in all calculi there is usually found a slight admixture of other varieties.

99 were phosphatic of the ordinary kinds.

50 were mixed; urates and phosphates.

9 were mixed; urates and oxalates.

16 were oxalate of lime.

6 were mixed; oxalates and phosphates.

1 was cystic oxide.

1 was pure phosphate of lime.

1 was phosphate and carbonate of lime, probably formed on large nuclei from the prostate.

4 were phosphatic, deposited on foreign bodies introduced into the bladder; these being, in two cases, a portion of exfoliated bone; in one a piece of sealing wax, and in one a piece of bougie.

I have never considered the removal of a foreign body from the bladder as equivalent to an operation for stone, unless the body has been really the nucleus of a calculous formation. Thus a hair pin recently introduced into the male bladder and successfully removed by a lithotrite is not admitted into the series, as it cannot be regarded as illustrating in any way the subject before us, viz. operations for stone. Furthermore, the small proportion of phosphatic calculi in the above list—less than the recognised average proportion—will illustrate a foregoing remark, that mere phosphatic concretions and deposits have been similarly rejected from the list.

I desire next to refer to the difference in the relative proportion in which the two operations have been employed in the series before us, as compared with that which has heretofore obtained in this country. For example, Sir William Fergusson's cases of lithotrity were just equal in number to his cases of lithotomy, that is to say, 109 against 110; a result partly due to the fact that he performed a good many of the latter before lithotrity had become an accepted operation in this country. Reckoning from the time at

which he adopted the method by crushing, his numerical proportion was probably at least 3 cases of lithotrity to 1 of lithotomy. But in my series the crushing operation has held a ratio in proportion of $5\frac{1}{2}$ cases to 1 of lithotomy. Throughout the entire term the small stones and the most promising cases have been reserved for lithotrity; while, as the necessary consequence, the knife has been employed only for cases in which the stone has been large, or when it has been associated with obstacles which render lithotrity difficult or impossible. As certainly during my life I have never rejected more than 5 cases, if indeed so many, as unfit for any operation, it follows that the most unpromising and difficult cases fell into the category for which the cutting operation was reserved.

I shall next take the question of mortality following the operation; first, in relation to lithotrity (see Table I); secondly, in relation to lithotomy (see Table II); and lastly, in the aggregate as affecting the entire 500 cases (see Table III).

TABLE I.—*Deaths following Lithotrity.*

Age.	Remarks.	Cause.
68	Unfit for operation	Calculous disease of kidneys and dilated ureters.
69		Diseased kidneys and dilated ureters.
81	Unfit for operation, if any he should have been cut	Hæmorrhage.
69		Fever, mania, delirium tremens(?).
77	Unfit for operation, treated at a distance in the country	Acute cystitis and fever.
64	Disease of heart	Exhaustion.
69	Unfit for operation, but demanding relief	Ditto.
73	Ought to have been cut, but he refused	Acute cystitis and fever.
80		Fever and exhaustion.
59		Pyæmia and local abscesses.
68	Ought to have been cut, but he refused	Acute cystitis and fever.
70		Nephritis and suppression of urine.
72	Stone, large, might have been cut	Chronic Bright's disease.
65	Ditto	Acute nephritis.

Age.	Remarks.	Cause.
62		Acute cystitis and fever.
55		Chronic Bright's disease and pyelitis.
62		Pyæmia, joint affections.
74	The pyæmia occurred after he left town, 6 weeks after operation	Phlebitis of leg after operation, and subsequent pyæmia.
32	Unfit for operation, which was done to relieve suffering	Chronic Bright's disease.
64		Pyelitis and exhaustion.
52		Pyelitis and fever.
66	Probably might have been cut	Diseased kidneys and dilated ureters.
77		Pyæmia.
75	Very feeble and unfit for any operation	Fever and exhaustion.
57	Large stone, very feeble	Exhaustion.
65		Diseased kidneys and dilated ureters.
66		Ditto.
81		Fever and exhaustion.
61		Diseased kidneys and dilated ureters.
70		Pyæmia.
58		Nephritis and exhaustion.
75		Fever and exhaustion.

TABLE II.—Deaths following Lithotomy.

Age.	Remarks.	Cause.
74	10th day after	Exhaustion.
68	21st "	Ditto (?).
73	5th "	Ditto.
74	3rd "	Peritonitis.
73	23rd "	Exhaustion.
80	24th "	Ditto.
69	14th "	Diseased kidneys and dilated ureters.
59	3rd "	Peritonitis, perforation by staff.
78	11th "	Secondary hæmorrhage (at a distance).
67	22nd "	Chronic peritonitis, sacculated bladder.
50	3rd " large oxalate of lime,	Peritonitis.
79	4th " unpromising, to relieve great suffering	Exhaustion.
65	5th "	Peritonitis, diseased kidneys, and dilated ureters.

Age.	Remarks.		Cause.
68	4th day after		Nephritis and suppression of urine, enormous prostate.
29	35th	„ certainly not a death from operation	Chiefly from bedsores producing exhaustion.
68	3rd	„	Peritonitis.
55	12th	„	Secondary hæmorrhage.
36	14th	„	Diseased kidneys and dilated ureters.
65	7th	„ to relieve great suffering	Exhaustion.
60	3rd	„	Peritonitis.
82	18th	„	Exhaustion.
60	7th	„	Peritonitis from sac of bladder suppurating.
47	3rd	„ any operation of questionable utility	Chronic Bright's disease and exhaustion.
70	3rd	„	Hæmorrhage.
78	12th	„	Exhaustion.
61	2nd	„	Peritonitis, perforation of bladder.
61	4th	„	Nephritis and suppression of urine.
79	5th	„ operation undesirable, to relieve great suffering	Exhaustion.
72	7th	„	Pyæmia.

TABLE III.—*Causes of Death in 500 Cases of Operation for Stone.*

	Disease.	Lithotriety.	Lithotomy.
1	Pyæmia	5	1
2	Diseased kidneys and dilated ureters	6	2
3	Acute nephritis	3	2
4	Chronic Bright's disease	3	1
5	Pyelitis and fever	2	—
6	Peritonitis, large sacs of the bladder in two cases	—	7
7	Perforation of bladder	—	2
8	Acute cystitis and fever	4	—
9	Exhaustion	7	11
10	Hæmorrhage	1	3
11	Mania	1	—
	Total	32	29
		61	

And here it is necessary to say that I have frankly accepted any death occurring within six weeks after the operation, under almost any circumstances, as a fatal issue to be reckoned to the tale of mortality. Thus, one of the deaths from lithotrity by pyæmia occurred six weeks after the operation, when the patient had left town, which he did with phlebitis in one leg. The veins of the leg had no doubt been affected through the circulation by the inflamed vesical veins, and thus pyæmic infection of the system resulted. Again, I left, one summer holiday, at the hospital a case of lithotomy, three weeks after operation, with the fullest assurance that he would recover. He had then a small bed-sore. On my return two months subsequently, I learned that he had died a fortnight after my departure from bed-sores and exhaustion, and I thought the death ought not to reckon to the operation. Both the patients I have nevertheless accepted in my list of fatal cases. There are three instances, however, among this large number of men at advanced age, of death occurring suddenly from organic disease of the heart, which was in no way connected with the process adopted for the removal of the calculus. The history of every case is given in a voluminous table presented with this paper; from which it may be seen that in one, a man, apparently in excellent health, undergoing lithotrity with little inconvenience, falls dead when at the water-closet, and is found at the autopsy to be the subject of old mitral disease. Two others were similar to a greater or less extent. Desiring then to deal with the group so as to arrive at a fair estimate of the mortality, all other deaths but these three cases have been included in it. Some remarks on the causes of death will follow hereafter.

These conditions considered, I come now to the numerical proportion of fatal cases.

In the 422 cases of lithotrity there were 32 deaths; or a mortality of $7\frac{1}{2}$ per cent., or 1 death in rather more than 13 cases.

In the 78 cases of lithotomy there were 29 deaths, or about 1 death in $2\frac{3}{4}$ cases.

Taken collectively, in the 500 adult cases treated by both operations, there were 61 deaths, or a total mortality of 12 per cent., or 1 death in $8\frac{1}{2}$ cases.

Let us briefly compare this result with the mortality recorded as the result of lithotomy and lithotripsy by the operators already named.

Cheselden's cases of adults over 20 years—46, with 13 deaths.

Martineau's	"	"	42,	"	2	"
Brodie's ¹	"	"	115,	"	9	"
Fergusson's	"	"	219,	"	45	"

Making a total of adults . 422, " 69 "

The mortality of the conjoint cases is within a fraction of $16\frac{1}{2}$ per cent., or 1 death in slightly more than 6 cases.

I will now refer to a table of lithotomy cases only, of all ages (which I obtained by great labour, some years ago, for my work on 'Lithotomy and Lithotripsy') by the leading hospital surgeons of Great Britain, from whom I obtained written records of each individual patient, amounting to a total of 1827 cases. Among these 1827, there are 736 cases of twenty years old and upwards, with 149 deaths, or slightly more than 1 death in 5 cases. This result shows a remarkable similarity to the table now made of Cheselden's, Martineau's, Brodie's, and Fergusson's operations.

I think I may venture to say that the 12 per cent, or 1 death in $8\frac{1}{2}$ adult cases, which belongs to the series before you, is the best result which has yet been shown in any authentic report of any man's *entire and unselected work*. And I will add that I believe it to be greatly due, among other things, to the care taken in deciding which of the two operations best meets the individual needs of each case.

I have long ago said that in accuracy of diagnosis, and in the proper selection of the operation which must follow, is to be found the key to successful results; and I have taken

¹ It is to be borne in mind that Brodie's were cases selected for lithotripsy, and that we know nothing of the result from the lithotomy performed or the cases which he rejected as too serious for the crushing operation. This gives a manifest advantage to the table above. So also does the incorporation in it of Martineau's selected series.

pains to show that without proper diagnosis in relation to the size of the stone and the condition of the patient (the former point being one of extreme importance), *it is more dangerous to employ the two operations than to practise lithotomy uniformly in all*. For unquestionably lithotrity is incomparable for safety when the stone is of moderate size, but is inadequate and dangerous for large ones; for these a well performed lithotomy is a less severe proceeding, while it is too severe and dangerous for a small stone.

I wish very briefly to note a few particulars which my experience has afforded, and which may be interesting to others. It will be manifest that space forbids me to touch on the ordinary points; reference will therefore be made to extraordinary occurrences.

The first section will relate to the accidents which I have met with in the performance of the two operations, and to the causes of death. The second will relate to the after history of patients who have been submitted to lithotrity.

First, accidents in operating. In performing lithotrity I have on one occasion broken a lithotrite in the bladder. In this case, a patient æt. 64, the stone was one which I did not consider ought to have taxed the power of the instrument unduly. What happened was this; while in the act of crushing, the end of the male blade snapped off close to its junction with the shaft, so that a slip of steel three quarters of an inch long remained free in the bladder; I withdrew the instrument and cut the patient next day, removing the stone and the broken piece, and he made a good recovery. I might easily have withdrawn the piece of metal by the lithotrite, but the texture of the stone (although not oxalate of lime) decided me to cut the patient. The case is No. 224 in the series. I may remark that the fracture took place precisely where, if fracture is to happen, it ought to occur. It was an old and very favourite lithotrite, and had been used for about 150 cases, which is quite as much work as any lithotrite is capable of safely performing. Long ago, in describing the construction of the instrument, I stated what Charrière, of Paris, had taught me, namely, that the parti-

cular point described ought to be the weakest, as a fracture there is really of little consequence, and prevents a twist or fracture elsewhere if undue force happens to be used.

In a second case I had a piece of uric-acid calculus not large, but so impacted between two flat blades, that I could neither get rid of it nor could I withdraw the instrument. In these circumstances I accomplished what I think has not been precisely thus done before; I very slowly drew the instrument and its contents through the neck of the bladder and the prostatic urethra, which are remarkably dilatable if only time is given to the process, and steady traction is performed coolly and without hurry. Thus it came still further forward, and when the urethra ceased to yield any more, I pushed the testicles backwards and made a short incision in the median line of the penis towards its root down to the urethra, until I reached the lithotrite, the end of which was then easily pushed into view through the opening, when the débris which had been impacted were removed, the blades closed, the instrument returned through the wound to the urethra, and withdrawn as usual by the external meatus. There was a little extravasation next day requiring one incision in the scrotum; all, however, soon healed; the patient recovered and is perfectly well at this day. This accident happened in 1874, Mr. Clover gave the patient chloroform and witnessed the whole proceeding; the case is No. 204. I have had no other accident in 422 cases of lithotrity. There was one death from hæmorrhage in a patient æt. 84, who had a considerable quantity of hard stone in his bladder. This was a very early case, No. 13, and one in which I should not now entertain the idea of adopting the crushing operation.

I now come to accidents occurring in lithotomy. In this operation I have met with a cause of death on two occasions, viz. perforation of the bladder by the staff. I confess that the circumstance was new to me, and I think it deserves careful attention. Both cases occurred some time ago at the hospital, and were publicly examined in the deadhouse there. I had often observed before the time of these accidents, the

extreme tenuity, and in some cases, softness, of the vesical coats in disease. I have examined bladders at a very early period after death, and before much post-mortem change can have taken place, so soft as to tear almost like wet paper. Now nothing can be more likely to happen sometimes, unless we are on our guard as to this source of danger, than the pushing the point of a staff through the upper fundus of a contracted bladder, if the instrument be so long as it often is. I have since been frequently struck with the unnecessarily long curve which some staffs have, and have felt, when seeing such an one in use, how dangerous its point must be in a bladder affected in the manner described. I am strongly inclined to think that in those cases of rapidly fatal peritonitis which are sometimes met with after lithotomy, if the search were carefully made, a minute rupture at the upper and back part of the bladder would be sometimes found. It may be very small, lying between the rugæ of the organ, and easily escape observation, yet give issue to a small quantity of urine into the peritoneal cavity; for it is not very easy to explain otherwise some of these attacks which carry off a patient in thirty-six hours or so after operation. Extension of inflammation from the bladder to its peritoneal covering has been suggested, but I think the mechanical cause a more probable one. Let me say that injury to such bladders may as readily be inflicted by the forceps as by the staff, but I do not think the knife has any thing to do with it. Clearly, in the two cases in question, the little openings were not so made; both the character of the orifice and its situation preclude such an explanation. Besides, I am quite sure that the danger of perforating the bladder with the point of the knife must be an extremely remote one, and impossible in fairly competent hands.

Secondly, secondary hæmorrhage has been fatal in three cases, that is to say, the bleeding having perhaps been free at the operation, but controlled, and ceasing altogether for a week or more, a sudden outbreak has occurred on the ninth or tenth day after, and the patient has succumbed. I have recently met with this occurrence on the fifteenth day when

the patient's life was in great jeopardy, but it was stopped by introducing the "tube en chemise" and stuffing it well, by which process the half-healed wound was wholly reopened. He made a slow but good recovery, and is now quite well. I have no doubt that the process of healing in arteries divided in elderly patients, is less rapid and perfect than in those of others, and that incisions in men between sixty and eighty years, as most of these were, involve risk from both primary and secondary hæmorrhage not met with in young and middle aged persons. But the occurrence of hæmorrhage, whether primary or secondary, I am happy to say I no longer dread. Thanks to a simple contrivance of my assistant, Mr. Buckston Browne, the india-rubber "tampon," inflated with air, there need be no uneasiness in future on the ground of hæmorrhage, since it may be completely commanded by this little apparatus. No man ought henceforth to think of cutting a patient without one at his side.

Another accident, but not a fatal one, which I have to name, is wounding the rectum. I confess that I am not surprised that it occasionally happens in those cases of elderly men in whom the rectum is sometimes a remarkably capacious cavity, and is felt when explored by the finger, surrounding partially, as it were, the prostrate and neck of the bladder. I think a certain proportion of such accidents must be met with by any man who operates frequently on patients of sixty years old and upwards. No doubt the danger of injuring the bowel is greater when "cutting low," as it is termed, that is by entering the point of the knife into the groove of the staff rather low down or far back. On the other hand by "cutting high" or entering the staff easily where it is not so far from the surface, the rectum will be perfectly safe, but the bulb or even its artery may be divided and the occurrence of severe hæmorrhage is risked. These two dangers are the Scylla and Charybdis of the lithotomist when dealing with old people. In youth and middle life there is less fear of injuring the rectum, and a lower incision may be made. I have wounded the rectum four times, and in the last case I laid open the incision into the bowel a

month afterwards, for I was not aware of the injury at the time of operation, indeed, there was no sign of it until a week after, and it is possible, although I do not take advantage of that supposition, that I may have left a very thin partition between the wound and the cavity of the bowel which subsequently sloughed. The patient was sixty-four years old, and the stone was a rough and spiked example of oxalate of lime. It is the only case in which I have divided the septum between the wound and the bowel, and it is the only case in which I have had any serious trouble subsequently, and the condition still exists and is a cause of great discomfort. In one of the previous instances death occurred by pyæmia, and in the second and third the opening was healed in one case, and in the other nearly so, by the electric cautery, which by the way has been of little service in the more recent case above referred to.¹

I may next say, before leaving the subject of lithotomy that in the earlier part of the series, I was anxious to test the various median operations which had been then much discussed; and that 20 out of the first 27 operations were those known as the median, medio-bilateral, and the bilateral of Dupuytren. After these I returned to the lateral operation, and the mortality has gradually diminished ever since; the first third of the 78 cases showing fewer deaths than the second third, and the latter third less than the second third; the last 20 having indeed been followed by only three deaths. This result is no doubt in part due to increased experience of the operation, but in part also to the superiority, as it appears to me, of the lateral to median operations for cases of rather large stone. For it is clear that lithotomy is now demanded only for such cases, lithotripsy being competent to the successful management of small ones, and of this I think the proof is before us.

I propose next to make a brief analysis of the causes of death in the total of 61 cases, as presented in the table of

¹ Since writing the above I have received a letter from the gentleman, dated January 2nd, 1878, informing me of the steady improvement which has of late been taking place in his condition.

two columns (see page 166). Those causes are of course similar for the two operations in cases of advanced disease of the urinary organs existing at the time; a condition unhappily frequent among patients who have been long the subjects of calculous disease. But each operation has also its special risks and special causes of death. Regarding first the causes of death common to the two operations, it will appear that that disease of the kidneys, with distended pelvis and dilated ureters, which seems mainly due to mechanical obstruction below, was found by autopsy in eight cases; it probably existed in some others not examined. Under the head of exhaustion, no less than 18 cases are set down, respecting which it is necessary to say that by this term is intended that failure of power at advanced age, which—no very obvious clinical sign of constitutional disturbance or of local disease existing—more or less gradually issues in dissolution. This group includes cases in which no autopsy could be made, and there is little doubt that in many of them, serious changes in the kidneys and ureters were taking place. Of these cases 7 belong to the lithotrity column, and 11 to that of lithotomy. But acute nephritis, pyelitis, and cystitis, are found mainly among the cases of lithotrity. On the other hand, 7 cases of peritonitis, besides the two caused by perforation already referred to, occurred after lithotomy only, I have no doubt that this cause of death may be rendered less frequent by increased care in the management of instruments in the bladder. In 2 of the 7 cases large sacculation of the bladder existed, and the sacs were inflamed and suppurating; an autopsy was not obtainable in every case, and this condition, always a most dangerous one in connection with either operation, was probably present in another case or two. Chronic Bright's disease was present in 4 cases. Fatal hæmorrhage, as already noted, was present also in 4.

The occurrence of pyæmia demands a remark. In the 32 deaths following lithotrity, 5 were due to this cause. The connection between it and the operation is not difficult to be traced. Cystitis produced by the presence of sharp frag-

ments may produce inflamed vesical veins; and the products of inflammation in the circulation lead to infection of the system. In the 29 deaths following lithotomy, only 1 was due to blood poisoning, a fact which furnishes a striking illustration, if one were needed, of the small liability to infection possessed by wounds exposed to septic influences. The wound in lithotomy can scarcely be guarded by any arrangement which could be devised, from access of common air, nor from much that is manifestly impure, and no attempt has been made in these cases to prevent such access; yet with a prolonged contaminated exposure, often amounting to some weeks, only one instance occurred.

I will now make a few remarks on the after history of elderly patients who have been submitted to lithotrity. It has been said, and not without reason, that their condition subsequent to the operation is often unsatisfactory, and that many suffer from troubles which rarely occur to patients whose calculi have been removed by lithotomy. I am quite willing to admit that facts support this allegation to a considerable extent. As a rule the patient who has been cut and who has recovered, does not suffer again from vesical troubles, unless he forms another calculus, as he sometimes does. On the other hand many who have submitted to lithotrity become afterwards the subjects of chronic cystitis, and phosphatic deposits, sometimes to a distressing extent. This condition I have made the subject of careful investigation, and I am bound to say that while it may be generally avoided, I do not think it always can be so; and the occasional liability to troublesome chronic cystitis after lithotrity, must be accepted as part of the price to be paid for avoidance of the greater risk to life which lithotomy involves. But I have no doubt as to the cause of the condition in most instances, nor as to the fact that much may be done to mitigate that cause.

The first circumstance which gives rise to it is the long period of continuous injury to, and consequent inflammation induced in, the mucous coat of the bladder, by prolonged contact with the fragments produced in the operation of

crushing. If the series of sittings necessary to remove a stone, extends over six or eight weeks, or even longer, as I have often known to happen in years gone by, a condition of chronic cystitis may be set up, from which the bladder will rarely quite recover. Hence rapid progress is an essential element in the achievement of successful lithotrity. One sitting should follow another generally after an interval of one or two, or, at most, of three or four days, and as rarely more than four sittings are required, a fortnight ought to suffice in almost every case, for the removal of a stone of moderate size. And here may be noted a very important fact, viz. whatever amount of cystitis occurs after the first sitting, it is beyond all question the most efficient treatment, at once to crush again and remove the mechanical irritant without delay. Mr. Clover's apparatus for removing fragments by "aspiration," I regard as particularly useful in these circumstances, and in most cases it is a valuable adjunct to lithotrity. There is little motive therefore for extending the duration of the proceedings beyond the period named; recurring attacks of severe rigors and severe orchitis only compelling the operator to do so. So that if the patient has little or no trouble to contend with, an interval of one or two days between each sitting is ample, and if cystitis is set up, another sitting and not delay is the best treatment.

Secondly, at the end of the operation or during the term of convalescence chronic retention of urine not unfrequently occurs. By small degrees the bladder ceases to empty itself completely, until it always retains perhaps two or three ounces, or less, after each act of micturition; and this habit becomes confirmed if the catheter is not used as often as may be necessary to empty the organ as soon as the retention, however slight it be, is discovered. It is impossible to be too watchful, or too suspicious of the first approach of this state. Space forbids me to enter upon important details in relation to these two points, which I have, moreover, considered elsewhere, but I wish to advert to the intimate relation in which they stand to the after troubles

of lithotrity, and to add that when cystitis and chronic retention have been promptly dealt with at first, there will rarely be serious or long continued troubles following the operation.

One great value of the lithotrite should be mentioned here, viz. its capability of removing phosphatic deposits from the bladders of elderly men who are compelled to use the catheter to withdraw the urine habitually. It is very common for such to form phosphatic deposits in the bladder, which must become large masses or considerable calculi, if not removed while small by the lithotrite. This I have done for patients some scores of times, but never regard it as a case of lithotrity, unless the calculous formation is at least as large as a nut, and is of hard consistence. Nevertheless, before the time of lithotrity, each one of these formations must inevitably have increased until a calculus was formed, and was then removed by lithotomy or permitted to remain, in which case a miserable death certainly followed. If the function of the lithotrite were limited to the relief of such cases merely, it would still have been a most valuable addition to the resources of the surgical art.

The last practical observation which I will venture to offer regards the relative proportion, among stone cases of average gravity, which should be allotted to each operation respectively. With my present experience, I think, had I again to operate in these 500 cases, I should treat a rather larger proportion than I have done by lithotomy, certainly among my last 100 cases, I have thought it right to assign more to the cutting operation than in the previous 100, and the result makes me satisfied with having done so. The limits of applicability in regard to the two operations, which after all cannot be defined by absolute formulæ, may, I think, be approximately estimated in the following manner. :—

Lithotrity is almost certainly successful in a fairly healthy patient, if the stone is rather small, say no larger than a filbert of moderate size, when it can be disposed of in two, or at most three sittings. In upwards of 70 cases of calculus no larger than a nut, chiefly uric acid, I have had 1 death

only, and that from pyæmia. I think the extreme limit of applicability may be thus stated in relation to the crushing operation, viz. never employ it for a calculus which cannot be easily disposed of by a flat bladed lithotrite of English construction, and dispense altogether with the old instrument with fenestrated blades; I have not used one of the last-named lithotrites for ten years; they are doubtless more powerful, and they certainly are more dangerous instruments than the flat-bladed ones. When a stone requires one of these powerful instruments to crush it, be assured lithotomy will be a safer proceeding.

The question then naturally follows: with what sort of stone is the English flat-bladed instrument qualified to deal? I should reply: for a uric acid stone, the long diameter ought rarely to exceed one inch or at most an inch and a quarter, about the size of an almond in its shell; for a phosphatic and mixed calculus the size may be much more considerable; a stone of oxalate of lime should not exceed an inch. Circumstances of course may demand some modification of these rules—for instance, a tyro in the use of the lithotrite should not readily undertake to deal with a rather large example, which nevertheless might be safely crushed by a surgeon of experience.

In bringing this paper to a conclusion, I desire to say that there are some other points of interest which might be named, but the foregoing appear to me to be the most important. It has been my aim to compress within the narrowest limits a faithful account of the most important results of my entire personal experience. It might have been wiser—and it certainly would have been an easier, and to myself, a more satisfactory task, to present this report in three papers instead of in one. I decided, however, on accomplishing the latter object if possible, and none can better know than myself how imperfectly it has been obtained; but I believe that it is desirable in these busy days to err rather on the side of brevity than on that of prolixity.