On the relative merit of the two operations for stone : Two lectures delivered at the Royal College of Surgeons of England, May, 1854 / by Frederic C. Skey.

ON THE

RELATIVE MERIT

OF THE

TWO OPERATIONS FOR STONE.

TWO LECTURES

DELIVERED AT THE ROYAL COLLEGE OF SURGEONS OF ENGLAND, MAY, 1854.

BY

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PREFACE.

Some twenty-five years have elapsed since the introduction of the operation of Lithotrity.

Many years will yet pass away before the operation will become universally established in this country—the rule of treatment, not the exception.

If Conservative Surgery be a desideratum, if preservation not only of a part, but of the whole machine, which is equivalent to life, be the object, and the necessary issue, of scientific inquiry into the best means of alleviating disease, we may class the operation of Lithotrity among the most valuable resources of modern Surgery. In the conviction that to every member of our profession, the contribution of such knowledge as he possesses, to all who may desire to learn, is a debt due to the public, not simply as a member of the medical profession, but as an integral part of the great social community of man, I publish the following pages.

13, Grosvenor Street,
June, 1854.

COMPARISON

BETWEEN

LITHOTOMY AND LITHOTRITY.

If the profession had been satisfied with an operation which has prevailed for so many centuries for the cure of a formidable disease, it is obvious that the inventive faculties of man had not been roused for the purpose of superseding it. That an apparently insuperable obstacle to that hitherto adopted has been finally overcome by steady perseverance, is the best evidence that the old operation, whatever the dexterity of its performance, and however comparatively successful the issue, possessed inherent defects in its principles, and in their application. Whatever comparative success may have attended its performance in hands the most dexterous and the most practised, it is undeniable that any operation that required a wound to be made of some two inches in length, and yet greater in depth, which exposes an important cavity, and extracts therefrom a stone of unknown dimensions, form, and composition, in which, therefore, there can be no determinate relation between the sizes of the object to be extracted, and that of the artificial canal or passage

through which it is drawn, and often dragged by main force, and thus dragged, too, in the immediate neighbourhood of large arteries, an important gland, and ducts essential, if not to the individual, at least to his successors,—it must be acknowledged that any such operation must be attended with danger, and if danger of a fatal result be not the invariable accompaniment, yet that danger is too near at hand, and in too close relation to the operation, to warrant our wilful indifference to any rational substitute. That such danger is within reach, may be inferred from the occasional fatality attending operations of lithotomy, the progress of a case of which, may have been unmarked by any event of an untoward or unpromising nature, and in which neither the condition of the bladder, nor the form, nor size, nor composition of the stone could reasonably excite apprehensions as to the result. My late friend, Mr. Vincent, operated for lithotomy seventeen times consecutively with success. He then performed on two cases on the same day, and both patients died. There was no peculiarity attendant on either operation, except in their results. The question of *danger* deserves some consideration. Employed in its widest sense it embraces risk, or peril, in every form and degree. It has, however, no definite line, no positive ascertainable boundary. If we imagine an operation, the results of which were successful, as frequently as 99 in 100, we could hardly affix to such an operation the title of dangerous; but if we narrow the circle to the total of 20, or of 15, or 10, and find one case fatal, I doubt whether the remainder could be deemed exempt from the imputation of positive

danger. And such is the fact in the operation of lithotomy, because, although individual members of our profession may justly boast a success greater than that I have specified, who have extracted stone by the aid of the knife successfully from more than twenty bladders without one single death, yet in the aggregate of surgeons, the proportionate number of deaths is much greater; and though it is difficult to obtain results with any exactness, yet the fatal consequences are probably in a considerably greater ratio than 1 in 10. If, therefore, we find any given operator in whose hands the old operation has been so successful as to materially widen the circle, all that can be said is that the operation involves less amount of danger in his hands, and that he, individually, has less reason than others for the substitution of the new operation.

It now becomes my duty to consider, in all fairness, whether the operation of lithotrity, which has been so widely resorted to in this, and other countries, possesses advantages more or less concurrent with the ultimate object of both operations—the extraction of a stone from the bladder.

I will first briefly allude to the *advantages*, and also to the *demerits* of the operation of lithotomy, for it would be useless to discuss the subject of the relative merits of the two operations, unless we have a clear starting-point by which to gauge the question of merit or demerit.

The great and palpable advantage of lithotomy is derived from the fact, that it removes the stone at one operation, and *that*, under favourable circumstances, in a short period of time—for a period of one to four minutes,

during which the offender, perhaps of years, is entirely removed from a bladder, may well be considered short —and the operation, when dexterously performed, may justify the term "brilliant." But the applause which attaches to such an operation should not in justice be awarded to the operator, till a later stage of the proceeding, and even a more critical period, at which the real hero of the drama has passed the crisis of danger, and entered on the path of all but certain recovery. It is too true that the very facility with which the operation has been completed, and which has appeared to justify the applause of the spectators, may have been occasionally obtained at no less an expense than the life of the patient. Some interruption to the progress of the proceeding may be allowed the surgeon while extracting the stone from the cavity of the bladder, especially if it be above the average size. This interruption gives, at least, evidence that he has not committed one grievous error, that of making an incision into the neck of the bladder beyond the limits which prudence and safety dictate. If we grant this one great merit, viz. that the stone is removed entire, in a short time, and without any great extent of suffering to the patient, we have perhaps at once placed the question of the merit of lithotomy on its highest eminence. But, unhappily, there are many alternatives to this occasional success—many that are common to the skilful and the unskilful—many that are proper to the unskilful only. There are attendant evils on the operation, and evils attendant on its consequences; and as it would not be a fair gauge of the character of an operation to involve in it the unskilful-

ness of its agents, I shall presume that every operation is performed with an average amount of tact and dexterity.

The difficulties attendant on the operation are :—

1. Enlarged prostate gland.
2. Stone of unusual size, or
3. Narrow outlet of bone.

The consequences which either retard recovery or which lead to a fatal result are :—

1. Collapse, without loss of blood.
2. Hæmorrhage occurring immediately, or consecutively.
3. A protracted operation, from one or various causes.
4. Wound of the rectum.
5. Inflammation of the bladder, involving the substance of the organ.
6. Sloughing from infiltration of urine.

I place *collapse* at the head of this list, because I consider it perhaps the most frequent cause of death. There are many persons whose constitutional peculiarity should, were it known, protect them from the knife employed for other than the simplest purposes, whose nervous system is fitful and unstable, and in whose persons a slight attack of inflammation greatly aggravates the danger of their condition. Among this class no operation of the magnitude of lithotomy can be deemed free from very positive danger. These are the cases in which death ensues before the local irritation has had time to build up inflammation to any injurious or fatal extent.

I have enumerated three chief difficulties attendant

on the operation. Enlarged prostate, stone of unusual size, small outlet between the bones of the pelvis. I do not enlarge on the two first, because they equally apply to the operation of lithotrity, but not in the same degree. The evil of enlarged prostate in lithotomy is immense. There is no greater satisfaction to the lithotomist than that obtained from the introduction of his finger into the bladder, and the bringing it in contact with the stone. Indeed, this introduction of the finger for the purpose of dilating the prostatic portion of the opening by pressure is a great safeguard to the patient, and shows that the neck of the bladder remains untouched. This is impracticable in enlarged prostate, not because the third lobe of Sir E. Home opposes an obstacle to the finger within the bladder, but because the whole gland is so swollen, pressing both forwards and backwards, and so materially affecting the position of the neck of the bladder, that no finger of ordinary length can reach, or nearly reach, the cavity of the organ. There is no certain or approximate criterion of the size of the stone, and if large, more than ordinary force is required to extract it through the gizzard-like structure of the gland. I have seen a large portion of the gland dragged away by main force!

The third difficulty relates to the too-vertical direction of the rami of the pubes and ischia. This evil, however, ought to be ascertained before the operation, and should be met by a division of the structures as low as possible. I have witnessed the inconvenience of this condition.

Collapse is promoted by two not uncommon circum-

stances attendant on the operation of lithotomy—loss of blood, and protraction of the operation. In the constitutions alluded to, the loss of blood, if considerable, is always serious—be it arterial or venous—obtained by a wound of any secondary branch of the pudic trunk, whether the artery of the bulb—an accident, I am satisfied, of no infrequent occurrence—or the *transversalis perinei*, or other vessels of irregular distribution, or by that of the large veins which in some bodies are found to occupy the lateral prostatic and vesical region. These veins are literally enormous, several of them equalling in diameter one-fifth of an inch. Under these conditions, any amount of hæmorrhage is not surprising, especially in advancing life. With regard to a large operation which exposes a cavity of the body, into which instruments of number and variety are introduced, and repeated with frequency, and often with that increasing force which not unnaturally actuates the operator whose "time has been called" long since, who has his work yet incompleted, and who is more oblivious than at starting, of the requisite delicacy of the manipulation, such protraction is most serious; and I appeal to the experience of any who, having witnessed the operation, usually occupying three, four, or five minutes, prolonged to half or three-quarters of an hour, whether the question does not instinctively rise to the lips, Can he recover? The very attitude promotes fatigue and exhaustion, and points to collapse in some degree or other with anxiety and fear.

Among other consequences must be mentioned the liability to injury to the rectum, an evil we have all re-

peatedly seen. This injury is caused rather by the negligence of the assistant than of the chief operator, and is produced by the depression of the staff, somewhat excusable, perhaps, in a protracted operation, when the arm of the assistant becoming fatigued he supports it by resting on the staff, and instead of the instrument being drawn upwards towards the arch of the pubes, it becomes depressed upon the rectum. It is, moreover, an objection to an operation that it demands the co-operation of a person who may be perfectly inexperienced in its chief requirements. Such injuries are often protracted, and sometimes permanent.

These are heavy weights in the scale of lithotomy, from which the rival operation is nearly exempt. But there remain two other consequences of lithotomy that merit attentive consideration in calculating the possible evils that result from its performance—I mean inflammation, and sloughing.

If we speak of inflammation in the abstract, the fact is, I think, unquestionable that inflammation is by far a more frequent consequence of lithotrity, than of the cutting operation, but it is of a totally different character.

The inflammation of the bladder which follows the latter, occurs at the expiration of three or more days after the operation, and is accompanied by great intolerance on the part of the bladder of its ordinary function—local pain increased by pressure on the hypogastrium—constitutional fever indicated by the condition of the skin, the pulse, the attitude, and the expression. The inflammation of lithotrity has none of these accompaniments.

The one is inflammation of an acute character, affecting the entire organ, although commencing in the mucous membrane, and involving the pelvic peritoneum; the other, a chronic form of inflammation, attacking, and confined to, the mucous membrane. If there be little comparison between the relative frequency of the two results, neither is there any comparison to be drawn between their relative intensity, or relative danger to life. The one is serious, the other not.

Sloughing of the cellular tissue of the pelvis, extending from the inner extremity of the wound to the side of the bladder and rectum, may be deemed an occasional, and when it does occur, a very serious consequence of lithotomy. It is very true that it owes its origin to a fault in the individual operation, and to be greatly charged against the operator. There is no principle more universally contended for by the experience of all practised lithotomists, than that which involves the smallest possible division of the prostate gland—*a division scarcely more than sufficient to admit the finger into the bladder*—and most religiously to abstain from division of any part of the neck of the organ.

If this division be made *to any extent,* the urine is liable to become infiltrated, and death of the part, as is well known, is then inevitable. Now, I believe such cases to be almost invariably fatal—albeit the extent of mischief on examination is not very large; and, if so, we need no better proof that the system is already greatly reduced, because we have sloughing from urinous infiltration following stricture to a far greater extent, but with

less danger. The difference is due, no doubt, partly to the infiltration and consequent sloughing taking place, in the one place within, and in the other without, the cavity of the pelvis.

Now all these results are peculiar to lithotomy, and find no parallel in the rival operation; and however truly we may point to the great aggregate of success that has attended the practice of a chosen few, yet when we consider that this success has been acquired only through the medium of frequent opportunity, and that it is probably calculated, not on early, but on cases of later years, when experience had been already achieved and purchased, not without some expense to the community, it would appear not an unreasonable deduction, that the fatality attending the operation is considerably greater in the wide aggregate of cases, than appears on the face of any published statistics of this disease. Certainly the principle of centralisation does not prevail as regards the practice of operative surgery: and there are, perhaps, few aspirants to surgical reputation throughout the country who are not sufficiently endowed with a spirit of enterprise, to reject the co-operation of the more experienced operator. If we may be supposed to improve by repetition, if we may be allowed to have acquired any benefit from experience, it is almost palpable that early operations must be imperfect; and it is of such operations that we hear nothing. I am inclined to consider the records of any given operator to be of the smallest value only, and no statistics can be available for our guidance, but such as embrace the results of many

operations performed by many surgeons, whether with, or without experience.

When we come, then, to consider the question of the average mortality in cases of lithotomy, we in reality enter on an inquiry of no small difficulty, founded on the disinclination of any class of men to reveal to the public their own misfortunes and their own failures. The same tone of mind, the same hope of distinction, the same enterprise, the natural aspirations of the mind which prompted the undertaking, all tend to the concealment of an adverse, and an injurious issue.

The great averages which prevail, therefore, require modification, and, instead of inferring a mortality such as may be obtained from any statistics, we should rather make the statistical report a starting-point from which to form additional deductions. The reported mortality in England is about 2 cases of death in 13 operations, or 1 in $6\frac{1}{2}$. In France about 1 in 5; while in the practice of individuals such as Cheselden, of Dalrymple, of Crosse, and of Liston, the average reached in some cases as high as 1 in 20, and in others as 1 in 35; among which may be justly mentioned the Birmingham county hospital, and the yet more remarkable examples of success that has attended the practice of Mr. Crichton of Dundee; and in St. Thomas's Hospital one death only occurred in fifty-eight cases. In the face of such reports, I should be inclined to place the average mortality of lithotomy in persons of all ages, as 1 in 5. Can it then be reasonably asserted that positive danger to life does not attend on the operation of lithotomy?

With a view to avert this evil, the ingenious device

was adopted, by means of which the stone is broken and crushed within the bladder, and thereby reduced in size to fragments sufficiently small, to pass along the track of the urethra.

It is, however, obvious that the treatment must be protracted, and the escape of the stone piecemeal when of considerable size, in small fragments, must occupy a period of many days, or even weeks, for its completion. There is one prominent advantage which lithotrity presents over lithotomy, viz. it greatly contracts the circle of danger to life, and this is the greatest and most striking merit it possesses; and can any argument more powerful be urged in favour of a given course, than that it offers recovery from a severe and painful disease, without danger to life? What then is the penalty? what is the alternative which yet retains, *sub judice*, the expediency of the substitute? Whence the hesitation? It is founded on the general belief, that although the question of liability to a fatal result is thereby rendered much more remote, yet that it still exists in some insidious form or other, to interrupt too frequently the progress towards recovery. I am prepared at once to acknowledge that in commencing the treatment of a case of stone by the operation of the lithotrite, we still enter on a career of danger, but it is danger in its most diluted and most equivocal form.

In considering the *advantages* of this operation, it must at once appear obvious that they are almost entirely of a negative character. They consist in the greatly modified form in which danger presents itself, if it presents itself at all; the absence of all the *difficulties*

incidental to the cutting operation, and the absence or the great modification of the evil *consequences* which lead to its frequent fatality, such as collapse, and inflammation of the substance of the bladder, and of the far greater rareness of infiltration and sloughing. Hæmorrhage is rare, and is yet more rarely formidable, supposing the operation to be performed with requisite skill and caution. It may, I suppose, be assumed as incontrovertible that if a stone can be removed from the bladder at the loss of from three to five weeks of time, however valuable to the subject, without great suffering, and that only occasional, with health and strength unimpaired, that such a result may well be denominated brilliant.

It appears to me that *eclât* holds a nearer affinity to danger, than we are apt to consider. It is by the magnitude of the danger that brilliancy or *eclât* is born. Better for the subjects of operative surgery that both were buried in oblivion, than that the misery of one man should reflect the credit of another.

THE EVILS OF LITHOTRITY.

Neither the evils often inseparable from the operation of lithotrity, nor its *consequences*, are less numerous than those of the rival operation; for I am of opinion that there are few cases of lithotrity, however ultimately successful, that do not present complications and difficulty of one kind or other. The question hereafter to be considered, is whether such complications are incompatible with the complete restoration of the health of the affected person.

For the present I shall reserve the subject of evils attendant on the operation; and presuming that moderate skill has presided at its performance, I proceed to enumerate its injurious consequences; and these are—

1. Protracted and occasionally severe pain.

2. Inflammation of the mucous membrane of the bladder.

3. Lodgment of fragments of stone in the urethra.

4. Hæmorrhage from the bladder or urethra.

5. Extravasation and abscess, from rupture of the mucous membrane of the urethra.

6. Collapse from disease, aggravated by a series of operations of the urinary system, involving either a sacculated bladder, from the cysts of which the remaining fragments of the stone cannot be disengaged, or positive disease of the kidneys themselves.

7. The supposed difficulty of removing every fragment from the bladder.

1. With regard to *physical pain*, there is no doubt that it is the attendant on both the operation, and the after treatment. The question is not dissimilar from that of *danger* to life. We suffer a *multitude* of positive evils rather than encroach within the circle of *one* danger; and we gladly compound for a repetition of many smaller sufferings, to avert the real misery of a single large one. The *degree* of suffering from the action of the lithotrite may, however, be inferred from the fact that we seldom resort to the employment of anæsthetic agents to mask our operation; still, pain is an evil to be thrown into the scale against the operation. It is not

often that the pains are so severe, however, as not to be held greatly in subjection by the employment of opiates—an agent almost contra-indicated in lithotomy, at least as an anæsthetic agent; and this fact expresses all that I need say with respect to physical pain consequent on the operation, while we always possess the alternative of chloroform for the operation itself, if required.

2. *Inflammation of the mucous membrane of the bladder* may be acknowledged to be a *frequent* consequence of the operation. This inflammation is of far more frequent occurrence than the inflammation following lithotomy. It may follow the first, or any subsequent operation; and so far as my experience goes, it occurs in some degree or other in the majority of all cases operated on. But in this form of inflammation we see the extent of the evil. It appears circumscribed. It does not extend to the other tissues of the bladder. It is chronic, not acute. It is attended by a certain amount of pain, often trifling in degree, by frequent micturition, indicating intolerance of the organ and a certain well-known ropy, viscid discharge, that separates from the urine, and adheres to the vessel into which it is conveyed. The intensity of the disease is determined by the quantity of this mucus, and in cases of positive severity it is occasionally tinged with blood. When it presents this feature, the pain is permanent, and often severe, and the intolerance is great. In this condition the subject of the operation may reasonably claim a large amount of sympathy. It is a curious and important fact, that these symptoms often subside imme-

diately on the repetition of the crushing operation, as I first learnt from Sir B. Brodie, and of which fact I have subsequently witnessed many examples, among which I will cite two. I broke a stone in the bladder of a stout gentleman aged about 63. Chronic inflammation followed, attended by intolerance of urine, continued heavy pain in the bladder, immense quantities of viscid and ropy mucus, always more or less tinged with blood. Sometimes for days together the quantity of the mucus exceeded that of the urine. He lost appetite and sleep. His health sank, and I anticipated a fatal result. In this condition, more or less aggravated, he continued for months in spite of the employment of every remedy I could devise. By the advice of Sir B. Brodie I repeated the operation. The above symptoms subsided within twelve hours, as if by the agency of a charm, and the patient ultimately recovered without any return of the catarrhal affection of the bladder.

I broke a stone of moderate size in the bladder also of a stout gentleman aged about 60. Nothing could be more simple than this operation, which, as he assured me, was far less painful than the contraction of his bladder had frequently been on former occasions. For two days he passed little stone, on the third day he began to experience frequency of micturition, accompanied with more or less of pain and discharge of ropy mucus, but not discoloured. He resumed his bed, and felt constitutionally ill. He obtained little benefit from treatment. After four days of somewhat severe suffering, with the recollection on my mind of the former case, I repeated

the operation, and his pain subsided directly, while his urine resumed its healthy character. On the strength of facts like these, one is almost inclined to doubt the correct pathology of this curious disease, and to ask, Is this truly inflammation of the mucous membrane? Of this condition of the bladder, be it what it may, we have, as I have already said, the frequent occurrence, and we call it inflammation. Possibly it is truly so. But whether inflammation or not, it will never be denied by the practised lithotritist, that it often subsides on the repetition of the exciting cause, and it may be safely asserted that it rarely reaches the level of an intensity incompatible with the perfect recovery of the patient.

3. *Lodgment of fragments of stone in the urethra.*—This evil, consequent on the operation of lithotrity, is, like the last, one of frequent occurrence, and, like it also, presents itself in varying degrees of intensity, from the temporary lodgment of a small fragment, unattended by more than simple inconvenience, to that of a large piece, which, becoming permanently fixed in the urethra, occludes the canal and produces retention of urine. In the first case, it is most probable that the lesser fragment will be carried off by the next act of expulsion, and it produces little more annoyance than is occasioned by a sense of itching or pricking. The second example is more important. The detention of the water is in itself a great evil, and gives rise to a feeling of distress and anxiety which is quickly depicted in the countenance. The organ is erected by the violent, but futile efforts at expulsion, the veins become gorged, and the whole condition betokens severe suffering.

There are two parts of the urethra deemed particularly obnoxious to this evil; the first is the membranous, the second the fossa navicularis at the root of the glans; but in truth, stone may lodge anywhere. A different proceeding is required in either case. If the lodgment has occurred low down in the membranous portion of the canal, unless it can be seized and extracted by a pair of urethral forceps, it is far better to return it into the bladder. The attempt to remove it will probably prove futile, but it should be made, and by the simplest form of instrument that can be obtained. If seized at all, *i. e.* if it can be brought into the grasp of the instrument, it should be pushed backwards about the one-eighth of an inch, and then turned round on its axis, and, if possible, drawn forward. It is not improbable that it will experience renewed detention at the fossa navicularis. Should this plan fail, the surgeon should pass down the urethra the largest sized catheter, and when he feels it in contact with the fragment of stone, push it forcibly, and sometimes by repeated jerks of the instrument, into the bladder. The difficulty of effecting this will be increased if many hours have elapsed. A catheter with the ordinary rounded end is ill-suited to this purpose: on the contrary, the instrument should be open at the extremity, that it may catch the stone with greater readiness. For facility of introduction, the orifice of the catheter may be filled by a ball of silver attached to the handle by a wire. On sounding the stone, the ball is to be withdrawn. An example of lodgment of detritus occurred to me some years since that gave me considerable trouble.

I broke a stone in the bladder of a gentleman who fortunately had a very capacious urethra. It was the third operation. In the evening of the same day, I was sent for, and I found the whole urethra completely clogged, and even distended, with fragments of stone, from the glans downwards to the membranous portion. In fact, as it afterwards proved, the whole proceeds of the morning's operation were lodged in the urethral canal. To attempt to extract this large quantity piecemeal seemed preposterous, and not less so the attempt to return it into the bladder. To leave him unrelieved was equally impossible, for he was greatly suffering—as much, however, as is usually the case, from apprehension of evil as from actual pain. Having with some difficulty extracted the first offender, and the cause of all the subsequent distress, I introduced into the orifice of the canal a small tube, and injected a quantity of warm water into the bladder by repeated and persistent efforts. When the organ was distended by the injection of some four ounces, the effort at expulsion, which was compulsorily great, removed a quantity of the offending matter from the urethra. A second injection expelled yet more, and a third removed the entire contents and restored him to perfect ease. No inconvenience followed. It is, however, by no means uncommon for the urethra to be occupied by a mass of detritus.

If these measures fail, we are still only required to adopt more active treatment, provided the fragment is a cause of positive inconvenience. If it produce a degree of suffering that is amenable to sedatives, any reasonable quantity of opium is a preferable alternative to incision;

but if its presence cause pain and distress, and, still more, retention of urine, there remains to us no proceeding but that of incision, whether in the perineum, the scrotal portion of the canal, or along the penis. A strong impression prevails against opening the canal within the limits of the scrotum, from the greater liability to infiltration in this situation; and it is recommended to push the stone forwards or backwards, and cut on the fragment either behind, or in front of the scrotum. But in truth, this is impossible. If the stone can be removed from the spot into which it has become impacted, there can be no necessity for an operation at all. But we have no alternative. As a general rule, if we can insure rest for a few hours to the divided parts, no evil will follow, and the urine will pursue its natural track without escaping through the wound. If there be a tendency to escape in any quantity, we must have recourse to the introduction of a catheter at every act of micturition. Should urine escape from the wound, it by no means follows that it becomes infiltrated.

It cannot be denied that lodgment of fragments of stone are occasionally a source of great evil and suffering. Of all the common evils attendant on the operation, this is deemed the greatest by the patient. Any unexpected mechanical obstruction to the expulsion of the urine is always more or less alarming to his mind. It excites the double distress—pain, and alarm. There is, however, no real danger, although the requisite proceeding may be both painful and troublesome. It is quite remarkable how capacious is the urethra of a healthy man, and how dilatable. I have sundry times

removed fragments of stone from the urethra that literally set at nought our ordinary calculations of the size of the membranous part of the canal. These, for the most part, were arrested in their progress forward, at the distance of about two to three inches from the external orifice, and they owed their retention not so much to their magnitude as to their angular form. Such fragments are the source of remarkable local disturbance, profuse discharge of matter is set up in the course of two or three hours, and the urethra anterior to it becomes painfully inflamed. To examine such a case one would immediately conclude that the patient was the subject of severe active gleet, so profuse is the discharge. I have selected two of these fragments, which I produce; the larger became entangled at two inches and a half from the orifice, and anterior to the scrotum; the second about three inches and a half, or opposite the scrotum. I had remarkable difficulty in extracting the larger fragment, which was too large to admit of removal through the glans, and I was compelled to divide this portion of the canal with a bistoury. The second I succeeded in seizing and at once removing. In both cases much stone was collected behind.

4. *Hæmorrhage from the bladder* is an oocasional consequence of the operation of lithotrity, but it is very rare under good management. There appear to me two conditions to its occurrence; 1. a congested state of the vesical vessels, with a more than ordinary tendency to bleed on rupture; and 2, coarse or hasty manipulation by the operator. If, for example, an attempt be made

to expand the lithotrite before the instrument is fairly introduced into the bladder, the result is pressure of the upper blade against the neck of the organ—a very painful proceeding at all times. This violence, conjointly with the increased vascularity of the membranes, will produce hæmorrhage. I have never seen hæmorrhage from a healthy bladder, without pain and violence during the operation, and I am strongly inclined to think that this consequence of the operation was rather incidental to the earlier, than the later period of its employment. I have had no case of hæmorrhage for several years. As there is no reason to be assigned why the two exceptions to a general rule, viz. unusual vascularity, and unusual violence, should come into juxtaposition in any given case, and as both appear essential to the result, so we may reasonably expect that, as we become more and more familiar with the art of lithotrity, this accident will be more and more rare. In the earlier operations it was by no means very uncommon to detach portions of either the mucous membrane of the bladder or of the urethra. Such an occurrence we should now feel to be attributable only to mismanagement, and to be as evitable as some other of the numerous evils which credulity has conjured up, to calumniate the fair repute of the operation of lithotrity.

I operated several years ago, on a stout gentleman (the subjects of stone are mostly bulky men) of about forty-eight years of age, of an active circulation, and of full habit. In expanding the blades I experienced some difficulty, and I was shortly after convinced that this

difficulty was owing to the instrument not being pushed sufficiently far into the bladder. During the operation he complained of unusual pain. His suffering appeared to be great. I broke the stone, however, across, and withdrew the instrument. Hæmorrhage followed, large clots came away. Towards night it was obvious that his bladder was actually distended with blood, some of which I drew off with a catheter. This bleeding continued for more than four days, and required continued attention and watching: I calculate he must have lost at least four or five pints of blood. No hæmorrhage followed the subsequent repetition of the operation, which was required six times.

In considering the evils consequent on the operation of lithotrity, I am anxious to do full justice to that of hæmorrhage, but nothing more. Certainly, it is an uncommon event, and when present, is only occasionally severe, and still more rarely is it as serious as in the case I have quoted. The question may be asked, Does it in any material degree retard recovery? I think not; and if I am not incorrect in my creed, that without violence to the bladder, always to be restrained by the operator, it will rarely, if ever, occur, it will take its position among the most unusual events incidental to the practice of lithotrity. But an exception to these remarks may be made in behalf of a bladder which is already the seat of disease. But if so, the person is not a fit subject for this, or for any operation, and inasmuch as the provocation to cause bleeding is little greater in the operation itself than in the previous introduction of instruments, so we may

suppose some positive knowledge ought to have been acquired as to the condition of the organ. I need hardly say that any form of malignant growths, and the operation of lithotrity, are obvious incompatibilities.

Extravasation and Abscess.—Among the evil consequences of the operation of lithotrity, is that of extravasation and abscess consequent on laceration of the urethra. If from any cause the mucous membrane is torn and separated from its sub-tissue, the efforts at micturition, when unusually potent, force the urine from the channel into this tissue, and abscess is almost inevitable. This accident may happen, and may exist, either in consequence of the operation, or from the extraction of stone from the urethra, on a small, or on a large scale; but in either, it will probably show itself early after the occurrence of the cause. If in the perineum, that region will become swollen as in the early stage of ordinary perineal abscess; if more forward, a thickening may be felt along the track of the corpus spongiosum, varying in form and size. This swelling, when opposite the scrotum, occasionally presents itself forwards in the form of a conical thickening, the base of which is placed on the urethra, and is quite moveable under the hand, so much so as to be readily mistaken for the testicle. If it attach itself to the lower part of the canal, in the neighbourhood of the membranous and prostatic parts of the urethra, and especially if posterior to the triangular ligament, its consequences may be most serious, because the escape of urine will probably be large, and the communication with the pelvic tissue more than merely pro-

bable. Moreover, the nature of the injury is in this region more obscure, and less tractable.

Under all circumstances this is a most disagreeable complication, but when low down and in the locality I have specified, it is dangerous, and we have no alternative but that of a free incision into the urinous abscess; and it will simplify the case rather than otherwise, if the stone were at once extracted from the bladder, inasmuch as the requisite incision is in the direct line of the operation of lithotomy, and is little short of it in extent. If the membranous part of the canal is to be laid open, including the triangular ligament, the dilatation of the prostate gland and the extraction of the fragments of stone, would add comparatively little to the difficulty; while the removal of the primary evil would probably give the patient the best and probably the only chance of recovery. In case abscess form forward in the perineum, along the scrotum, or on the under surface of the penis, so long as it exist in the form of thickening, and neither be attended with pain, nor cause obstruction to the passage either of the urine or of the fragments of stone, there is no immediate necessity for interference; while positive suppuration, indicated by fluctuation, or indeed if the tumour be painful without a sense of fluctuation, compels the employment of the lancet. In January last, in withdrawing the lithotrite from a bladder, I found it entangled with stone, which I did not perceive until I had removed it through the membranous part of the urethra. Still I felt that it dragged its way laboriously, instead of moving freely in the canal; I extracted it with some difficulty from the glans. On exa-

mining the end, I found projecting fragments of stone, one of which had carried with it a small portion of the mucous membrane of the urethra. Two days afterwards my patient called my attention to a swelling, of the size of a small pigeon's egg, on the scrotal portion of the urethra, firmly fixed at its base to the corpus spongiosum, but having an apex that appeared very moveable under the pressure of the hand.

In this state it continued for three weeks, during which I operated with the lithotrite four times, without increase of pain or difficulty.

6. *Collapse from disease incipient or advanced,* is not surprising, supposing the strength of the constitution already invaded by its presence. But an operation in this condition of the urinary organs is in contravention of sound judgment, and correct diagnosis. If it be resorted to, as a *pis aller*, let it be so understood, but do not throw on lithotrity the demerit of an operation undertaken in violation of the most sacred rules which guide us through the great crises of operative surgery.

If disease exists, it is our duty, if possible, to detect it by inquiry and examination, and to reject the case as inapposite to the operation.

In the preliminary inquiries prior to lithotrity we require a certain condition of both genital and urinary organs. The negative of these, which such cases as those I am now alluding to present, should at once proclaim to the mind of the surgeon, the probability of a fatal result. The negatives I refer to are embraced in the following :—a stone of many years' existence, accom-

panied by frequent micturition, great irritability of bladder, pain, distress, loss of health. These are important indications of failure, not to be lost sight of. If stone be present with these indications, if relief must be obtained, it is preferable to resort to lithotomy, because it presents the better prospect of a successful issue. It is more probable that the bladder, or even the kidney will recover under one positive shock to its system, which encompasses the primary object of the removal of the stone, than from the repetition of a crisis of irritation, to which it is morbidly sensitive, and which must be resorted to with unusual frequency, and each repetition of which, building up fresh mischief, forms an advancing step towards its fatal consummation.

A gentleman aged 56, while residing at a remote part of the continent not renowned for surgical celebrities, suffered for a period of five years from severe pain in the bladder, accompanied with frequent micturition, which sometimes for weeks together was intensely painful. He had occasional remissions, obtained by alkaline drinks. But the pain returned accompanied with great intolerance, tenesmus, &c.

His health suffered severely with loss of sleep and appetite. He returned to England early in 1851. I detected a stone in his bladder. His urine was healthy, and so far as could be ascertained by careful inquiry, his kidneys were sound, but the stone appeared large, and the bladder very irritable and sensitive. The opinion of an eminent physician, well versed in diseases of the urinary organs, was favourable to the operation of litho-

tomy, in preference to breaking the stone. The gentleman, however, objected to the proposition, and with the sanction of an eminent surgeon I simply broke the stone across. The operation was brief, and not very painful. It was, however, followed by some hæmorrhage. Pain followed during the night, and on the next day the bladder showed symptoms of increased irritability. Pain, catarrh, mucus discoloured with blood, followed. Micturition more and more frequent with urgent straining, and then total loss of expulsive power. Traumatic fever. For three weeks the urine was drawn off by the catheter every hour or hour and a half, and he sank in six weeks from the date of the operation. The bladder was found to be small, the mucous membrane thickened, soft and pulpy. Two large sacculi were found occupying the sides of the organ, one of which contained five moderate-sized calculi. The kidneys, though not positively diseased, were not healthy, the fibrous investment separating from the gland with morbid facility.

In the year 1847, I broke a stone in the bladder of an elderly man, large and corpulent, in St. Bartholomew's Hospital, which his bladder had contained several years. At the expiration of three days he had passed off a fair quantity of detritus. Catarrh of the bladder followed, during which the discharge of ropy mucus was very large. From the first appearance of this mucus he passed no fragment. He had then irritative fever with all the concomitants of local and general disturbance, and he died in a month after the operation. His bladder was discoloured, the mucous membrane soft and pulpy. Several sacculi were found,

and three of them contained the stone in fragments. In both of the above cases the apertures between the cavity of the bladder and its sacculi, were more than sufficiently capacious to allow of the passage of the stone through them.

These cases are almost always ushered in by severe rigors, and followed by fever and prostration; they terminate early, but not always early, in death; for we find them running on for weeks and sometimes for two or three months. The kidney is found to be the local seat of the disease. We find abscess or infiltrated pus throughout its substance. Lithotrity, however, is not responsible for cases of this eccentric character.

Neither of the above were cases for lithotrity, and possibly not for lithotomy either, but certainly not for an operation which involved the necessity of repetition of the cause of irritation. In the operation on the first patient I had no alternative; in the second I committed an error in diagnosis.

A few words on the subject of *Sacculated Bladder*. That this condition of the bladder occurred, at least in the two cases I have quoted, at a late period of life, may be inferred from the fact, that the stones were both detected in the bladder immediately prior to, and at the operation. These sacculi are, I presume, caused by excessive contraction of the muscular fibres of the organ, for the purpose of overcoming some obstacle to the transmission of its contents. It is, of course, impossible to ascertain their presence with any certainty during life, or to afford any relief, if detected. In many of those I have seen, the orifice was so large as to

render the escape of the stone into the blader a matter of probability, on the violent contraction of which they might be forced back again into each sacculus. I do not think that any part of the muscular coat of the organ generally extends over or across them, although it is an occasional occurrence. It seems difficult to imagine how the stone could be retained within the sacculi in all the varying attitudes of the body, when by the simple act of turning round to expel urine it appears inevitable that they gravitate into the bladder; often, however, the orifice is much contracted.

That the presence of sacculi is a great and serious complication is unquestionable; but it should be fully admitted that their formation is by no means confined to the operation of crushing, but may exist in any condition of the bladder or urethra, requiring powerful contraction of the muscular coat; and, *ceteris paribus*, it must be acknowledged that in very protracted cases, in such as are accompanied by chronic inflammation, great intolerance of the presence of urine, and stangury, or an irresistible tendency to contraction of the muscular coat, after the bladder has expelled its urinous contents, these sacculi are very liable to form, and the fragments become forced by the contractile efforts of the organ into them. In the case of lithotomy the case is different; 1st, because the recovery, if so destined, is rapid, and the bladder, when relieved from its difficulties, is not liable to this morbidly violent action; and 2nd, if it were so liable, if the bladder be free from the presence of stone, the sacculi, *quoad*, the present disease, are harmless. In like manner we find sacculi occupying the sides and

occasionally the base of the bladder in cases of old stricture, to the number of four, five, or six. The liability, therefore, to their formation occurring in protracted and untoward cases, must be classed among the evils attendant on the operation of crushing, though rather in the light of an effect in the chain of objectionable symptoms, than an objectionable symptom itself.

The last evil laid to the charge of lithotrity is that founded on the difficulty, I may say the supposed difficulty, *of removing the last fragments of stone* contained in the bladder, and the probable result of which would be the re-formation of another stone. Before I refer to the subject of statistics, on which, indeed, little reliance can be placed, I would say that I do not see the difficulty of ascertaining the presence of a fragment that the urethra will not receive.

If it be so small as not to exceed the calibre of the canal, it will of course pass away without difficulty. If it be too large to reach its destination through the canal, I maintain that it requires no erudite tact to detect it with a *fine sound*, well and carefully employed in exploring the bladder. This inquiry may be made, and repeated with instruments of varying form and magnitude. The best resources, both of touch and hearing, are of course brought into requisition in perfect silence, but beyond this no refinement is necessary. We have, indeed, no evidence in the reported cases of relapse, that re-formation of stone is attributable to this cause. The operation of lithotomy conveys to the bladder no exemption from return of disease, while the only evidence of return of stone after lithotrity is derived

from the practice of M. Civiale, who gives a proportion of about 10 per cent. in his own practice. This is certainly a far greater average than follows the operation of lithotomy, but I have no doubt English recent evidence would enlarge the average, very considerably. My own experience, though it has been comparatively small, points to a very different result; a result, which justifies my insisting on this liability as a most meagre objection to the more recently-practised operation. Besides, granting that a fragment of stone remained in the bladder after the final introduction of the lithotrite, too large to be expelled by the urethra, and too small to be detected by skilful sounding, if such be possible, why not leave it to increase in size till it prove worthy of one more operation? The case which has already proved itself an exception to a general rule, which at the greatest average has assigned only 10 in 100 cases to the liability to return, is most unlikely to become again an exception to the same rule.

The possible presence of *polypus* should be alluded to. The general structure of these vesical polypi is that of ordinary mucous membrane, i. e, it is composed of the several elements entering into the composition of that tissue, viz. fibro-cellular, covered with a thick layer of tessellated epithelium. It is a remarkable fact, that the epithelial scales are generally much larger and more flattened, than those covering the normal mucous membrane of the bladder itself.

Having now considered in sufficient detail the consequences that may occur after the operation of lithotrity, and proposing to myself to leave the accidents of the

operation till I describe the operation itself, I will now inquire under what conditions, which any given case presents, should we decide in favour of the one or the other operation. I shall accomplish this end more readily by adopting the negative, and by stating under what symptoms the operation of lithotrity is *not* the operation to be selected: 1st. It is incompatible with infancy or with childhood, simply because the young urethra is too contracted to admit a lithotrite of sufficient size to ensure safety. But between the period of childhood and the matured age of manhood, there exists the whole period of boyhood, of which it is difficult to fix the exact date either of its beginning or its end. Before we can determine the applicability of the operation to the period in question, we must ascertain two points of considerable interest to the operator; 1st, to what extent the urethra of a boy (say of 12) is dilatable; and 2nd, whether the lithotrite that is of a size capable of being introduced into such an urethra, is possessed of strength sufficiently great to crush any given stone that it may meet with.

1st. If it be proved that the urethra is dilatable without great suffering or ultimate injury, if the urethra of a boy of 12 years of age can be sufficiently enlarged to admit of a lithotrite of the size of No. 7 catheter, and if the instrument of that size be competent to crush any moderate-sized stone such as may be found in the bladder of a boy of 12, we then have all the required conditions, and may without hesitation adopt the operation of lithotrity so far as regards the size of the canal, and the required strength of the instrument.

My colleague Mr. Wormald informs me that he has operated successfully on a child of nine years, and he assures me that he had no difficulty in obtaining an urethra large enough to admit the passage of an instrument of sufficient magnitude to accomplish its object with perfect safety.

2ndly. The case is unsuitable for lithotrity unless in manhood the urethra will permit without effort the passage of the instrument, or rather so long as its introduction is difficult. It is not true that this condition of the canal presents an equal objection to the operation by cutting; because a lesser-sized staff may be carried into the bladder on one occasion even with force, without injury. The operation is completed, and the urethra may return to its ordinary degree of contraction without affecting the issue of the case; whereas, it is a positive evil in the operation of crushing to have to contend with a *morbidly* contracted canal. The tendency to the contraction would occupy much time in the intervals of the operation, and hamper the surgeon while performing it; and moreover, it is of no slight importance that the canal of the urethra be brought into a condition of perfect tranquillity, not only before the operation, but especially so after it.

In this decision, however, much depends on the nature of the constriction, and on the degree of irritability of the canal. If, by the introduction of instruments, it can not only be sufficiently dilated, but show a disposition to *remain dilated*, the operation is not contra-indicated; but we must not forget that stricture of many years, especially if tight, is most likely to re-act on the

bladder and thus entangle us in fresh difficulties. Mr. Edwardes, of Wolverhampton, informed me that he operated for lithotrity on a man, but was unable to catch the stone from its small dimensions. But this advantage accrued to the patient, viz. that the urethra was thoroughly dilated by the instruments employed on the occasion. On the day but one following, a small calculus escaped from the urethra, and the man recovered.

3rdly. The case is unsuitable for lithotrity if there be any tendency to organic disease, whether of the bladder or the kidneys. If we detect no disease of the kidneys—if the urine on critical examination be chemically unobjectionable—if the bladder be neither torpid nor intolerant—in other words, if the organ can receive and retain from four to five ounces of water, we have all the requirements with which the bladder can furnish us, and we have, in the absence of positive evidence, no reason to apprehend evil from the condition of the kidneys. This is all that is required on behalf of the urinary system—a bladder free from pain, except at the time of action, during micturition, when the presence of pain may be expected and explained.

I need hardly say that frequent micturition betokens irritability of bladder, and that a certain degree of tolerance of urine is favourable to the future operation, as exhibiting the absence of that irritability which is the not infrequent concomitant of calculous disease. But this is all that we can look for or expect, and nearly all that we can desire; our information, however, is but negative, and I know of no form of inquiry by which it can be converted into knowledge of a positive kind.

We believe we have no disease, simply because we see no evidence of it.

4thly. The case is unsuitable for lithotrity if the stone be of unusually large size, and especially if accompanied by an irritable bladder. In proportion to the size of the stone, must be that of the lithotrite. If a full-sized lithotrite be admissible into the bladder, it may be found yet too small to grasp the stone. If the attempt be repeated again and again without success, there is no alternative, and we must resort to the cutting operation. But supposing the stone to be grasped by the instrument, it does not necessarily follow that it will be prudent to crush it. I consider that a moderate-sized stone will require from four to six operations. A large stone will, therefore, require from nine to twelve. And in the case of a large stone, it is always probable that the irritation to the bladder will follow in an almost compound ratio, consequent on the condition of the organ which has been the seat of irritation, probably, for many years, from the necessarily greater violence in the attempt to crush the stone, and from the large amount of detritus caused by the fracture. If the stone be large, it is probable that the escape of the fragments of the stone, however satisfactorily crushed, will be slow, occupying probably months, caused by the inability of the organ to contract freely on the urine and on the fragments conjointly, by reason of the presence of the stone. On all accounts, therefore, we should avoid a very large stone.

In considering the evils consequent on the operation of lithotrity with a view to calculate their value, and to determine their weight in the adverse scale, it is most

important that we distinguish those that arise from defective manipulation, from those unavoidable evils which are incidental to the condition of the patient; for it is only just to give to dexterity and to experience all their tribute, and to throw on coarse or careless manipulation the demerit of failure. I have classed these evils under seven heads.

1, Protracted pain; 2, Inflammation of the mucous membrane of the bladder; 3, Lodgment of fragments; 4, Hæmorrhage from the bladder or urethra; 5, Extravasation of urine, and abscess; 6, Collapse; and 7, the liability to the retention of stone in the bladder. Of the above seven evils and liabilities, I conceive that four are of far less frequent occurrence in the hands of experience, or in an operation in which the dictates of experience are strictly obeyed. The operation of lithotrity, of all operations in surgery, requires the exercise, not so much of dexterity, as of the utmost gentleness in its every stage. Every indication of suffering should be noted by the operator, and as carefully avoided; not solely for the purpose of preventing present discomfort, but with a view to avert future evils of an important kind. To defective manipulation may be referred, not infrequently I think, at least four of these consequences—hæmorrhage, extravasation, and re-formation of stone on the old nucleus, to say nothing of present suffering during the actual operation. In the description of the operation which I am about to give, I shall endeavour to point out the mode of avoiding each. Pain, though invariably caused by unnecessary violence, is often an

inseparable attendant, and the frequent companion of chronic inflammation and its concomitants.

Chronic inflammation may occur under the best management. If I were to select from the records of my own observation, the example of the least possible suffering and the briefest execution, I should recall that which, in the course of a few days, exhibited the plainest indications of severe chronic inflammation. For the lodgment of fragments, for collapse, rigors, founded on indetectable disease, the lithotritist is not responsible; for there can be little doubt that the seeds of diseased kidney, and probably more than the seeds, have lain dormant in the system, and for some period prior to the operation.

But who shall detect these forms of disease in the kidney in their early stages? Acute observation has declared their detection to be beyond the reach of art.

Some conclusive evidence may be obtained if we can ascertain that such evils were of more frequent occurrence among the earlier than the later operations of the lithotritist, and this I strongly suspect to be the case. So far as my own practice can furnish me with evidence, it is quite confirmatory of the truth of this opinion.

I proceed to the operation of lithotrity and its immediate antecedents. On detecting a stone in the bladder, the following inquiries occur to the mind of the surgeon:— Duration of symptoms, and, probably, of stone; probable size of the stone ascertained by the sound, with which it may be measured by being carried while in contact across, or along it. By such means some approximation

may be made to its size, at least by ascertaining whether the stone be large or small, or neither large nor small; the patency and healthy condition of the urethra; the state of the bladder as regards its tolerance or intolerance of its fluid contents. This we learn by inquiring the degree of frequency of micturition, whether every hour or every three hours, or how often during the night our patient is disturbed, and whether the act of micturition is performed quietly and without effort, or attended by effort and straining. Is the urine healthy, free from albumen, and free from deposit, of the average colour, and about the specific gravity of 1020? It is as well to examine the bladder through the medium of the rectum and prostate gland; we *may* detect something. It is highly probable that we shall detect nothing, unless previous inquiry leads to the suspicion of lurking mischief. The general condition of the health, appetite, pulse, &c., all point, if satisfactory, to the probability of a favourable issue.

Of preparatory treatment I have little to say, because I believe little is required. I have a strong objection to the adoption of any depletive measures, either by bleeding or active purgation. Such measures reduce the tone of the nervous system, and are the probable precursors of collapse. A dose of castor oil on the previous day, and twenty-four hours of rest, for the most part horizontal, appear to me all that is required. The diet may remain unchanged, unless, indeed, the subject of the operation is prone to excessive indulgence in wine or spirituous drinks. Under such circumstances, I should feel inclined to postpone the operation for a month, till he

had in some degree corrected the habit, by reducing the quantity of his daily stimulus.

For the operation, three instruments only are required. A silver catheter, a syringe with a stop-cock, and the lithotrite. Each should be carefully examined and be laid on a table, warmed and oiled, and in the best possible condition for use. For the lithotrite, strength is the greatest of all its requisites. If dilated at the extremity into the form of a bowl, it will embrace a large quantity of stone; but the breadth of the instrument is only obtained at the expense of its strength. The scoop or bowl-shaped lithotrites are only advantageous when the stone is soft or friable, and no considerable force of pressure is required; but in the case of a hard stone, it is not a safe instrument even in the most dexterous hands. The modern lithotrite is short in the curve, the upper or convex blade serrated with strong angular teeth, which fit into an excavation of the lower or concave blade, and through which a portion of the fragments are forced in the act of crushing. This opening is most important, inasmuch as it ensures the entire comminution of that part of the stone which falls within the blades, and protects, at the same time, the instrument from becoming clogged by the stone. Of course this slit should not be made so broad as in any essential degree to weaken the blade. There is no reason why the diameter of the shaft or length of the lithotrite should equal that of the curved or working part, supposing the latter to be of the full size of No. 11 or 12 catheter, and, indeed, it is not desirable that it should be so, because in the

employment of the instrument there is little strain on the shaft, but great strain on the angle. At the same time, there is no great advantage in any considerable reduction of size beyond freedom of play and facility of motion along the canal. The slightest familiarity with mechanics will explain the great advantage of the body to be crushed being brought as near the curve as possible. When the stone is caught near the point, the instrument is most severely tried, and, if possible, such application of its power should be avoided. I shall refer to the principle on which this objection is founded hereafter, and also to the mode of avoiding it.

A few words on the application of the crushing or compressing agency. It is well known that the force required was applied by means of percussion with a small hammer, when the lithotrite was first introduced into this country by Baron Heurteloup, the objections to which were positive. It was quickly superseded by the screw. The relative power of accomplishing the desired end is, probably, in favour of the hammer, but that very fact constitutes its demerit. The power of percussion is ill regulated by the hand. In fact, the density of the stone ought to determine the percussive force, and this is difficult to regulate by the muscles of the arm. The consequence was, that the convex blade was occasionally broken, to the great scandal of the operation. Lithotomy was the only resource, and that under unfavourable circumstances for its performance. The screw is now almost universally employed. The screw of the lithotrite among the mechanical powers is a compound of the inclined plane and the lever. The power of the screw,

taken singly, depends on the fineness of the groove. A screw of twelve circles to the inch is of double power to one of six. To this power is added that of the lever, in one form of instrument, and of the wheel and axle in another. Of these two latter, the lever is the simpler and more powerful. There are at present in use two instruments, in each of which the lever is superadded to the screw; one by a transverse bar of some three inches in length, which rotates by its centre, and the leverage of which is equal to half its length, viz. one inch and a half; the other consists of a key-handle, screwed straight downwards. Its value depends, of course, on the length of the loop. The only advantage derived from this application of mechanical power, is that of permitting the attachment of an oblique piece of metal beneath the upper end, by which the lithotrite may be held more firmly in the hand.

Having already expressed my conviction that much of the success of the operation depends on the manner of its performance, I shall venture, at the risk of wearying you, to enter with some minuteness into its details.

The operation may be undertaken in a sitting, or a bed room. If in the former, the patient may be placed in a nearly recumbent position, on a sofa or on an easy chair. Yet these are both objectionable. In operative surgery, we are too prone to be indifferent to the comfort and convenient position of ourselves; our operating tables are too low, or too high, or too broad. In a protracted operation no evil to the surgeon can be greater than a low bed or table. Ease of position is a great deside-

ratum to the surgeon. The objection to a sofa or an easy chair is partly of this description, and partly that of want of length. If a sofa, with the patient lying lengthwise, the operator is in a false position. All the trunk, from the dorsal vertebræ downwards, should be horizontal, and, indeed, a small firm pillow under the pelvis is often desirable. There is no support, in my opinion, superior to a four-post bed, across which the patient should be placed, with his pelvis brought to its edge, and his back supported on the inclined back of a chair, the upper bar of which should reach to his loins, and between which and the chair so reversed, a pillow may be interposed; the legs separated, and each foot supported on a chair. At the first operation the presence of an assistant is desirable. A large-sized catheter is introduced into the bladder. The advantage of a *large* catheter is that of fully dilating the urethra, and thus of admitting the lithotrite with less effort. Warm water of about the temperature of 98° should be slowly injected to the extent of about four or five ounces. If there be a tendency to expel it, a cessation of a minute should be permitted, and then resumed. If time be thus given, the bladder will rarely fail to retain the requisite quantity, and the expulsive efforts as rarely continue after the lithotrite has reached the bladder. This instrument is now passed as gently as the force for its introduction permits, the penis being forcibly drawn up over it. When the angle reaches the entrance of the bladder, and the shaft lies nearly horizontally in the hand, some force is required to complete the introduction, in consequence of

the want of adaptation of the curved urethra to the straight instrument, but it is not painful.

Under ordinary circumstances, unless the penis is unusually retracted, nearly the entire shaft up to the screw apparatus, should be lost to the view, and then, and not till then, will the instrument move readily in the bladder. The blades are expanded by the thumb, when the transverse bar or lever is unscrewed to the end, and fixed by the nut. In opening the blades, this rule appears to me important, to make each blade move equally from the centre between them, pressing the instrument forwards at the same instant that the near or convex blade is withdrawn. By this movement we avoid the painful pressure of the instrument against the neck of the bladder. If the neck of the bladder is touched by the blade, a start, or a movement, and an expression of suffering, invariably follows. The stone is now to be caught by the lithotrite; but in what manner? There is but one mode compatible with safety, and which is not only the safest, but the surest. The instrument is not to be employed as an explorer to follow the stone to its hiding-place in the bladder, but the stone should be brought to the instrument. If we would avoid danger, or at least so near an approach to danger as is comprised in the liability to seize the mucous membrane of the bladder, we should rigidly follow this important rule of action. It must be obvious that to protect this delicate organ from injury, the quantity of fluid I have proposed to inject is perfectly inadequate, if we are to carry the point of the instrument in all directions, twist-

ing it to the right, then to the left, and then round to the back. I am persuaded that four or five ounces of water is all that the majority of bladders, so conditioned, will contain; and double this quantity is scarcely sufficient for perfect safety, unless this rule be strictly observed.

If, on having expanded the instrument, the lower blade be pressed downwards towards the rectum, by the elevation of the handle, the bladder will assume a conical form, the apex of which is directed downwards. Into the apex of this cone the stone will fall *three times out of four*, and I believe I may say in a yet greater proportion. I have myself caught the stone on one occasion ten times in succession, and I have repeatedly fixed the stone nine times, the blades being expanded and closed twelve. No action can be more simple, or more easy of execution. If the stone adhere to the coats of the organ, or if it fail, from any other cause, to fall into the concave blade, a slight shake of the instrument, or, what is less annoying to the patient, a slight shake given to the pelvis with the open hand, will generally succeed.

This mode of catching the stone is really so important as to be worthy repeated experiment on the dead subject, during which the remote blade should be pressed with moderate firmness against the bladder where it is in contact with the rectum, while the near blade is drawn out to the greatest capacity of the instrument, if the size of the stone be uncertain, and less so as it becomes reduced in size. We are indebted to the late Mr. Fernandez, Jun., for the original invention of this form of successful manipulation. I consider it a sound

principle, and I will go so far as to say, that unless it be adopted or superseded by a better, yet unknown, every other mode of seizing the stone is less safe, less simple, and less expeditious.

When the stone is caught, the lithotrite should be screwed home. In the case of a person advanced in life, or with a large stone, or with an irritable and intolerant bladder, or where the operation has been painful or protracted, or there is an oozing of blood from the urethra when the stone is once broken across, the instrument should be withdrawn. If the converse of these circumstances prevail, it may be caught twice or thrice, but not more. Two minutes is time sufficient for the entire operation. The patient should be desired to retain the horizontal position, and be left perfectly quiet. No effort should be made to obtain the expulsion of the injected fluid, and, indeed, it would be needless, for the bladder, for the most part, is incompetent to the task. Some hours will probably elapse before the fluid is evacuated, and we shall not be disappointed if no fragments accompany it. This is generally the work of the second, third, or fourth day.

The escape of the fragments of stone appears to obey no rule, and it is impossible to calculate the time they may require. I think, however, a period of four or five days will exhaust the bladder of all that are competent to be discharged, to the accomplishment of which, it would appear desirable that the act of micturition should be performed while in the attitude of stooping forwards, or while the person is supported on the hands and knees; and it is almost unnecessary to

remark that the receiving vessel should be covered with moderately fine gauze, on which to collect the detritus. On two occasions I have known the entire fragments to have come away within a few hours, one on the afternoon of the day on which the operation was performed, the other on the day following. In the latter case, the expulsion left the bladder entirely free from calculous matter.

An obstacle to the escape of the fragments is found in cases of chronic inflammation, accompanied by a profuse secretion of ropy mucus. Here the fragments become enveloped and clogged by the viscid matter, and days or weeks may elapse before a single fragment makes its appearance. In such a case, the operation may be at once repeated, and it is very probable not only that the fragments will come readily away, but that the viscid matter will cease to be secreted.

The after-treatment is simple, consisting of the endeavour to allay irritation by means of enemata or suppositories of opium, and drinking copiously of barley-water or other form of diluent drinks, which will greatly facilitate the escape of the stone. As a general principle, it is, perhaps, better not materially to interfere with the diet of the patient, but to follow, with some slight restrictions, the bent of a reasonable inclination, and to prevent constipation of the bowels by means of castor oil, with a few drops of tincture of opium, about every second or third day, if required. An interval of about six or seven days should be allowed between each operation, and as the second and subsequent operations are a repetition of the first, they need no description, beyond this remark—that when it has become obvious that

the operations are unattended with evil consequences, the stone may be more fully crushed; but it does not appear to me ever desirable that a longer period should be devoted to the operation, at any one time, than three or four minutes, during which the stone, or its fragments, may be thoroughly crushed about ten or twelve times.

I have now to advert to a very important and interesting part of this subject, viz. that of the accidents that may occur during the operation. These accidents may be reasonably subject to a division into occurrences, the result of defective or coarse manipulation, and occurrences of a purely accidental nature, that neither caution nor forethought could evade. Among the first, we must look backwards into the past history of lithotrity, to the time when, following on the track of the invention, such accidents were occasionally met with, and the very occurrence of which has formed the foundation of modern exemption. We have been taught not only how to act, but what to avoid. Peril has taught us wisdom. We avoid the shoals that beset the course of early adventurers, and obtain our ends by the light of their, or, I might say, of our own early experience, so recent is the invention.

The accidents which recent experience has averted, result from injury or violence done to the organisation. This was formerly no uncommon event, and we heard of ruptured urethra, ruptured and even punctured bladder, extravasation of urine, and death. But I will not enlarge on a subject so full of painful retrospect, while I have so much faith in our power of averting evil, formerly incident to new machinery and new manipulation.

I have urged on the surgeon the exercise of the utmost delicacy in every stage of the operation. Such delicacy of touch, such refinement, which is the best and safest substitute for dexterity, is the sure safeguard against every danger of this class; and without this safeguard I, for one, would unhesitatingly consign the subject to the former operation, with all its attendant evils.

The accidents which are more or less unavoidable relate to the almost necessary imperfection of the instrument employed: 1. The convex blade of the lithotrite may be so strained by the pressure of the screw as to fail in its complete closure into the corresponding blade. 2. The blades may be so clogged by fragments that it is impossible, by reason of their accumulation, to push home the convex blade. 3. The near or convex blade may snap off in the act of crushing the stone.

As regards the first of these accidents, it may be observed that unless the balance be maintained between the resistance offered by the metal, and the power exercised by the screw, aided by the lever, no instrument can be reported safe. All that British art can effect in giving strength to iron, is done; but if the process of hardening this metal were rendered absolutely perfect, the instrument may be so overcharged with mechanical power as to become a source of inherent danger; for unless this occurrence be rendered quite controllable, I do not see how we can honestly detach the operation of lithotrity from the imputation, and from the reality of danger.

It cannot be denied that stones are met with in the bladder that try the power of the lithotrite severely; and this is dependant on one of two causes—indeed, occasionally on both. The first and simplest cause is that founded on the hardness of the stone. If the stone be unusually large, and composed of oxalate of lime, its first disruption is obtained by great effort, and should only be attempted with the strongest instrument. The degree of force causing this strain is necessarily greater as the stone approaches the point of the instrument; and, looking to the construction of the lithotrite, every stone tending to a cylindrical form is liable to be pushed upwards towards the point when pressure is applied upon it. A third element of difficulty is founded on the mode in which the stone is caught. A lithic-acid stone, of an oval form, if seized in the long axis, requires immense force of pressure, on the same principle as that which applies to the resistance presented by an egg compressed in the same direction between the hands.

Under such circumstances, the only course to pursue is to drop the stone, and endeavour to seize it by its shorter axis, or, in the case of the more rounded stone of oxalate of lime, to seize it again and again, relying on the aid afforded at each effort by the partial disintegration of its atoms by the previous one. It is this liability to the accumulation of the debris of the stone in the concave blade that induced me to urge on the watchful observance of the operator, the necessity of screwing home the blade at every employment of that instrument, for the evil is somewhat insidious in its

nature, and the accumulation becomes large, and the consequent difficulty of extraction great, before we are aware of its presence.

If the defect of contact of the blades, caused by excessive strain, does not exceed a few lines, or the one-eighth of an inch, the lithotrite may yet be withdrawn from the bladder, provided it be done very deliberately, occupying, perhaps, a period of some minutes to allow the urethra to dilate without injury, because the edges are smooth, and there is no necessary abrasion of the lining membrane; but this difficulty is far more serious when the instrument is clogged by projecting and pointed fragments; and they will, probably, be both projecting and pointed, if many and repeated attempts to crush the stone have been made in the bladder. In this difficulty, the lithotrite should be withdrawn with force, if practicable. If great force be required, it is better to leave the instrument in the bladder for half an hour or longer, and to trust to the influence of the water injected to dissolve the continuity of the pulverised mass, aided by percussion against the head of the instrument. Whenever effort in withdrawal is made, the mucous membrane will, probably, be torn in some part of its course; and we must look with some interest to the possible formation of abscess, or of slight urinous infiltration as a not improbable result. On this subject I have already spoken at sufficient length. An accident of remarkable nature occurred to me within the last year, which, as it may occur to others, I will relate. A gentleman, aged twenty-six, consulted me, having symptoms of calculus, which was readily detected. In the

following week I operated on him. On the occasion I employed a new lithotrite, made by Mr. Ferguson, which, though it had been thoroughly *proved*, had never been introduced into the living bladder. The instrument was one of the largest size, but not the largest. I caught the stone without difficulty, and turned down the screw upon it. At the first turn of the screw the stone appeared to yield to the pressure, and I was encouraged to continue, but immediately afterwards the instrument came to a dead stand. Relying on the acknowledged merit of the instruments obtained from the Ferguson forge, I continued the pressure slowly but considerately. Finding I could make no impression on the stone, I determined to drop it from the blade, and endeavour to seize it by its shorter axis: that in which it was already caught was equal to one inch and a third; and as my patient had suffered only during six months, I had good reason to conclude that this was the long axis of the stone. On expanding the instrument, however, I ascertained that the stone was adherent to the lower blade, for, on closing them again and again, the measurement continued exactly the same. I shook the lithotrite smartly, but without success. I then employed the syringe, and struck the end of the lithotrite many times with considerable and with increased force, holding the shaft firmly in my hand, but with no better success. What was to be done? The circumstances were painful, not to say serious. It was now evident that the stone was firmly wedged into the hollow of the concave blade; and it seemed to me very doubtful whether I could, by any reasonable application of force, detach it, for I had

already exerted all the power of the screw which I deemed justifiable. In this emergency, I left the lithotrite in the bladder, and held a hasty consultation with my friend, Mr. Savory, in an adjoining room, who kindly assisted me, the result of which was the endeavour to act on the stone from the rectum. On returning, I introduced my finger into the intestine, and at the same time drew the lithotrite with the impacted stone close up to the neck of the bladder, then pressing my finger with as much lateral force as I could employ, I felt the stone fall into the bottom of the bladder; I then caught it by the short axis, broke it twice asunder, and withdrew the instrument. On examining the blades, they were found slightly strained, and it was apparent that the stone had been seized near the point and not near the joint. The force employed had been very great, certainly beyond what I had ever previously used. No evil consequences resulted. The stone proved to consist of lithic acid, intermingled with oxalate of lime, encrusted thinly with phosphatic salt, and its resistance at every succeeding operation was peculiarly great, even to the last.

Such are among the accidents to which the operation of lithotrity is liable; and if their importance is to be tested by their severity, let them also be judged by their infrequency. In the aggregate of cases they are rare; and the worst alternative that the most serious form can involve, is an appeal to the knife, and to extract the stone by means of lithotomy. This refers to the fracture of the instrument, for which we have obviously no other resource.

I have endeavoured to place before you the relative merits and demerits of each operation, without bias or prejudice. I have already adverted to the most striking difference between them, viz. the certain presence of *danger* inseparable from one form, and its occasional, though rare, presence in the other. Against the evil of *danger* in lithotomy is opposed the loss of time in the other operation. I do not speak of consequent illness or physical suffering, which frequently appertain to the operation of lithotrity, because they find their equality in the rival operation. The same principle now urged is a recognised principle in another operation in surgery, which involves a structure whose extreme delicacy claims for it the highest kind of interest. I allude to the operation for cataract, in which, in all appropriate cases, the operation for solution is certainly preferable to that for extraction of the lens. Whence the preference? Why prefer an operation which demands for its completion a period of many weeks, to the rejection of that which removes the entire disease by one *coup* at an expense of days only? It is the consideration of *danger* that is thrown into the scale, by which the preference is determined; and if the question of danger to a single organ is the turning-point of the minor operation, *à fortiori*, where life itself is involved, the principle should prevail with tenfold force.

Personally, I have no complaint to urge against Fortune. The average of success attendant on my own cases of lithotomy has been great; but the element of *danger* was ever present, to claim its occasional victim.

If I select this operation, it is because, were I myself the subject of urinary calculus, I should prefer the protracted trouble, the probable pain, and all the concomitant evils of lithotrity, to placing one foot within the confines of that dread circle, which Nature in her beneficence, by every art and by every instinct, has taught us to shun with all the alacrity and all the resolution which the love of life has engendered in the human breast.

THE END.

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