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PRACTICAL

LITHOTOMY AND LITHOTRITY

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PRACTICAL

LITHOTOMY AND LITHOTRITY

OR

AN INQUIRY INTO THE BEST MODES

OF

REMOVING STONE FROM THE BLADDER.

BY

SIR HENRY THOMPSON, F.R.C.S.

SURGEON EXTRAORDINARY TO HIS MAJESTY THE KING OF THE BELGIANS
EMERITUS PROFESSOR OF CLINICAL SURGERY AND CONSULTING SURGEON
TO UNIVERSITY COLLEGE HOSPITAL, ETC. ETC.

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TO

STUDENTS IN MEDICINE

ESPECIALLY TO THOSE, BOTH PAST AND PRESENT, OF

University College Hospital

WITH WHOM, AS COMPANIONS AND FELLOW-WORKERS, I HAVE SPENT

SOME OF THE MOST PLEASANT HOURS OF MY LIFE

THIS WORK IS INSCRIBED

BY

THE AUTHOR

PREFACE

TO

THE THIRD EDITION.

I HAVE found it necessary to re-write some important portions of the present work. Since the appearance of the last edition, nearly ten years ago, my greatly increased experience enables me to speak on various points with more certitude than I could formerly have done. Thanks to the confidence with which so many of my professional brethren, both in town and country, have favoured me, it has fallen to my lot to watch over and to operate on several hundreds of calculous cases. The results of these I have analysed and reported here with scrupulous accuracy and care. Thus, a table will be found in the Appendix, containing the leading particulars of five hundred cases of Operation for Stone in the Bladder of the male adult; a brief *résumé* of which I presented to the Royal Medical and Chirurgical Society of London about two years ago.

I think I may be allowed to add that the facts there presented, collated after an expenditure of much time and patient labour, form the largest contribution which it has hitherto been permitted to any single operator to offer to the profession on this subject. I might have

appended more than a hundred cases which have since come under my care; but many of these being recent, it has been deemed wiser to reserve them for a separate and future communication.

Next, I have devoted a new chapter to the subject of 'Lithotrity at a Single Sitting,' furnishing the results of my practice of this proceeding, amounting now to nearly forty cases, all briefly cited.

Lastly, it has been my aim to offer some further practical hints in relation to the performance both of Lithotomy and Lithotrity. If in this way I am able to furnish any aid, however small, to those who are still at the outset of a career, I shall be amply repaid for the pains bestowed on my subject.

35, Wimpole Street:
June 1880.

PREFACE

TO

THE FIRST EDITION.

The larger portion of the matter contained in the following pages was prepared for the Lettsomian Surgical Lectures of the Medical Society of London for the past year. The limits prescribed, however, permitted me to select for delivery only a portion of the matter prepared. I have, therefore, determined on publishing the whole in its original form, believing that in this way only could I hope to do anything like justice to the subject itself, or to the views which are put forth in relation to it.

I may premise that it is no part of my design to present a history of the means employed during the last 2000 years to remove stone from the human bladder. Neither is any portion devoted to discussions respecting the chemical and physical constitution of calculi, the causes of calculous formation, or the symptoms which the presence of stone in the bladder gives rise to: these subjects having, with the exception of causation, been fully and successfully examined.

The sole object of this work is to present a consideration of the best operative procedures now in use for the removal of stone from the bladder of the male patient.

These will be described, with a view not only of enforcing those broad principles which are pretty generally, though, perhaps, not always sufficiently, recognised, as necessary to guide the surgical student, but of furnishing many useful practical details, which a considerable experience and careful observation of varied schools alone can supply.

An exposition of these, it is believed, may prove not without value in relation to Lithotomy, and to some debated questions in connection with it; while some important considerations, bearing on the operation of Lithotrity, will, it is believed, be discussed here for the first time. Lastly, the various modes of operating will be compared, and their merits discussed, with a view to determine the relative scope and applicability of each to the numerous and varied exigencies which are presented by calculous patients. The principles so deduced will be exemplified in practice by the recital of cases from my own experience selected for illustration.

And here I must be permitted to acknowledge the very many obligations which I have incurred, and the unusually valuable sources of information which have been kindly placed at my disposal during the prosecution of my task.

I am indebted to many of the best known hospital surgeons of this country for very complete and valuable information relating to nearly 1,500 cases, the value of which I can scarcely over-estimate, affording me a total of authentic reports from all sources respecting more than 2,300 cases, of which 1,800 are available for statistical purposes. (See pp. 225–6 *et seq.*)

I have been entrusted by the son of the late Mr. Crichton, of Dundee, one of the most experienced and successful lithotomists in Great Britain, with the entire and unpublished notes of his practice. He cut, by the

lateral method, during a career of about sixty years, upwards of 200 cases, and of most of them made valuable observations on the spot, and sometimes at considerable length and in great detail. These will be frequently referred to.

From Dr. Keith, of Aberdeen, whom I regard as possessing as large an experience as any man living in this country, since he has operated on more than 300 cases, I have received most important aid. For his extreme kindness in freely placing at my disposal the history of each one of these cases, and all the leading particulars respecting it, noted while the patient was under his care, my most grateful acknowledgments are due.

In Lithotrity, the unrivalled experience of Civiale, its renowned inventor and perfecter, has been unreservedly communicated to me on all occasions; and he has been especially desirous to afford me all the aid in his power in connection with my present task. I gladly seize the present opportunity of acknowledging to him my great and numerous obligations.

It has been my aim to embody in these pages as much as possible of the fruits of these experiences, added to that which I have myself personally enjoyed. The aim and scope of every portion of the work, as regards both its plan and execution, although I am very conscious of numerous shortcomings, will be to carry forward, from the outset of the first chapter to the final propositions of the last, a series of logical deductions from sound experience in relation to practice, and thus to verify the title which I have selected, viz. PRACTICAL LITHOTOMY and LITHOTRITY.

35, WIMPOLE STREET:
April 1863.

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PART I.

LITHOTOMY.

CHAPTER I.

LITHOTOMY: GENERAL CONSIDERATIONS RESPECTING IT.

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THE various operations which are employed for the Removal of Stone from the Bladder of the male subject may be arranged under two heads; viz.:—

1. Those by which the stone is removed through an opening artificially made by the surgeon, either into the urethra or bladder; and comprehended under the term LITHOTOMY.

2. Those by which the stone is crushed in the bladder, and removed through the natural passage or urethra, without cutting; the process being in all cases sufficiently indicated by the general term LITHOTRITY.

I shall enter first upon the consideration of Lithotomy, as being the older operation, the most extensively known, and that which is generally best understood. It is to be regarded also as, perhaps, the most widely applicable operation, if all the cases of stone, in children and adults, are considered indiscriminately; although it is certainly not to be so regarded if adult cases are considered separately. This question, however, will be discussed at length in the proper place. Moreover,

Lithotrity is better understood after the anatomical and surgical details of Lithotomy have become familiar to the mind, than when the converse order is pursued. Indeed, on many grounds it is advantageous to the student, in relation to both Lithotomy and Lithotrity, to make the study of the former precede that of the latter.

The subject of Lithotomy is by no means so simple and so limited at the present day, as it was considered to be a few years ago. If we take the writings of our best surgeons of the last fifty or sixty years, who have devoted themselves to it, we cannot but be struck with the fact that no other mode of performing Lithotomy is described or alluded to, except for occasional trial, or as a matter for speculative remark, than the Lateral Operation. Most assert that it is the only method which should be employed, except in certain circumstances, which are extremely unusual, and it is right to add that some great authorities appear still to hold the same opinion. The last thirty years, however, have witnessed some change in this respect in Great Britain, and several attempts have been made to remove the stone by other modes of incision; while the surgical practice of Paris has exhibited similar endeavours for a longer period of time. The introduction and progress of Lithotrity have in a great measure been the cause of this. Lithotrity has achieved such indisputable success with small stones, that those whose habits and inclinations lead them to prefer the use of the knife, have endeavoured to find a method of employing it which should compete on equal terms with the crushing operation. But where no such bias exists, almost all surgeons are now convinced that the difference between a large stone and a small one is so great, both as regards the prognosis of the case and the problem offered to the operator, that it is impossible to regard even all calculous patients who are to be submitted to the knife, as belonging to one category and as amenable but to one mode of the remedy. It is believed to be neither philosophical nor politic to apply to every stone, whether it weighs one drachm or three ounces, invariably one and the same proceeding. We have learned the importance, in the first place, of ascertaining, before deciding on any operation, the physical characters of the stone, that is to say,

its size and hardness; and secondly, the condition of the patient in relation to the state of his urinary organs and his general susceptibilities. Hence the student of our subject in these modern times has more than one mode of Lithotomy to understand, and several questions presented to his consideration, in order that he may arrive at a practical solution of the question when any individual patient comes before him, viz. What is the best operation for this particular case?

Hence, also, it is that, up to the present time, there has been little attempt to offer a comprehensive appreciation of the various methods now in vogue. The choice has been mainly limited to the alternatives of Lateral Lithotomy and Lithotrity, with recently, in some quarters, the added resources of the Median Operation. An attempt to supply this desideratum will occupy the latter portion of this work.

The various procedures employed under the name of Lithotomy must be arranged in two separate classes, viz. :—

First. Operations by which the bladder is reached from the perineum; and among these I shall notice six principal methods, which will sufficiently include all minor modifications.

Secondly. An operation performed above the pubes, and known as the High or Suprapubic Operation.

First. Operations performed in the perineum, or Perineal Lithotomy.

These are of various kinds, but all may be classified either as Lateral or as Central Operations.

Lateral Operations are those which are confined within one of the lateral divisions of the perineum. The incisions are directed between the central and lateral muscles of that region. They necessarily approach the pubic ramus, the pudic artery and its branches, and are directed transversely to these latter, near to their origin from the arterial trunks. They involve one side of the prostate gland, it may be nearly to its full extent, while in children, and in exceptional adult cases, they go beyond it.

Central Operations are those in which the incisions are limited to the central part of the perineum, and are made in

the line of the raphé itself, or tranverse to it, and lie mainly between the anus and the symphysis pubis. They do not approach the rami, or the great vessels, nor do they run transversely near to the origin of the branches from the pudic artery. In no case do the incisions reach the external limits of the prostate gland.

I. Lateral Operations.—There is but one typical form of Lateral Lithotomy, although some of the details of its performance vary in different hands. It is the operation which is at present most widely employed in this country, and is well known as the Lateral Operation. Its origin is believed to be due to Pierre Franco, of Provence, about the middle of the sixteenth century. It was brought into note by Frère Jacques at the end of the seventeenth century; and was largely employed by his pupil Rau, in Holland, in the beginning of the eighteenth. The operation in its present form, however, differs somewhat from their methods, and is for the most part that which Cheselden adopted and practised in London with great success, in the early part of the last century, and which obtained for him a wide and enduring reputation.

II. Central Operations.—Belonging to this group there are at least five in number. 1st. The *Median Operation*. The stone was removed by a median incision in the perineum, made close to, and parallel with, the raphé in the old Marian Operation during the sixteenth century, and long afterwards. But the great improvement, and the far greater success which the Lateral method realised, led ultimately to the total extinction of the Marian. The disastrous results of this procedure were due to the violent laceration of the neck of the bladder and posterior part of the urethra, by which room was made for the extraction of the stone, and not to the median incision of the urethra, which was all that the knife effected in that operation. This distinction was, nevertheless, lost sight of by most lithotomists (Ledran may be partially excepted [1]) until the Italian surgeons, at the commencement of the present century (Manzoni of Verona, then De Borsa, and subsequently Rizzioli) drew attention, by their success, to Lithotomy in the Median Line.

[1] See not only his *Parallèle*, Paris, 1730; but Heister's testimony, *Institutiones Chirurg.*, vol. ii. pp. 116–17, and 167 (Amsterdam, 1739).

Mr. Allarton brought it into notice in this country, publishing his own method of performing the operation and the results, in 1854. This plan has since been frequently tested by others, in this country and abroad, and certain modifications have been made by some, the 'prerectal' operation of Nélaton, for example, but it is now generally known as the Median Operation. Dr. Buchanan's method, in which he uses an angular staff, first employed by him in 1847, may also be classed under the head of central operations, although it is capable of becoming a lateral operation when required.

A slight median incision also may be made for the purpose of introducing a lithotrite, crushing the stone and removing all the débris through the perineal opening; a combination of lithotomy and lithotrity, sometimes called 'perineal lithotrity.'

The *Bilateral Operation*—so named because the incisions, both external and internal, involved equally each side of the middle line—was designed and made public by Dupuytren in 1824. It was subsequently practised in Paris, by himself and others, for some years. As we shall see hereafter, it is, notwithstanding its name, a central, rather than a lateral, operation.

The *Medio-Bilateral*, a combination of the two preceding operations, as the term implies, was published by Civiale in 1836, having previously been practised by him, and subsequently both by himself and others, to some extent in France.

The *Recto-vesical Operation*.—This may be regarded as a continuation of the Median operation from the perineum into the rectum, and is supposed to have been designed by Hoffman in 1791, though probably not practised by him. Sanson and Vacca are pre-eminent among those who performed and advocated it in the commencement of the present century.

In entering on the subject of Lithotomy performed in the perineum, whatever be the operation selected, it is necessary to study closely the anatomy of that region. It would, however, be superfluous to enter upon any systematic or minute examination of it here; but I shall call attention to one or two points relating to what is usually termed its surgical anatomy, which appear to me to be important.

A body is supposed to be tied up in the usual Lithotomy

position, to expose the perineal region: a region, let it be recollected, in which deep incisions are to be made, and through which the stone is to be extracted.

It is important to keep steadily in view these two indications, since the region contains vital organs, and is very limited in extent.

Therefore—*a*. The incisions must be planned so as to avoid certain parts which it is dangerous to cut; and—

b. They must be planned so as to secure the greatest amount of space for the passage of instruments inwards and of the stone outwards.

The perineal region is a small space, measuring rarely much more than four inches in any direction, as generally regarded, and its limits are defined in the greater part of its extent by bone. Beneath its surface are the rectum, urethra, bulb, prostate gland, bladder, and the pudic artery, with some of its branches, besides less important parts.

Its surface boundaries are often said to present a space of triangular form; the apex at the pubic arch; the base, a horizontal line uniting the two tuberosities of the ischium. Such a triangle is nearly equilateral, and each of its sides measures in the adult about three inches in length. Such a representation may be convenient to the anatomist, but it is artificial, and for the surgeon not quite exact.

Sometimes the space is said to be lozenge-shaped, in which case the anatomist includes under the term not only the space above described, but another triangular portion, having the same base as the preceding, and the apex at the coccyx; the latter region covering in the lower part of the rectum and the ischio-rectal fossæ.

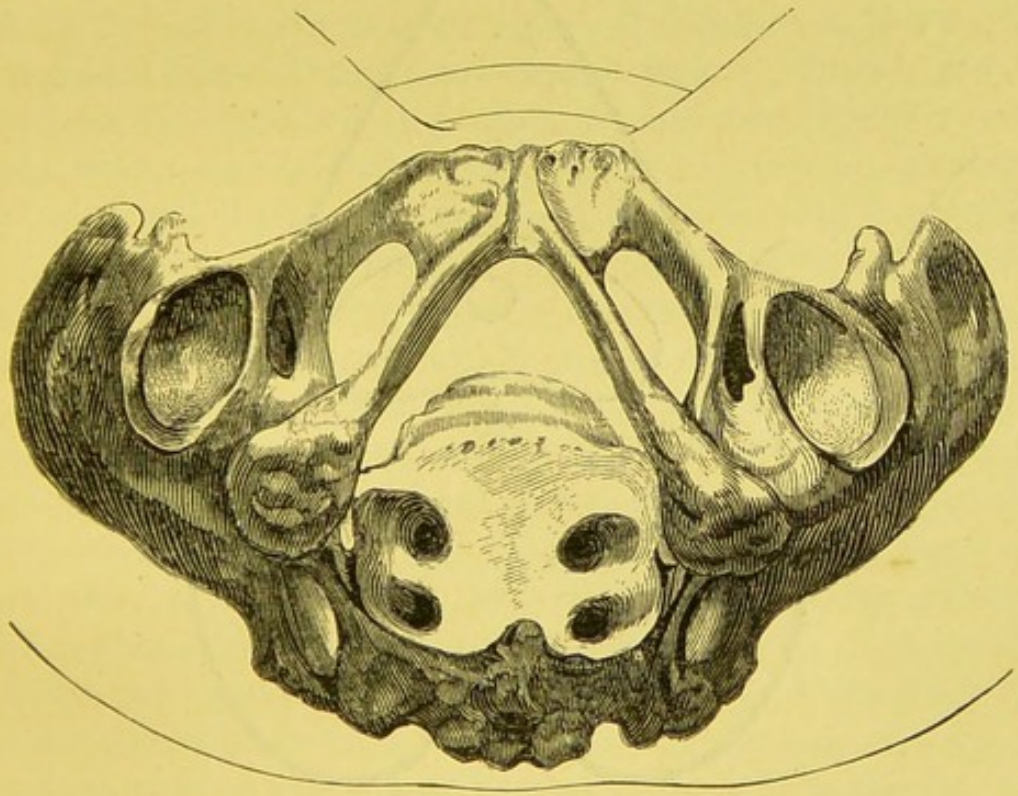
Now, the surgeon should study for his purposes the anatomy of the male pelvic outlet as a whole, just as the obstetrician has studied that of the female. He wants to know precisely what are the size and form of that outlet, as well as how the important organs are disposed therein. Neither the triangle nor the lozenge rightly represent it in relation to his requirements; while the division of the region into two separate portions for the sake of dissection is unfavourable to the formation of a correct conception of it as a whole. Furthermore,

the surgical student must soon perceive that neither of the two regions thus annexed includes space enough, either for the first incision required in the lateral operation, or for the removal of a moderately large stone outwards.

The true form of the male pelvic outlet, and consequently that with which we have to do, is that of the conventional heart; the ace of hearts, with the apex upwards.

Take the skeleton of an adult male pelvis, in which the bones are united by their ligaments, and place it in the position for lithotomy. Such an one is faithfully represented by fig. 1.

FIG. 1.



Pelvic bones in the ordinary position of Lithotomy, showing form of outlet.

The apex of the inverted heart is at the lower border of the pubic symphysis; the diverging sides are the rami of the pubes and ischia; the rounded lobes of the heart are defined by the great sacrosciatic ligament, and the notch dividing them is formed by the tip of the coccyx.

The pelvic outlet thus described is represented in a diagram adjacent (fig. 2); but accurately drawn from the skeleton, on a scale of two-thirds of the natural size. This figure will be

employed to represent the outlet throughout this work in connection with the incisions employed in the various operations for Lithotomy.

In a well-developed adult the measurements of this heart-shaped space are as follows:—

From apex under pubic symphysis to the interlobular notch at the os coccygis, about $3\frac{3}{4}$ to 4 inches.

From the anterior part of one tuber ischii to the corresponding part of the opposite bone, about 3 inches.

FIG. 2.

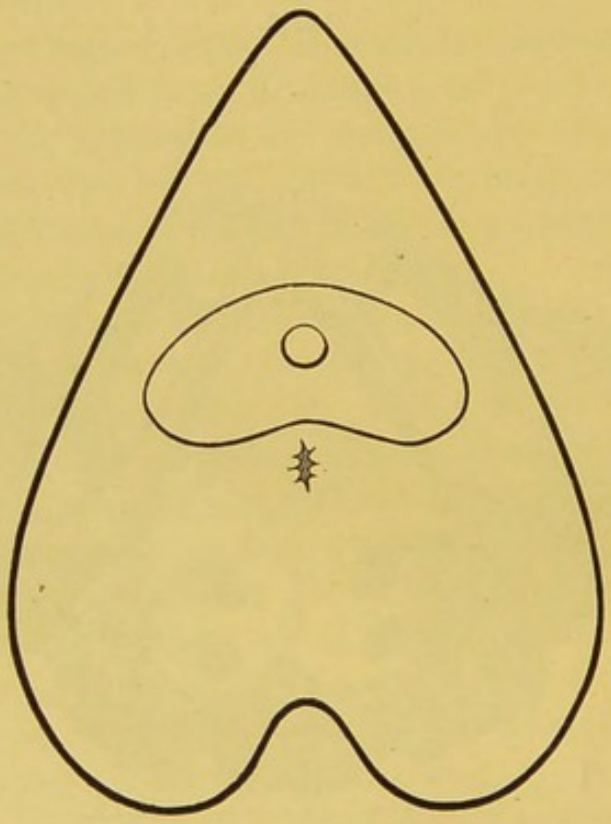


Diagram of the male pelvic outlet, showing the situation of the prostate, urethra and anus: drawn on a scale of two-thirds of the natural size.

From the apex to each tuber ischii at the part just named, about 3 inches.

Consequently, the two last measurements include a right-angled triangle—the perineal triangle of the anatomist.

From the apex to the centre of the anal orifice, about $2\frac{1}{2}$ to $2\frac{5}{8}$ inches.

From centre of anal orifice to tip of coccyx, about $1\frac{1}{4}$ to $1\frac{3}{8}$ inch.

From the apex to extremity of either lobe of the heart-shaped space, the line of incision in Lateral Lithotomy, about 4½ inches.[1]

To commence: we will suppose an examination of the region on an untouched subject in the dissecting-room; or, better still, as it appears on the living body. First, there are the projecting tuberosities of the ischium, and from these the upward converging lines of the rami may be traced by the fingers near to the apex, where they are obscured by the body of the penis overlaying them as they approach it. Then, about an inch and a quarter below the anal orifice, may be felt the coccyx, and on each side the fingers deeply pressed encounter nothing but soft structures occupying the spaces indicated by the rounded lobes of the heart-shaped figure. In the middle line above the anus is seen a slight prominence caused by the corpus cavernosum and its enveloping muscle, and placed vertically upon it is the line of the raphé, which divides the region into two equal lateral portions. The anus itself is situated in a deep depression, and a transverse line drawn from the centre of one tuber ischii to another falls just above it.

Observe, that the sides of this space, from the apex to the tuberosities of the ischium, are bone; and that the interlobular notch of 'the heart' is bone also; boundaries, therefore, which yield nothing to pressure, and cannot be overstepped by incision. But, on either side of the notch, the tissues are soft and yielding; and incisions in the long axis of either lobe divide no important structure. Danger exists only at the external boundary, in the presence of the pudic artery; in the upper part, from that of the artery to the bulb; and in the central line, from the presence of the bulb itself and the rectum. It is through one of these lobes, and precisely in the direction of its longest axis, that the external incision in Lateral Lithotomy is made; and, which is of equal consequence, it is in the direction of that axis that traction must be exerted when the stone

[1] In some bodies the pelvic outlet is more contracted or narrower than the above measurements; the distance between the tubera ischii being in the adult only 2¾ inches, and in a few instances only 2½. This latter condition offers some obstruction to the removal of a large stone, and if the lateral operation is adopted in such a case, its line must be less oblique than usual. *Vide* Chapter VI. 'Difficulties and Dangers met with in Lithotomy.'

is of large size. It is in the upper and narrower division of the outlet, viz. that between the anus and the symphysis pubis, that the incisions lie, in all operations which are strictly central, and traction is made directly in the middle line from the perineum to the operator. It can be demonstrated that it is impossible to remove so large a body through an incision confined to this portion of the outlet, and not involving the rectum, as through an incision in the axis of the lateral portion.

Now, every proposal to perform Lithotomy in the perineum must first be tested as to the relation which its incisions bear to the outlet thus described; since, as we shall see hereafter, there is no single cause of death or danger following Lithotomy, greater than that which ensues from the removal of a stone through an insufficient or an ill-placed opening.

Bearing in mind the form of the space, let us proceed to make a surgical, not a minute or anatomical, dissection of it. The latter is necessary in its place, but that is not here. We want now only the salient points, to refresh the memory, not to encumber it with non-essentials.

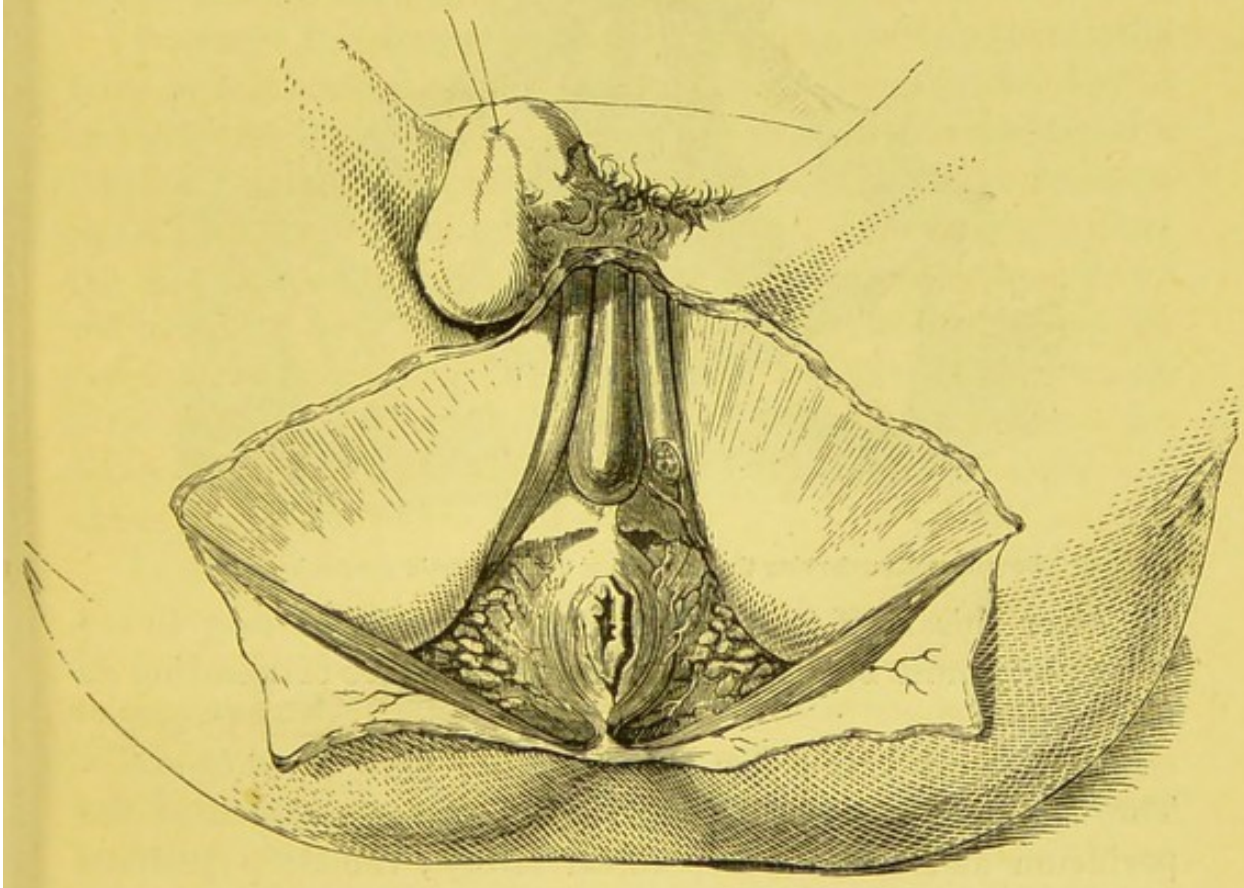
Without entering on the details of the process, let it be supposed that the skin, cellular tissue, and fat are removed: this completes the first stage of dissection.

The accelerator urinæ muscle occupies the middle line at the top of the space, and the sphincter ani surrounding the end of the rectum continues the line below it. The space is crossed transversely by the two transversus perinei muscles; and the erector penis lying on the pubic ramus of each side forms one side of a triangle, of which the transverse muscle is the base, and the accelerator the remaining side. From this are seen issuing the superficial perineal artery and nerve, with their branches. Below the transverse muscle is the ischio-rectal fossa, with a few unimportant branches of artery and nerve permeating it. The central point of the perineum is seen between the bulb and anus, where the four muscles unite in a crucial form. All these are superficial to the triangular ligament, or deep fascia, of the perineum.

The next stage of the dissection removes these muscles, and exposes the corpus spongiosum and the corpora cavernosa of the penis: the deep perineal fascia is seen in the intervals.

Here (as represented at fig. 3) it is left untouched on the right side of the subject, while it is removed, together with the compressor urethræ muscle, on the left, to show the course of the pudic artery, and its branch the artery to the bulb, which lie beneath it, the latter perforating the fascia. The left corpus cavernosum is also divided to show the arteries more clearly. The position of these vessels forms the important point of this dissection.

Fig. 3.

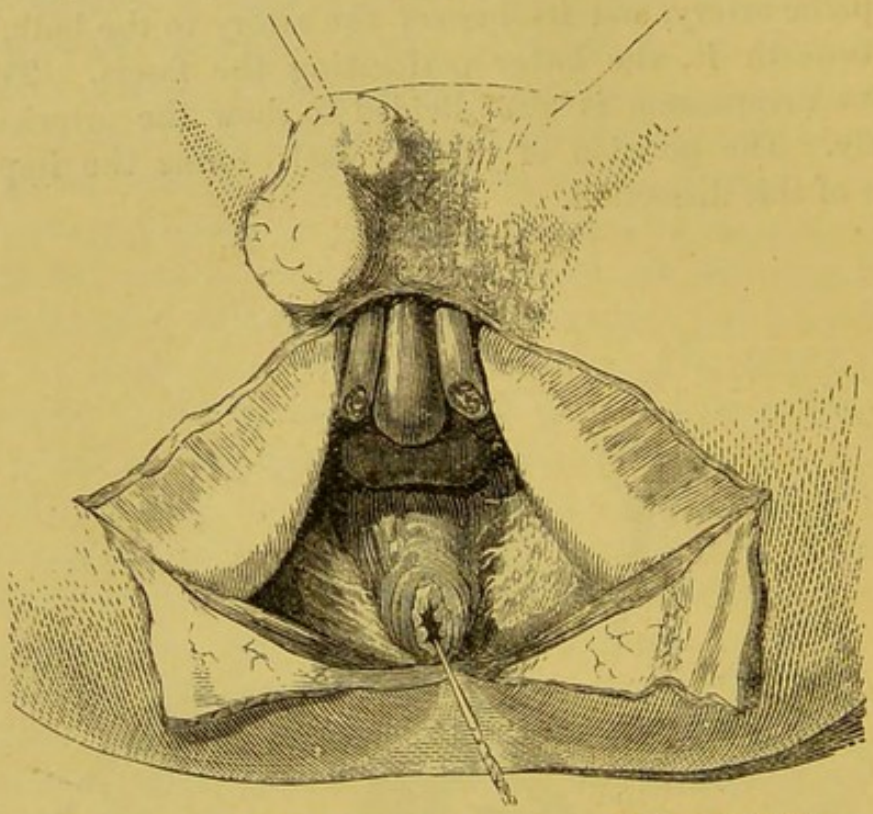


The second stage of the dissection of the perineum, showing the course of the pudic artery, and artery to the bulb, the fasciæ, &c.

The last stage of the process consists in clearing away the whole of the perineal fascia, the vessels just named, and the deep fascia, now usually known as the pelvic fascia, which lies beneath the vessels, and forms a sheath for the prostate gland. The fibres of the levator ani having been divided on each side, the rectum is drawn downwards, and carefully separated from the prostate, maintaining the latter as much as possible in its normal position. To illustrate the situation of this organ and

neck of the bladder is the object of this, the last, dissection. The result is shown by fig. 4.

Fig. 4.



Deep dissection, showing the situation of the prostate in the pelvic outlet.

After this brief anatomical *résumé*, it will be easy to see what parts must be divided in the various modes of operating in this region.

In Lateral Lithotomy the following parts *must be cut*.—The skin and superficial fascia; the transverse muscle of the perineum and transverse perineal artery; the deep perineal fascia, the membranous urethra, and muscular fibres surrounding it; a little of the levator ani, the prostatic urethra, and part of the prostate gland itself. In addition to these, the following parts *may be*, and often are, cut:—a part of the accelerator urinæ muscle covering the bulb of the urethra, and a little of the bulb itself; also the internal meatus at the neck of the bladder. Occasionally, especially when the vessel is given off lower down than usual, the artery to the bulb is divided also.

In Central Lithotomy the following parts *must be cut*.—The skin and superficial fascia; the tendinous structures which unite the muscles in the central point of the perineum, and a

few fibres of the accelerator urinæ muscle; some small arterial branches anastomosing across the middle line; the deep fascia, the membranous urethra, and muscular fibres surrounding it; the prostatic urethra, and the lower part of the prostate gland itself. Besides these, the bulb of the urethra is generally divided to a small extent; and when deep lateral incisions are made, the prostate is divided in the direction named, with a little of the deep fascia right and left of the median line and the muscular structure contiguous to it, as well as the internal meatus, according to the design of the operator.

Further: it will appear that, in order to remove any large body by the Lateral Operation, room must be provided in the direction of the lower angle of the wound. The pubic arch limits the space unalterably in front, the ramus of the ischium equally so on the outer side; the rectum and coccyx occupy the middle line. Hence, in withdrawing a large stone from the bladder, traction must be made obliquely downwards to the right of the operator in the direction of least resistance, which is towards the hollow of the sacrosciatic ligaments, where the fibres of the gluteus muscle only cross the heart-shaped space already indicated as the true outlet of the male pelvis.

Lastly: it will be equally obvious, that in the performance of Lateral Lithotomy, the following parts *are to be avoided.* In front, the artery to the bulb, and the bulb itself. In the median line, the rectum. On the outer side the pudic artery; which, however, could only be endangered by the most reckless incisions; still, its situation, at the margin of the ramus bounding the space there, is always to be remembered. In the last or deepest incision the boundary limit of the prostate is not to be overstepped in the adult, whenever the stone can be removed without doing so; but this point will be discussed at length when we consider the steps of the operation itself.

In central operations (the recto-vesical excepted) the rectum must be avoided in the lower part of the incisions; and it should be the aim of the operator to avoid the bulb above, or to wound it as little as possible. Of incisions in the prostate, as in the preceding case, more will be said hereafter.

CHAPTER II.

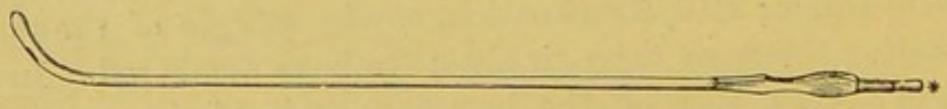
THE LATERAL OPERATION OF LITHOTOMY.

The Instruments necessary.—Preliminary Proceedings: Assistants, &c.—The First Stage: Management of the Staff; finding the Stone.—Second Stage: the Incisions superficial and deep; probe-pointed Knives; Gorgets; Lithotomes.—Third Stage: Removal of the Calculus.—Fourth Stage: the Tube; the Air Tampon; Treatment of Hæmorrhage, &c.—The after Treatment.—Aston Key's Operation.

I SHALL first enumerate the instruments which it is desirable to have ready for use before performing the operation of Lithotomy by the lateral method. The non-appearance of a single instrument of importance at the moment it is required may produce great embarrassment to the operator; hence a list should be at hand by which the instruments can be selected the day before the operation.

Sounds of the proper form for detecting stone in the bladder (fig. 5).

FIG. 5.



An eight-ounce syringe (fig. 6), with suitable catheter for injecting by urethra; and a tube for washing out the bladder by a reversed current through the wound after the operation (fig. 7).[1]

Full-sized staffs, as deeply and widely grooved as their size admits, consistently with maintaining their strength. The groove to be midway between the convex and the lateral aspects

[1] This nozzle is after the suggestion of Dr. Gross of Louisville, *Urinary Organs*, 3rd ed., p. 248.

of the staff, to stop abruptly half an inch from the extremity, and not to extend so far up the handle as to permit the urine to escape (fig. 8). The curved portion not to be so long as it is usually made, since a small or contracted bladder is some-

FIG. 6. FIG. 7. FIG. 8.

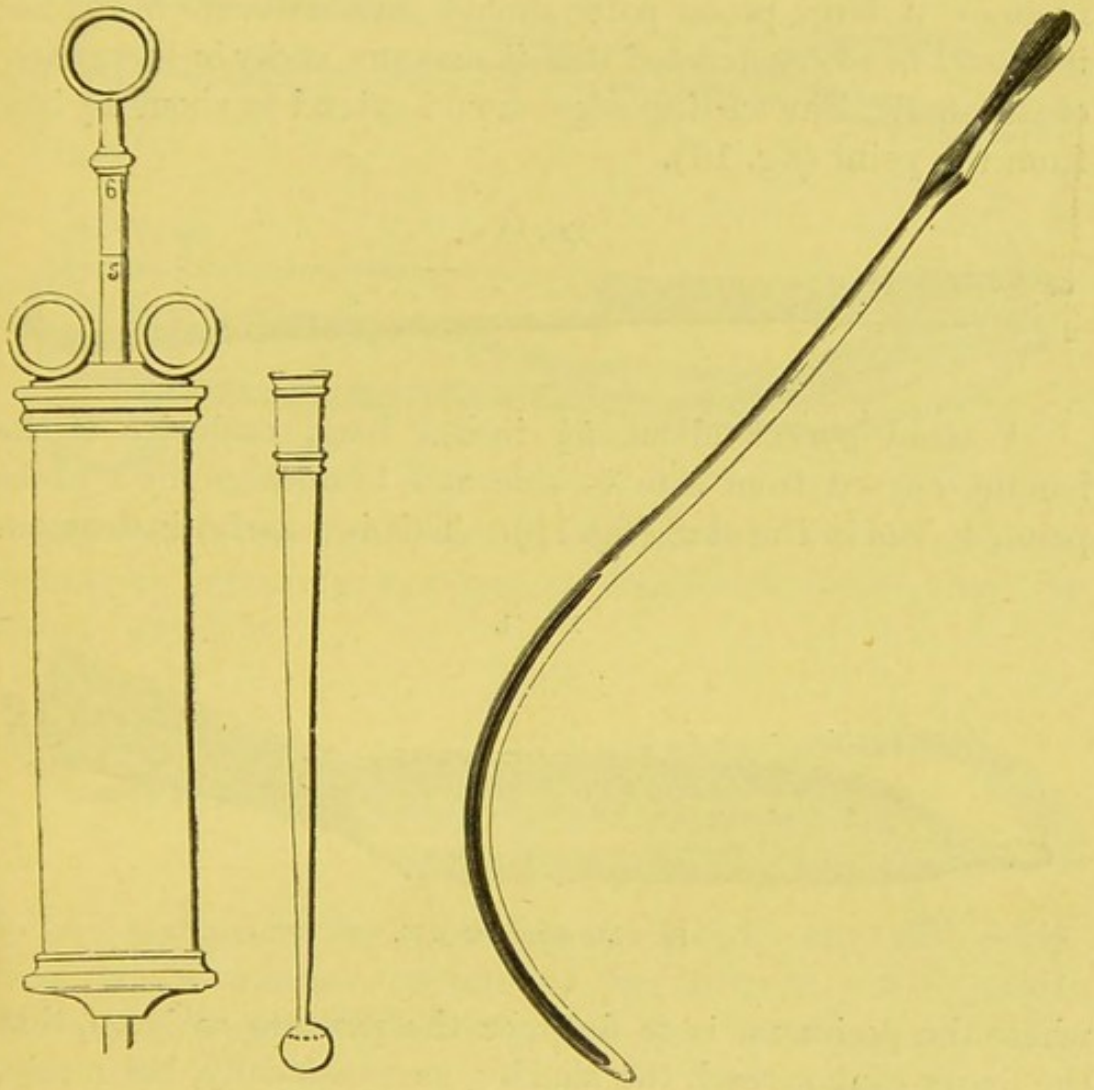


FIG. 6. The syringe, with graduated piston rod.
FIG. 7. Nozzle for reversed current.
FIG. 8. Staff, with lateral groove.

times exposed to the danger of perforation when that portion of the staff protrudes far into the cavity.

A knife, of which the blade and handle together measure

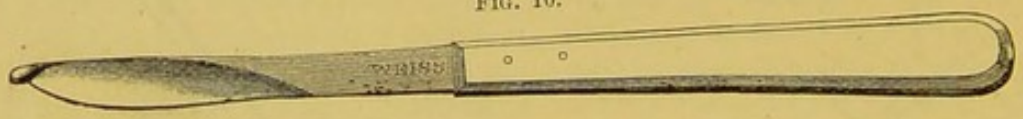
FIG. 9.

(for the adult) about $7\frac{1}{2}$ inches long; of this, the blade may be

about 3 or $3\frac{1}{4}$ inches. The cutting edge should have a length of about one inch and a quarter from the point: for form, &c., see fig. 9. Smaller sizes are required for young subjects.

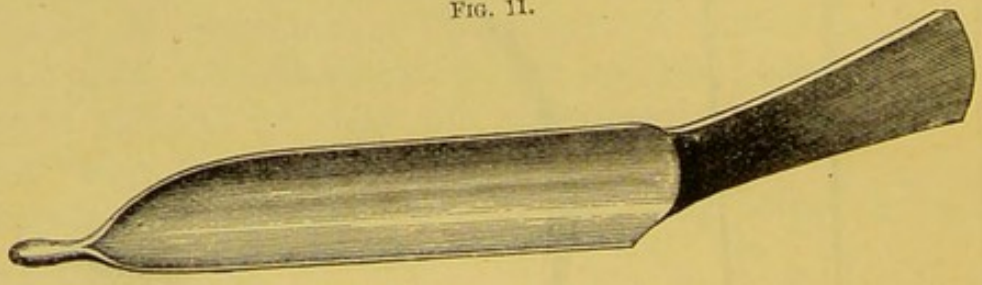
A second knife, of which the blade and handle may measure together about 8 inches; of this the blade may be about $3\frac{1}{2}$ inches. A large probe point should terminate the blade, and it should be so constructed that it may run easily in the groove of the staff. The cutting edge should extend to about $1\frac{1}{4}$ inch from the point (fig. 10).

Fig. 10.



A blunt gorget about $5\frac{1}{2}$ inches long, exclusive of the handle, curved from side to side and terminated by a probe point, to run in the staff (fig. 11). This is a useful instrument

Fig. 11.



See other gorgets at p. 30.

where the perineum is so deep, or the prostate so large, that the finger cannot reach the bladder, as occasionally, but rarely, happens.

Forceps of various forms and sizes. It is desirable to have the blades of good length, so that the angle produced by opening them is acute rather than the reverse: a better form of wedge is thus presented to the orifice, through which the instrument and the stone have to pass. The inner surfaces of the blades should be slightly roughened; they are sometimes lined with very thin canvas or kid leather, to afford a surer hold, and avoid any crushing of the stone itself. The extremities of the blades must not meet; an interval of about one-eighth of an inch should exist between them when the

instrument is closed. It is necessary to have curved as well as straight forceps. (Useful forms are shown at figs. 12 and 13.)

Fig. 12.

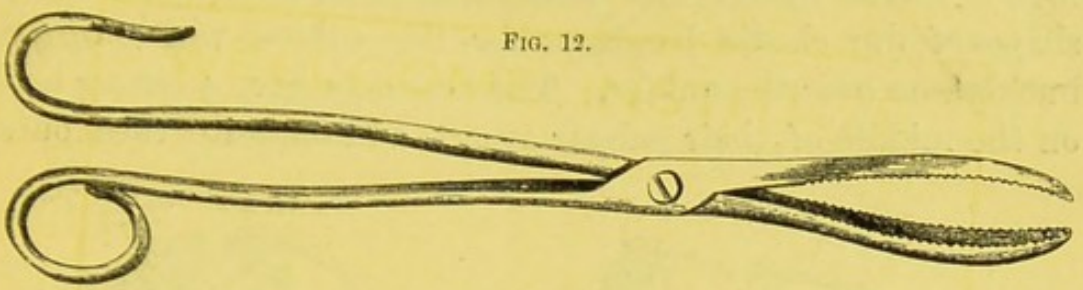
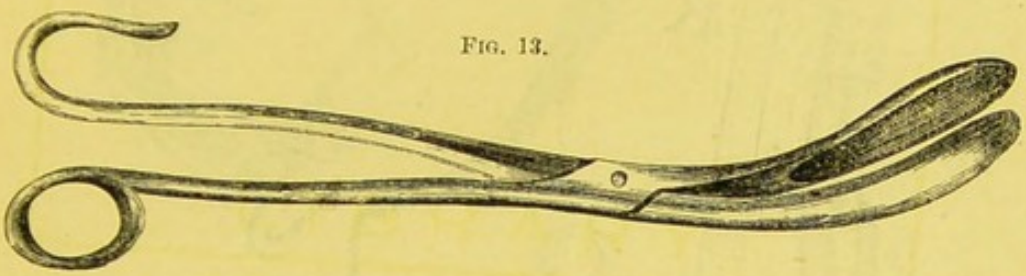
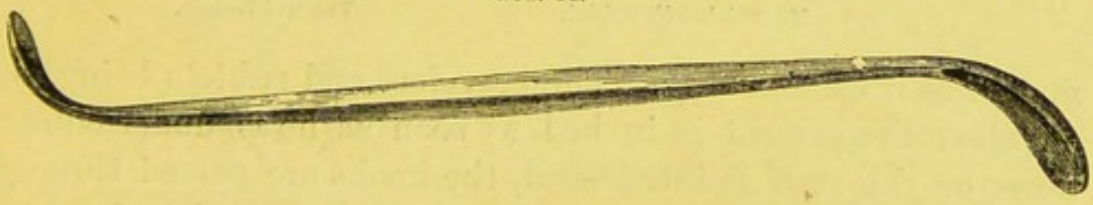


Fig. 13.



A scoop is sometimes useful, and succeeds in certain circumstances in removing a stone, or fragments, better than the forceps (fig. 14).

Fig. 14.



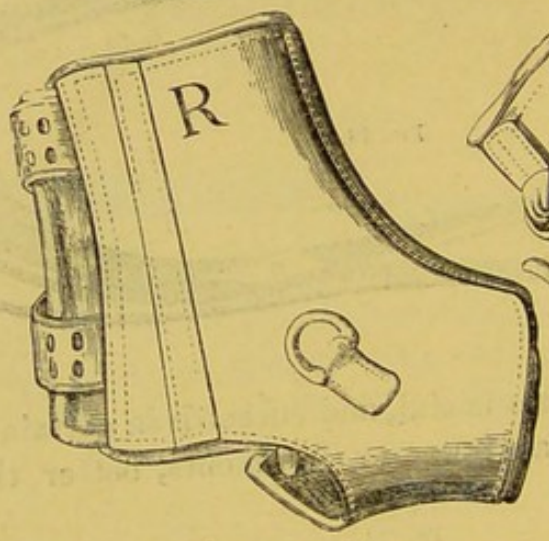
An instrument for searching the bladder after the operation, in case another calculus or fragments may still remain there. Nothing answers better than the sound represented at fig. 5.

A strong instrument for crushing a calculus of unusually large size, and requiring to be broken before removal, is occasionally necessary. Several forms have been designed, but almost all consist of a pair of ordinary strong forceps, with screw or other power to approximate the handles. (See Chapter VI.)

A pair of worsted web lithotomy garters, strong, but pliant; each measuring not less than three yards. An anklet, to accomplish more easily and more securely the same purpose, has been designed and employed by Mr. Prichard, of Bristol. (Figs. 15 and 16.)

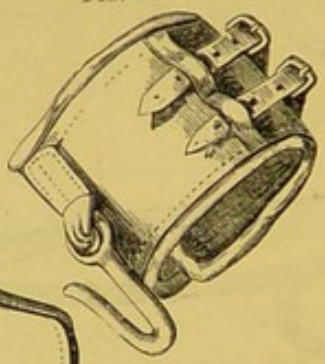
His description is as follows:—'These straps consist of padded leather bracelets fitting to the wrists, and buckling firmly round them; and some firm leather anklets, of the shape of the elastic bandages for the ankles, which can be buckled on over the ankles. The bracelets have a strong hook on the middle of their palmar aspect, and opposite each outer

Fig. 15.



Mr. Prichard's anklet.

Fig. 16.



The wrist-piece.

malleolus is an iron ring. The bracelets and anklets being put on when the patient is in bed, as soon as he is under chloroform, or the staff is introduced, the hooks are passed through the rings and all is done.'[1] I have used these anklets for some years, and much prefer them to the garters, as being more simple and secure.

A tube to be introduced through the wound into the bladder, after the operation, if desired. One may be specially fitted for plugging in case of deep venous hæmorrhage. (Fig. 17.)

But the most certain mode of dealing with severe bleeding, the ligature failing or being insufficient, is the addition of an inflatable thin india-rubber bag to the tube, so arranged around it, that while its draining action is left intact, the bag can be distended with air, through a small flexible tube provided with a stopcock (see fig. 18). It should be introduced so far that the whole cut surface is exposed to the action of the bag: indeed, the further end of this should just protrude

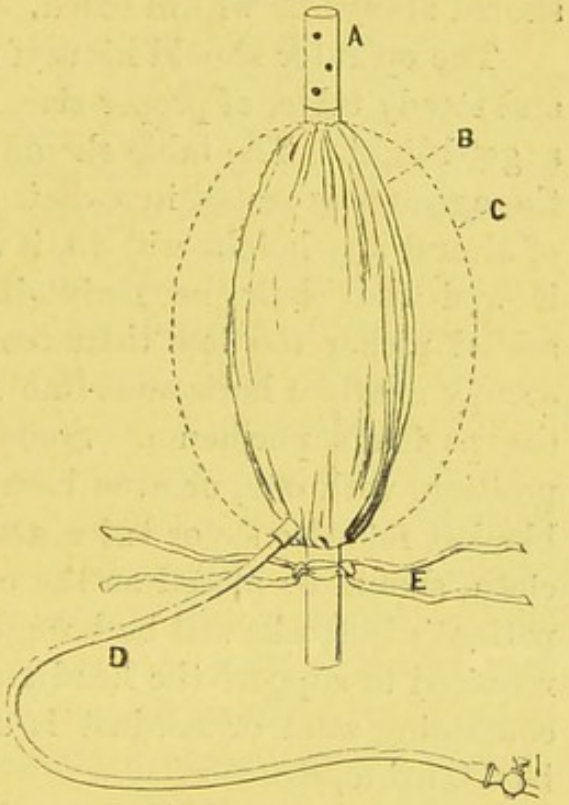
[1] *Brit. Med. Journal*, Dec. 22, 1860, p. 993.

slightly into the bladder itself. This done and inflation being made, the distended bag produces pressure on every portion of the wound's surface, closing every inequality, and effectually stopping all the hæmorrhage. After twelve or twenty-four hours or so, a little air is allowed to escape, and the pressure is

FIG. 17.

The tube surrounded with a piece of thin calico, or oiled silk, to retain the plugging in case of hæmorrhage.

FIG. 18.

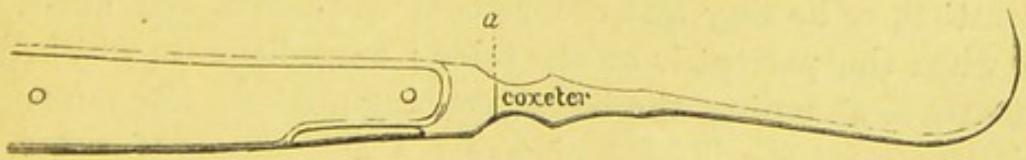


The Air Tampon.

A. The tube.
B. Thin india-rubber bag undistended.
C. Line indicating form of bag distended by air.
D. Flexible tube, with stopcock for inflating bag.
E. Tapes to fasten tube in place.

gradually relaxed, until the apparatus can be removed altogether. It was designed by my assistant Mr. Buckston Browne, and is known as the 'dilatable air tampon.'

FIG. 19.



Tenaculum (Dr. Keith). At *a*, the hook unites with the handle by a screw, and can be separated from it, for the purpose of leaving it in the wound beneath a deep-seated vessel after tying round it, when the ligature cannot be secured otherwise.

Ligatures; artery forceps; curved needles and strong silk, tenaculum (fig. 19) to secure any deeply-seated arteries (see

Treatment following the Operation, under the head Hæmorrhage, page 37); bandages, sponges, lint.

Other appliances.—Vessels containing hot and cold water, one of the former to heat the forceps and other instruments; napkins in abundance, oil; chloroform is of course to be given. Brandy, wine, smelling salts, and chloric ether, or sal volatile, should always be within reach.

The operator should himself see that there is a strong, firm, and steady table, of proper size, and capable of being placed in a good light. The table should be 2 feet 8 or 9 inches high, if the operator is seated in a chair of ordinary height; but a table of almost any height will do, if the relative proportion between it and the chair be maintained. The operator should be seated rather too low than too high. The fore-arms should occupy nearly a horizontal line when operating on a level with the patient's perineum. Some surgeons prefer the kneeling position, with one, or even both knees resting on the floor. A blanket folded once or twice, and covered with some waterproof cloth, should be placed on the end of the table, over which the patient's buttocks will be brought. Pillows or cushions will be required to support the head and shoulders. A shallow vessel containing sand or sawdust is useful to protect the floor from blood, urine, &c.

THE OPERATION.—It is usual to ensure action of the bowels by an aperient, on the day before the operation; if, however, they have been regularly and sufficiently moved in the natural manner, a purge is undesirable, since it only weakens the patient. But on the day of the operation, and about two or three hours previous to it, a full enema of warm water should be given. The surgeon should ascertain that the action of this has been efficient and completed at least an hour before the operation, or he may find the rectum distended, and about to act when the patient is on the table; a condition in which the chances of wounding the bowel are augmented. By pursuing this method time is also given for a few ounces of water to collect in the bladder if desired, which would probably have been emptied simultaneously with action of the bowels. The left side of the perineum may be previously shaved with a common scalpel or a razor.

[Some surgeons, and especially at the present day, regard it as important that there should be a considerable quantity of water in the bladder. I venture to express an opinion that its use is overrated; and that it is sufficient to take the chance of the urine accumulating for an hour before the operation; at all events, any attempt to inject an irritable bladder is rarely of any service. Cheselden expressly says that he prefers the bladder empty, as the stone is then sure to be found close to the internal incision at the neck; whereas if the organ is full it may entangle the stone in its folds as it collapses. Mr. Crichton, of Dundee, was of the same opinion, and insists, in his MS. notes, that if the bladder is empty, or nearly so, the stone is certainly found at the neck of the bladder.]

ASSISTANTS.—There should be one steady, experienced assistant to hold the staff; it is his duty to follow implicitly the operator's instructions throughout. Two others also are necessary, each to support firmly a leg of the patient; one of them to draw the scrotum a little upwards, and to the right side; or this may be done by the assistant who holds the staff. These suffice, in addition to the physician who administers the chloroform. Another may be sometimes useful to hand sponges, ligatures, &c., or to supply any want of the patient; all of which, however, may be done if need be by a nurse. The instruments should be carefully arranged by the operator himself (on a tray or otherwise), within easy reach of his right hand, so as not to be touched, and possibly deranged, by an assistant.

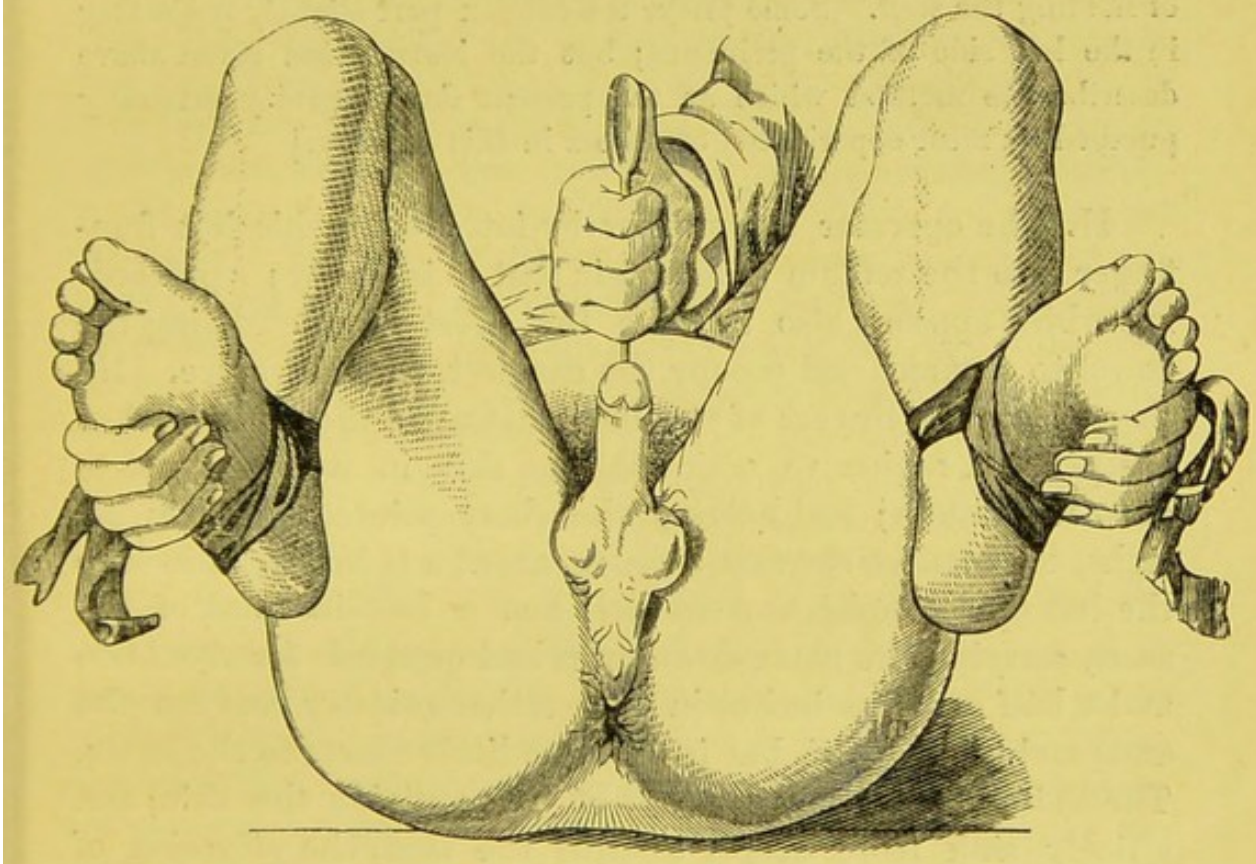
I. All the preliminary arrangements being complete, the patient should be placed on the operating table, and be sufficiently covered with blankets. Chloroform having been administered, the staff should be carefully introduced, and the stone found, and struck by it if possible, the click being heard by the operator, and by one other person at least. If it cannot be felt with the staff, a sound of the proper form should be introduced, the bladder explored, and unmistakable signs of the presence of calculus elicited. It may be necessary in order to discover it, to inject a little warm water, particularly if the bladder has emptied itself during the sounding. If, after a fair search, the stone is neither heard nor felt, no operation can take place, and the search must be resumed on another day.

[But it is very desirable, and in most instances it is possible, to strike the stone with the *staff itself, upon which the patient is to be cut.* Because, supposing the stone to be struck with the ordinary sound, and some difficulty is experienced in passing the staff subsequently, it is possible that the operator may have made a false passage, and unwittingly passed the instrument out of the urethra altogether. Or, the staff may have passed into an old false passage, which the sound, having a different curve, escaped. The obvious and necessary consequence is, that any operation performed on a staff so placed will not lead into the bladder, no stone will be removed, and the discovery of the error may not take place until it is too late to repair it. This unhappy accident has been known to occur, not very unfrequently, particularly in children. It could not happen if the surgeon were determined to hear the stone struck with the staff itself; and, especially if he has not had much experience, nothing less than this should satisfy him. An experienced surgeon knows whether the staff is in the bladder, without feeling actual contact with the stone, by the degree of mobility possessed by an instrument rightly passed, strongly contrasting with its fixed condition, when passed out of the urethra; but the rule laid down should be considered always binding. It is especially necessary in young cases, because a staff passed into the cellular interval existing between the rectum and bladder has often a good deal of mobility, and thus is believed, but erroneously, to be in the vesical cavity.]

The staff being placed in the bladder and confided to the chief assistant, the patient's head and shoulders should be a little raised by two or three pillows, and the hand and foot of each side made fast by means of the anklets described. If the garter is still preferred, it is to be used as follows:—An assistant extends the right arm by the patient's side, and drawing up the right foot by flexing as much as possible the knee and hip-joints, places it in the hand so that the palm embraces the outer side of the instep, and the fingers lie transversely below the sole, with the thumb across the dorsum. The garter is then folded double, with a running noose at the doubled end, which is placed round the wrist; the two free ends are crossed tightly under the sole and round the ankle, so as not to slip, and finally are tied with a bow on the outer side. Meantime the opposite limb is similarly treated. When all is made secure the buttocks are brought down until they project slightly over

the edge of the table. Each leg is firmly and steadily held by an assistant, who, facing the operator, places his nearest hand (*e. g.* his left if standing on the patient's right) on the inner side of the patient's knee, while his other grasps the patient's foot, keeping it well backwards and outwards. The staff is confided to an assistant who stands on the patient's left, and takes it in his own right hand. He should hold it so that the handle is perpendicular and strictly in the middle line, neither deviating to the right nor to the left; and as there must

FIG. 20.



The position of the patient when tied up for Lithotomy.

necessarily be some base of support in so doing, it should be made to rest steadily but lightly against the lower border of the symphysis pubis. In this position, about two inches of the staff ought to be lodged in the bladder. With his left hand he may gently draw up the scrotum a little towards the right groin, and so keep it out of the way.

The operator, having placed the necessary instruments within his reach, takes his seat and separates the legs as much

as he deems necessary to expose sufficiently the perineum and part of the buttocks adjacent. He ascertains that the position is square to his own front, and that the patient is firmly placed. (Fig. 20.)

By a glance, and by passing the fingers over the perineal surface, he observes whether the tubera ischii are wide apart, or whether they approximate more than usual; and he plans the line of the first incision somewhat in conformity with the result of his examination. (See page 9.)

[Different authorities give different directions respecting the mode of holding the staff. Some prefer the convex part slightly projecting in the left side of the perineum; but the instructions given above describe the method which at the present day is pretty generally pursued by most experienced operators in this country.]

II. The operator commences by introducing his left forefinger into the rectum to ascertain that it is empty; a proceeding which appears also to have the effect of stimulating the bowel to contract and occupy the smallest possible space. He then places the fingers of the left hand upon the upper part of the perineal region to maintain the skin in its place, not to draw it upwards; and holding the sharp-pointed knife in his right, commences the first incision about a third of an inch to the left of the raphé, and an inch and a half in front of the anus, carrying the blade downwards and outwards for about two and a half or three inches in a direction midway between the anus and tuber ischii, but inclining a little nearer to the latter. The knife should, at its point of entry, divide the skin, and quickly sink more deeply towards the staff, the situation of which should be kept in the mind's eye, into the superficial fascia and fat in the hollow which exists between the bulb and anus on the one side, and the ramus of the ischium on the other; the incision is then to be gradually made more superficial through its lower part. If a large stone is anticipated its entire length may extend to fully three inches. As a rule, then, the first incision should be free.

[The line of the first incision is somewhat differently taken by different operators. Nearly all agree to commence a little to the left of the raphé, but not so in regard to the distance in front of the anus.

Thus, Sir William Fergusson directs that it should commence one inch and three-quarters in front. Mr. Erichsen one and a half inch, Sir B. Brodie, Mr. Stanley, Mr. Skey, and Dr. Gross, advise one inch and a quarter, while Mr. Coulson and Dr. Keith of Aberdeen direct that it should be one inch only in advance. The latter attaches considerable importance to this point, and argues in its favour at some length in his work on the subject.[1] Mr. Crichton always made his incisions low : I infer from his notes, as near as possible to the last-named spot.

It is quite clear, also, that Cheselden, himself, commenced about one inch in advance of the anus.[2]

The directions given by other well-known operators are not expressed in precise terms, and on this account they are not quoted. Now, as it appears that nearly all advise an external incision of about the same length, that is, of three inches or thereabouts for an adult patient, it follows that the situation of the opening relatively to the pubic arch and to the bladder must differ, and somewhat materially. This discrepancy has sometimes been the source of perplexity to the student ; although it is true that where the incisions are commenced high up, the skin only is cut at first, and where they are low, the knife is made to penetrate into subjacent tissues at once, so that, in any case, the deepest part of the incision is made into the hollow between the accelerator and the erector penis muscles, just beneath and outside the bulb of the urethra. Nevertheless, it is the safer practice to err, if it be an error, by placing the incision too low rather than too high. The low incision avoids the bulb and the artery thereto; it enters the urethra in the membranous portion, or just at the apex of the prostate ; and it places the axis of the wound in its best relation to the pubic arch, that is, as far as possible from that unyielding boundary of the perineal space. It thus affords room for removing a large stone, and lessens the chance of bruising the neck of the bladder with its external cellular relations in the act of extraction, the danger of which will be pointed out in Chapters V. and VI. But it is not to be overlooked that the lower the incision is placed, the more danger there is of wounding the rectum : and especially so, if the operator overlooks the necessity for commencing a little further to his right from the raphé, when he enters the knife at

[1] *Hospital Statistics of Stone*, pp. 17-21. By Dr. Keith, Aberdeen, 1849.

[2] Cheselden's *Anatomy of the Human Body*, 5th ed. 1740 ; 6th ed. 1750 : 'I first make as long an incision as I can, *beginning near the place where the old operation ends.*'

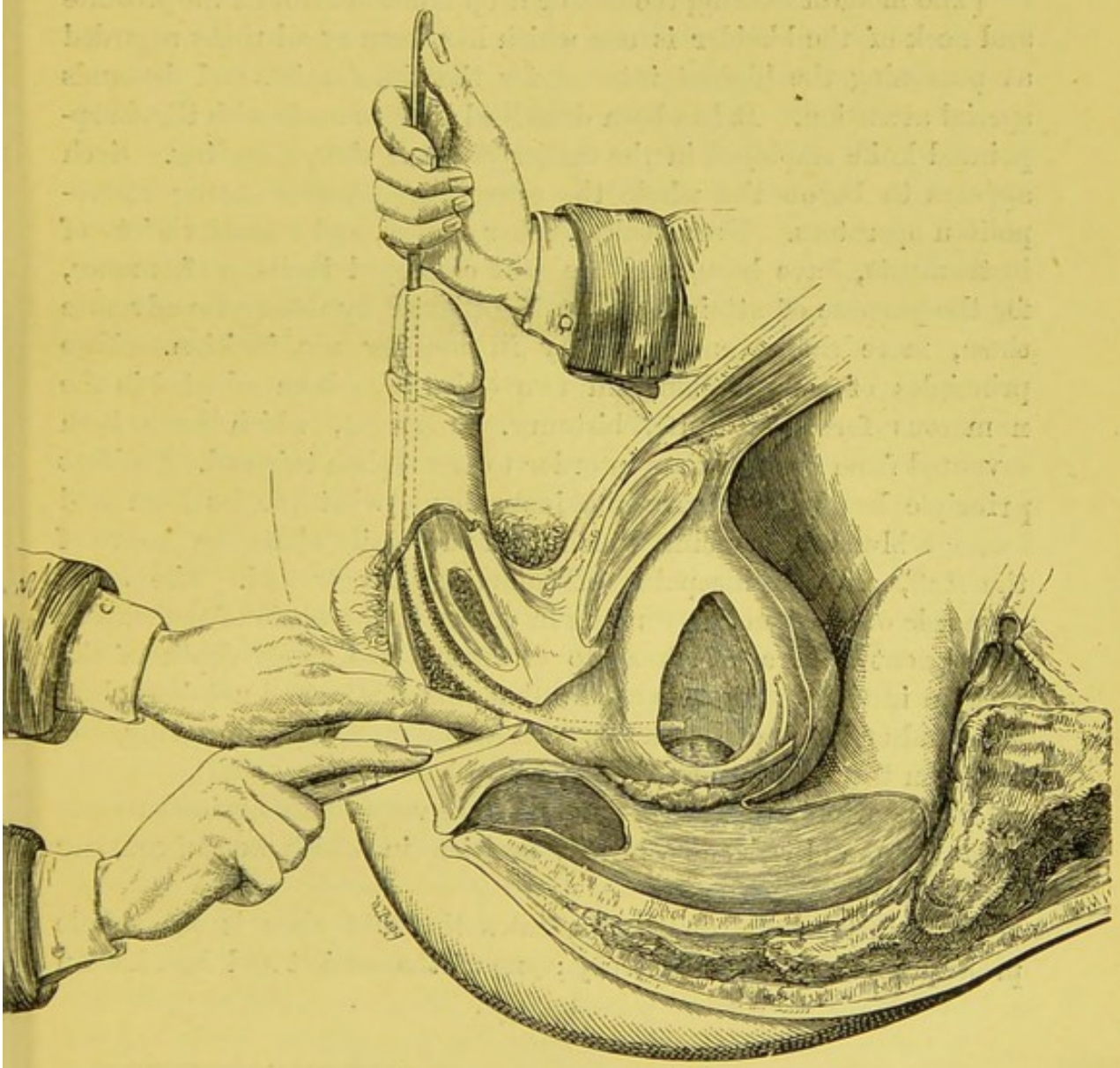
an inch or inch and quarter, instead of an inch and three-quarters, above the anus.]

The left forefinger now enters the wound and separates freely, especially at its deeper part, the fat and fascia in the direction of the staff, which should at this stage be just felt beneath, guarding, at the same time, the rectum by pressure downwards and inwards, while the knife follows, and by an additional small stroke or two enables the operator to define clearly the line of the staff, and press his finger-nail into the groove where it lies in the membranous portion of the urethra just in front of the apex of the prostate. Guided by the nail, he carries the point of the knife into the groove at this spot, and he holds the knife so that the blade is neither vertical nor horizontal, but inclining rather more to the latter direction, while the point is directed a little upward. This important stage of the operation is illustrated by the annexed woodcut (fig. 21), in which the parts are shown by an anatomical section. The knife is now pushed steadily along the groove of the staff into the bladder, the operator being careful to remember that the depth of the incision in the prostate very much depends on the angle which the blade makes with the staff in that act. The hand, therefore, must not be lowered too much; if a small incision is required, the knife is to be maintained very nearly in a line with the extremity of the staff, so as to make an acute angle with it; the point being kept up only enough to ensure its transit clearly and closely along the groove, which must not be quitted for an instant. When the bladder has been entered, the knife is withdrawn to make way for the finger; but if the operator is of opinion that more room is wanted, he can enlarge the incision to the extent deemed necessary while withdrawing the blade, by carrying it outwards and downwards, in the line of its entry, so that the edge sweeps lightly along the outer angle of the wound.

The operator now slips the point of his left forefinger into the groove of the staff, and along it, slowly and steadily through the wound in the prostate, slightly dilating it as it passes, until the last joint enters the vesical cavity (as it will in ordinary cases), and comes into contact with the stone, mostly felt lying

at the neck of the bladder. In this position he is enabled to ascertain its situation, and, at the same time, to make a kind of hold upon the bladder, and maintain his communication with it. He now orders the staff to be withdrawn, and taking a

FIG. 21.



Anatomy, in section, of parts interested in Lithotomy. Position of hands in last incision. [Mr. Bagg has represented this for me very carefully, from a dissection made expressly for the purpose.]

pair of long straight forceps, introduces it by sliding the blades slowly and gradually along the palmar aspect of his finger, until they are fairly within the bladder. It is manifest that additional dilatation of the wound in the prostate must be made in this act; and it is important that the forceps should not be

thrust in so as to form a rent in the soft tissues, but that the operator should coolly and slowly insinuate them in order to dilate gradually as much as may be necessary, and rupture as little as possible. Meantime a little of the urine will probably escape by the wound.

[The mode of making the last or deep incision through the prostate and neck of the bladder is one which has been at all times regarded as possessing the highest interest for the lithotomist, and demands special attention. It has been described here as made with the sharp-pointed knife employed in the earlier stage of the proceeding. Such appears to be on the whole the prevailing practice among metropolitan operators. Nevertheless, other means, and a great variety of instruments, have been, and are still employed in its performance, for the purpose of attaining, as it is believed by those who advocate them, more safety and certainty in making the incision. Two principles of construction, and two only, have been adopted in the numerous forms of knife, bistoury, or gorget, which have been invented from time to time in order to accomplish this end. The first principle has been to give the instrument, whatever its form and name, a blunt probe-point, which shall run easily along the groove of the staff, and be incapable of inflicting any wound. The other principle of construction consists in giving to the blade of the cutting instrument such a width as to determine the exact depth of the incision intended; so as to ensure that this depth shall not depend on the hand or judgment of the surgeon at the moment of operating, but solely on the pre-arranged depth of the blade itself.

These principles serve to classify all the very numerous instruments referred to, and reduce them to a position in which we can consider their merits.

The instrument which illustrates the first class is the simple probe-pointed knife, or bistoury; one of the earliest and best-known

FIG. 22.

Sir William Blizard's probe-pointed knife.

forms being that of Sir William Blizard, whose name it still bears (fig. 22). This, or some other form of it, of which several are exhibited in the adjacent figures, has been used by many of the best operators in order to make the deep or final incision, on the alleged ground of

its complete efficiency and superior safety to the sharp-pointed knife. But before exchanging his scalpel for this instrument the operator is very careful that the opening made into the urethra upon the groove of the staff is sufficiently large to admit the probe-point easily, and he secures the opening with his finger-nail during the change. Provided this is accomplished, there is no possible objection to the use of the probe-pointed knife, and if an operator has a conviction that it is safer in his own hands than the sharp-pointed scalpel, he should certainly employ it. With regard to any liability to injure the bladder in the use of the scalpel, *if it exists*, there can be no hesitation as to the propriety of adopting the guarded point. It is said that the opposite wall of a bladder has been perforated by the scalpel in Lateral Lithotomy, but in such a case its point must have left the groove in the staff, and have been freely exposed in the bladder, an act which, under no ordinary circumstances, can form part of the operation.

For the numerous varieties of instrument, designated by the term gorget, which illustrate the second principle of construction referred to, the probe-point also is always employed. Nevertheless, the opponents of the gorget condemn it mainly because it is alleged to slip out of the groove, although it possesses the same guide which is believed to preserve the knife in its place. This discrepancy requires to be explained, and it is not difficult to do so. The slipping of the gorget is not necessarily due to inherent vice in the instrument, but in part to the particular mode of applying it, which has usually, but not invariably, been pursued ; viz. to the depressing of the handle of the staff by the operator's left hand at the precise moment when with his right he thrusts on the gorget to the bladder. Thus the groove in which the beak is destined to run is suddenly raised, and loss of contact is liable to result, especially if the left side of the instrument like the first cutting gorget (of Hawkins) had a convex shoulder. Cline removed this disadvantage, making the left side straight, and placing the beak at the end of it. The practice of this double movement must, I think, be regarded as a principal cause of the slipping of the gorget. Had the staff been held steady throughout, as is the usual mode in modern Lithotomy (Mr. Key's operation excepted), the gorget could have traversed it as safely and as certainly as the probe-pointed knife. The double movement is doubtless to be done safely enough, but it might be hazardous in the hands of a tyro.

A second and an influential cause of slipping existed in those gorgets, the cutting edge of which forms an obtuse angle with the back of the blade ; so that the bladder was pushed before the instrument,

FIG. 30. FIG. 29. FIG. 28 FIG. 27. FIG. 26. FIG. 25. FIG. 24. FIG 23.

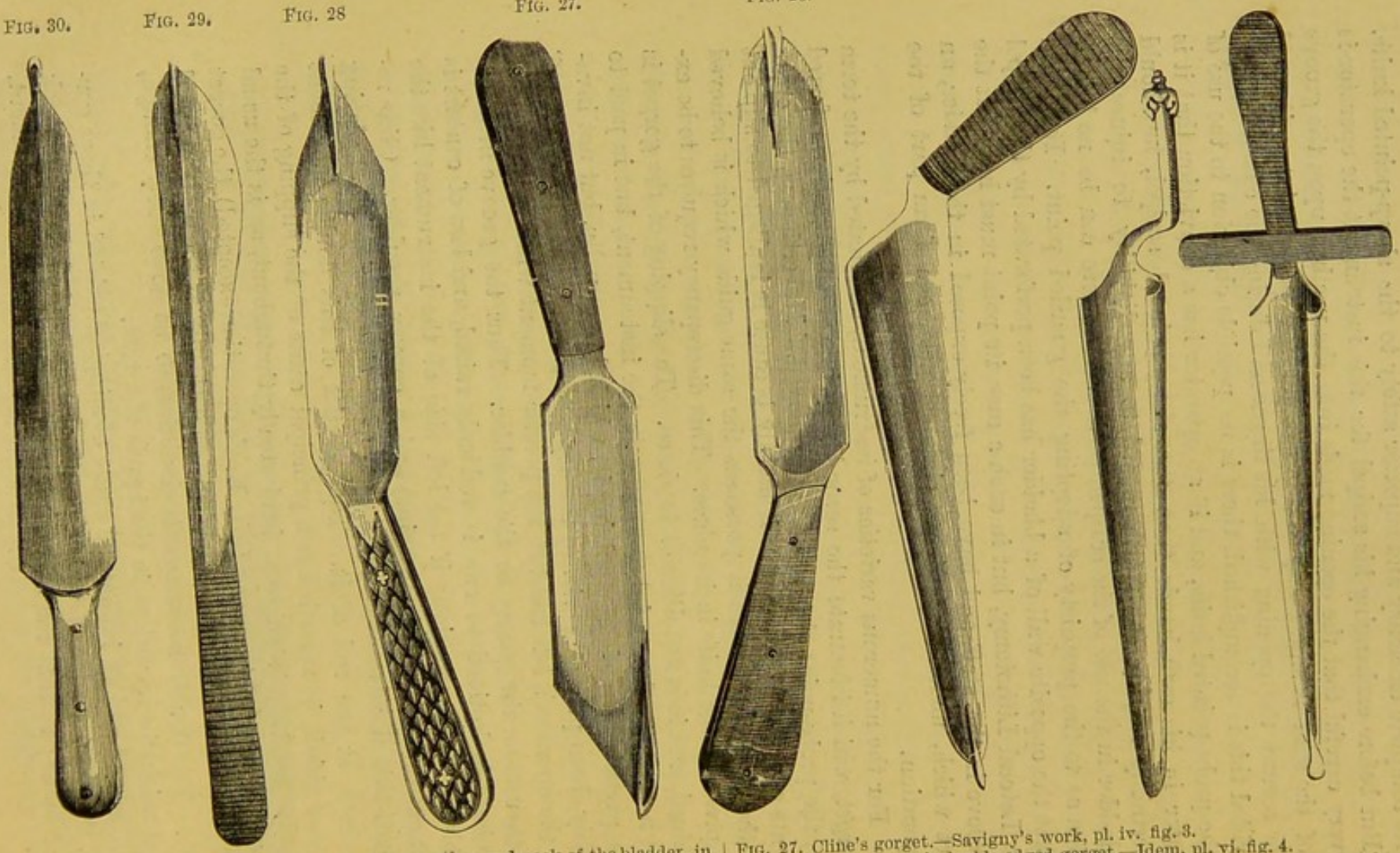


FIG. 23. Instruments used as dilators of the urethra and neck of the bladder, in the 'apparatus major,' or Marian Operation.—Heister, Institut. vol. ii. tab. 28.

FIG. 24.

FIG. 25. The dilator of Cheselden.—Heister, Institut. vol. ii. tab. 31, fig. 9.

FIG. 26. The cutting gorget of Hawkins.—Savigny's Collection of Engravings of Surgical Instruments. Lond. 1795, pl. iv. fig. 1.

FIG. 27. Cline's gorget.—Savigny's work, pl. iv. fig. 3.

FIG. 28. Sir A. Cooper's double-edged gorget.—Idem, pl. vi. fig. 4.

FIG. 29. Scarpa's gorget.—From one sent by Professor Scarpa to Mr. Crichton, of Dundee, now in my possession.

FIG. 30. Dr. Keith's gorget.—From one in my possession.

instead of being penetrated by it. This objection was also overcome by Cline, who gave it an acute angle. The various gorgets which have formed the leading varieties of this instrument from its first employment as one of the instruments in the 'apparatus major,' or Marian Operation, to the present day, are shown in the wood-cut on the preceding page.

The famous charge of John Bell, that 'the gorget slips! and all the surgeons of Europe confess it,'[1] has been repeated perhaps too readily, doing much to discredit an instrument with which we should not forget that some of the most successful practice in this country has been accomplished.[2] But why it should slip more than the probe-pointed knife, if similarly used, does not appear, and has never been explained satisfactorily.

The essential practical difference between the two instruments is this: that, with the narrow-bladed instrument, or probe-pointed bistoury, the depth of the internal incision depends on the angle it makes with the staff when pushed through the prostate and withdrawn; while with the gorget, the depth of the incision depends mainly on the breadth of the blade; that the wound shall not be too small is thus ensured, and it will not be too large unless the gorget is too wide or is not kept, as it enters the bladder, closely in a line with the staff.

Sir Benjamin Brodie used and recommended a probe-pointed knife, of which 'the blade is broad enough to divide a considerable portion of the prostate as it enters the bladder, without its being necessary to increase the size of the incision by cutting laterally afterwards.' This was really neither more nor less than a narrow cutting gorget (fig. 32).

John Hunter's lithotomy knife was wider still, and was, indeed, a cutting gorget in disguise (fig. 31). So was Langenbeck's (fig. 33), which had a spring catch, converting it, at the operator's will, into a probe-pointed knife. The knife which Mr. Smith, of Leeds, used, and with much success, is a wide-bladed, probe-pointed knife. He has four sizes, adapted to the requirements of different cases (fig. 34). Between all these broad knives, and a well-made cutting gorget of moderate width, there is really no essential difference.

Dr. Keith, of Aberdeen, uses a peculiar gorget; for ordinary cases, one which is seven-eighths of an inch wide; and for cases of enlarged prostate, one which is one inch and an eighth wide (fig. 30). The peculiarity of his instrument is this: that its edge, made at first

[1] *Principles of Surgery*, 1826, vol. iv. p. 227.

[2] Mr. Green cut forty cases with the cutting gorget (of Cline) without a single casualty. Cline himself was very successful. It was usually about three quarters of an inch wide, and one inch for cases of enlarged prostate.

sharp by the cutler, is afterwards just blunted by himself with a file. It thus divides the substance of the prostate through which it is pushed, but is quite incapable of incising in any way the coats of the bladder. But it is to be recollected that he makes the deep incision with the probe-pointed knife first, and then employs this to extend it and to conduct the forceps. The form of Dr. Keith's gorget is very nearly that of Cheselden's instrument as drawn in Heister's Surgery

FIG. 31.

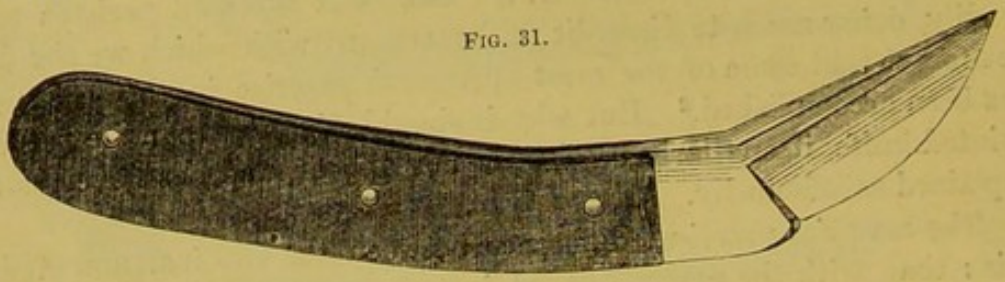


FIG. 32.

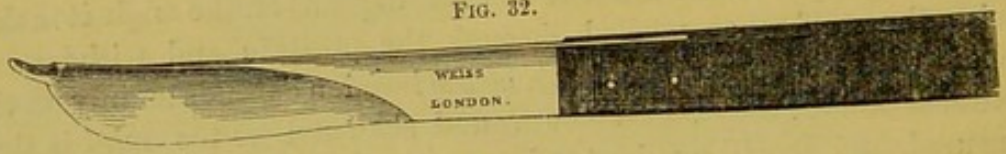


FIG. 33.

FIG. 34.

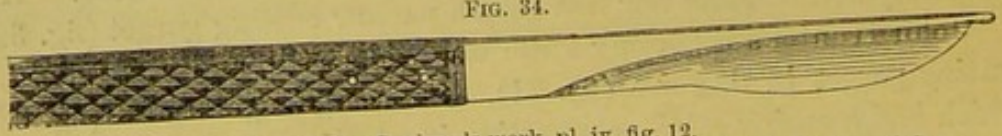


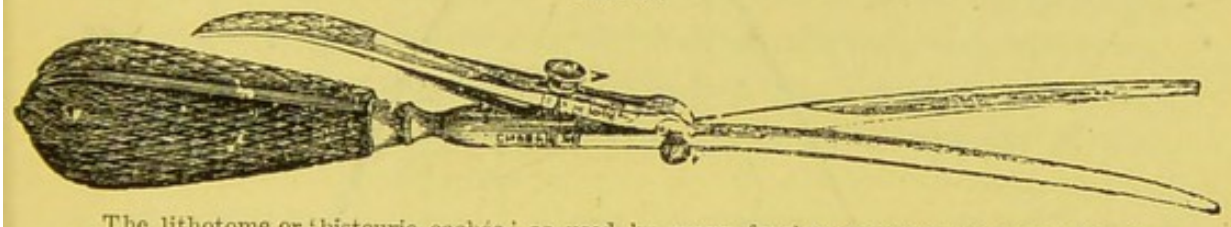
FIG. 31. John Hunter's knife.—Savigny's work, pl. iv. fig. 12.
FIG. 32. Sir B. Brodie's knife.—From one in the possession of Messrs. Weiss and Son.
FIG. 33. Langenbeck's knife.
FIG. 34. Mr. Smith's (of Leeds) knife.—From one sent by Mr. Smith to the author.

(see fig. 25); but it tapers a little less than that of Cheselden. Mr. Crichton also employed the cutting gorget in a very large proportion of his successful cases. He subsequently employed the probe-pointed knife, continuing to use the gorget still in cases of deep perineum and enlarged prostate. The two gorgets which he employed (which, as well as those of Dr. Keith, are in my possession) are made on the pattern of Cline. It is only fair to state that most of his worst cases were cut with it, the very cases in which his success was so remarkable; and that he confessedly substituted the knife on account of the outcry against the gorget, and not because he disliked the latter.

To this same principle of construction belong the 'bistouries

cachées,' or lithotomes of all kinds (fig. 35); *i.e.* the depth of the incision depends on the breadth of the instrument, and is therefore a result more of mechanical arrangement than of the intelligence and skill of the operator. As in the gorget, its incision is the fruit of well-considered pre-arrangement, not of the surgeon's judgment exercised at the moment. The bistourie cachée, and the cutting gorget, different as they are in appearance, and in the manner of their employment, are essentially the same in principle; the gorget cutting the desired depth inwards by pressure, the lithotome cutting it outwards by traction. Only the gorget, owing to its tapered form, cuts rather less deeply at the internal extremity of the incision than at the outer, while the lithotome cuts accurately to the same depth throughout, and consequently incises rather deeply the neck of the bladder, a fact of importance, and rendering the gorget, perhaps, the safer instrument of the two. Blunt gorgets, that is, gorgets which have no pretensions to cut, are rather directors than gorgets in the sense in which we have been considering them. They are intended

FIG. 35.



The lithotome or 'bistourie cachée,' as used by many foreign surgeons to make the deep incision. A, a screw which regulates the extent to which the blade protrudes from the sheath.

to dilate an *already-divided* prostate, and to furnish a safe guide to the forceps in certain cases. It was in this light that Cheselden viewed the instrument.

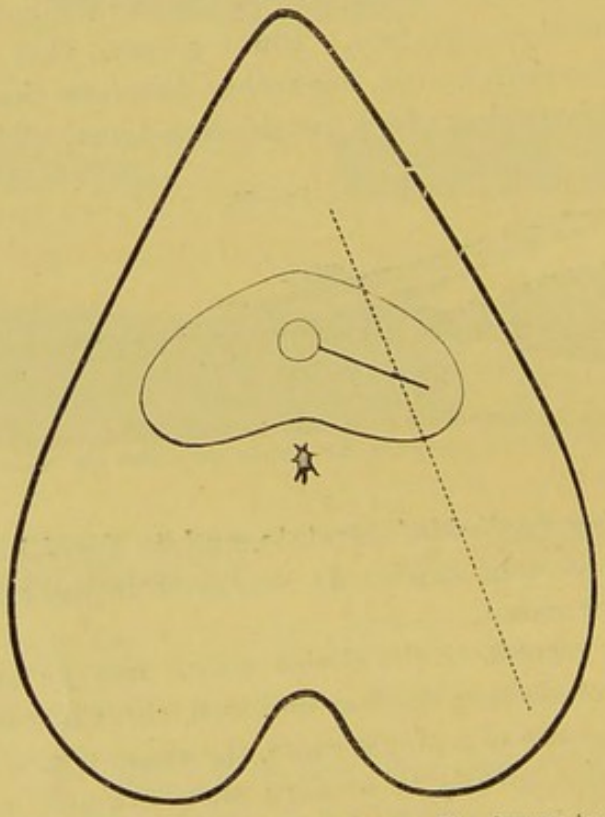
Now, with respect to the choice which may be exercised among these methods of making the last incisions, there is a certain ease and simplicity in the use of a single knife, the sharp-pointed scalpel, which has commended it greatly to modern surgeons, and, unless there are some exceptional circumstances present, it must be admitted to be both a safe and convenient instrument. It was always used by Liston, and has been employed at University College Hospital by Mr. Erichsen, myself, and our colleagues ever since. Sir William Fergusson also always employed it.

But, on the other hand, there are circumstances in which the probe-pointed knife may be superior. When the stone is large, and the deep incision must therefore correspond to it, the latter is a safer instrument, since its point leaves the staff in that act. When the perineum is deep, as in very stout subjects, and in those suffering

from enlarged prostate, so that the finger cannot follow the knife as far as to the neck of the bladder, I prefer the probe-pointed knife for the last incision, as well as the blunt gorget to dilate it, and conduct the forceps into the bladder. I have adopted this method with advantage in a few cases where the prostate has been unusually large.]

There is one more important point to be noticed in relation to the last incision. It is its want of exact parallelism with the external incision. The surgeon is often advised by authors to take care that the plane of the incision at the neck of the bladder should be identical with that of the external wound.

Fig. 36.



Superficial and deep incision in Lateral Lithotomy. The former is represented by a dotted line; the latter by a black line.

Practically, it never is, and rarely can be so; and it is unwise to conceal the fact. A glance at the diagram (fig. 36) will show the difference between the direction of the two incisions. Neither is there any evil in this want of parallelism in respect of the withdrawal of the stone; while the near approach to a horizontal line is the safest direction for the last incision. That incision, indeed, was nearly if not quite a horizontal one

with most of the best lithotomists of the last generation, whether using the knife or the gorget; sometimes, indeed, with the latter instrument, it inclined upwards. For it is necessary to recollect that if the incision in the prostate be made in the same direction as that of the skin, the limits of the gland would be more easily exceeded. The line of safety through the prostate and neck of the bladder, whether we regard the distance of its enveloping capsule from the staff, or the situation of the seminal ducts, is a slightly oblique line, directed rather nearer to the horizontal than to the perpendicular. And, inasmuch as all such incisions, whether internal or external, produce in the tissues openings more or less oval in form, there is far less want of correspondence between the axes of different portions of the entire wound than might be theoretically supposed. The finger passing through a wound so made, if it be cleanly and neatly incised, feels it to be direct and cylindrical throughout. It is quite an error to suppose that want of parallelism between an internal and external incision made in soft tissues, to which a considerable amount of dilatation is to be applied, affects the form or capacity of the route.

III. The forceps being now in the bladder; one blade below on the floor, the other above, the instrument is opened freely and fairly, a handle lightly held in either hand; and as the urine flows out, the stone may be found between them on closing; if not, they are to be kept closed and slightly moved right and left, to ascertain on which side the stone lies. Supposing it can be felt lying on the outer side of the blades, which still occupy the position first described, the upper blade is raised, by simply depressing the lower handle, and when pretty widely separated, they are slowly turned over to that side and closed, when the stone will almost certainly be felt within the grasp of the instrument. If so, and the withdrawal feels easy, it is made at once, first rotating a little the forceps on its own axis, to make sure that nothing else is included but the stone. If the angle of the handles indicates that the blades are wide apart, the point of the fore-finger should be slid along the instrument to ascertain the size and position of the stone, and to readjust the latter if possible. The long axis of the stone

should correspond with that of the forceps, and its narrowest diameter should be presented to the blades. If the operator fails to seize the stone, he must still proceed cautiously, and avoid all rapid, plunging, and uncertain movements of the instrument in the cavity of the bladder. And when the stone is fairly seized, the extraction must be slowly and cautiously accomplished; the greatest amount of dilatation of the neck of the bladder and prostate has generally now to be made, and it is more than ever necessary that it be done slowly and judiciously. The forceps must be held so firmly as to secure the stone, but not be grasped so as to crush it. They should be slowly moved from side to side while steady traction is made in the direction of the wound, and consequently in a line obliquely downwards towards the operator's right side. It is quite impossible to overestimate the importance of slow and cautious action in this stage of the proceeding.

The stone removed, a searcher should be passed into the bladder and a gentle exploration made, to ascertain whether others exist. The calculus itself may be examined for facets on its surface, which are almost always, but not invariably, indications that it was not the only calculus present. On the other hand, the absence of facets is by no means absolute proof that no other stones are in the bladder. If one or more are found, their extraction must be made by the methods already described, taking care not to injure the bladder by haste or violence, which is now the main evil to be feared.

If the stone is found to be unduly large, so that, although grasped in the most favourable position for extraction which its form admits, the divergence of the blades proves to be too great, or is obviously so, for extraction through the wound, one of two courses, at least, remains to be adopted: either to enlarge the wound, or, to crush the stone, *in situ*. These alternatives, however, are rarely presented. Stones weighing nine ounces, and entire, have been successfully removed by the single incision. Crushing *in situ*, with an empty bladder contracting on the calculus, is a dangerous expedient. Nevertheless, when the stone is too large to remove by any wound which it is prudent to make, this course has been of late years usually adopted. It has been successful with a stone weighing upwards

of 14 ounces. See discussion of the subject in Chapter VI., on the Difficulties and Dangers met with in Lithotomy.

IV. The Hæmorrhage, which should be watched throughout, is now to be especially regarded before anything else is done. If an arterial jet is seen within reach, a ligature is to be used, or it may be arrested by torsion; if arterial bleeding is taking place freely from a deep part of the wound, its source must be carefully sought, and ligatured if possible. It is very rare indeed that an arterial jet cannot be so commanded, if ordinary patience and skill are exercised. But if the ligature cannot be applied in the usual manner, it may, perhaps, be passed beneath by means of a curved needle, and the current stopped by a knot made upon the bleeding point. A safe and efficient mode, when the difficulty is great, is to use a tenaculum of the common form, but connected with its handle by means of a screw, so that the handle can be detached at pleasure: the hook of the instrument is passed under the mouth of the vessel, a noose of thread or silk is thrown round the soft parts beneath and tied; the handle is then unscrewed, and the hook left in its place. I believe I have saved a life on two or three occasions by tying in the tenaculum.[1]

Of similar service, doubtless, is a contrivance by Dr. Gross, which he calls 'the compressing forceps.' It consists of blades resembling those of a pair of slender dressing forceps, with a screw combining the handles: this or any of the numerous forms of bull-dog forceps acting on a similar principle, can be applied and left in place.[2]

In the very rare instances of failure by such means, while nevertheless the pressure of a finger on the bleeding point itself, or on the pudic artery, commands the hæmorrhage, a trustworthy assistant or two may be employed to keep up such compression for a few hours, at the end of which time, if it has been steadily and unremittingly applied, the object will have

[1] I am indebted to Dr. Keith, of Aberdeen, for the tenaculum with the screw (fig. 19, p. 20), which adds much to its convenience. In the cases referred to in the text, the handle was immovable, and was much in the way; in one instance the instrument remained ten days in the wound, coming away by itself at the end of that time.

[2] *Urinary Organs*, by Dr. Gross, 3rd ed. p. 260.

been secured. In the absence of such means, and where all other methods have failed, a ligature placed round the pudic artery as it lies under the ischio-pubic ramus has been found successful. But if the hæmorrhage is venous, the blood being dark in colour, flowing freely, but not in jets, it arises most probably from some of the veins about the apex of the prostate which have been divided. This is sometimes a difficult matter to control. Ordinary plugging of the wound with lint or sponge is very inefficient, and may rather mask the occurrence of bleeding than prevent it, by confining the blood to the cavity of the bladder. A more efficient method is the employment of an addition to the gum-elastic tube often introduced after the operation, to convey away the urine. This consists in fastening round the tube, about an inch from the end, a piece of strong but soft muslin, or fine linen, arranged, if I may use such a simile, like a petticoat, reaching to the opposite end. The material is to be plaited in a few folds there, to give room, after the instrument has been introduced into the bladder, for strips of lint to be tightly packed into the cavity around the tube between it and the enveloping material described (fig. 17, p. 19).

But this and all other modes of checking hæmorrhage, the arterial jet alone excepted, which should always if possible be ligatured, are superseded by the air tampon described on page 19, fig. 18. Even moderate arterial bleeding may be safely dealt with by this apparatus, relative to which however the law just laid down should as a rule be adhered to. With the tampon the operator may feel always safe: and indeed no one should ever perform lithotomy without one at his side. All provisions and directions relating to icebags, irrigation, etc., formerly described, are now unnecessary, since this is absolutely efficient if it be only properly applied.

Supposing there is merely a little general oozing from the wound, it is sufficient to inject a large syringeful or two of cold water through a long bulbous-ended tube (fig. 7, page 15) into the bladder, from which it returns in a current, and then to introduce a simple gum-elastic tube about six or seven inches long, to prevent the inner portion of the wound becoming stopped by clot or otherwise, and producing retention of urine. The tube is fastened by tapes to a bandage round the patient's

middle; but care must be taken that the end of the tube does not project far into the cavity of the bladder and become a source of irritation there. But it is by no means certain that a tube is necessary. Many operators have discarded it altogether, and are satisfied with the result. I have done so for some years, and the wounds appeared to close better and more quickly in consequence, some indeed almost by the first intention.

AFTER TREATMENT.—The patient is next to be put to bed. This should be a firm, well-made mattress, guarded by waterproof cloth. A dry and warm draw-sheet is to be placed beneath his buttocks, so that the wound and all that issues from it is clearly visible. On this account it is desirable that the window of the apartment should face the foot of the bed. Each lower limb is to be semiflexed at the knee, and to repose easily, inclining outwards on a pillow. The attendant will watch sedulously the flow of urine and the oozing of blood during the first twenty-four hours; if the tube appears to be blocked, a feather must be passed through its entire length to ensure freedom of passage. What he desires and expects to see is the outflow of clear unstained urine before the end of that period; which demonstrates the cessation of hæmorrhage and the proper action of the kidneys. Opium may be administered, and in a full dose, if there is much pain, spasm, or restlessness; but it is better to do without it, unless manifestly wanted. I cannot coincide with the conventional practice of giving thirty to forty minims of tinctura opii, or Battley's liquor, simply because a formidable operation has been submitted to, since in many constitutions it deranges the stomach and liver, constipates the bowels, and injures the capacity for taking or digesting nutriment. Cleanliness is of the greatest importance: the draw-sheets must be very frequently changed; the nates are to be kept clean by the occasional application of a soft moist sponge, and all sources of impurity are to be speedily removed. A clean napkin, folded several times, should be placed every hour beneath the end of the tube, and subsequently to its withdrawal, in the same situation, to absorb the urine. Mild, unstimulating diet, chiefly in the fluid form, such as milk and animal broths, should be freely afforded at first, until the stomach desires solid food, which may then at once be given. There should be

no unnecessary haste to give aperients; and three or four days may well elapse after the operation without any anxieties on that head. I have seen mischievous irritation of the pelvic viscera set up by a purgative dose, for which no real occasion existed. As the case progresses, care must be taken, especially with elderly patients, to avoid irritation of the skin of the back and buttocks, which, if neglected, might produce bed sores. The surface is to be defended from the contact of urine by the free use of common ointment, and hardened by the occasional use of astringent lotion, or by simple brandy-and-water. A proper position of the patient is by no means unimportant as favouring the desired result; the head, shoulders, and upper part of the trunk should be kept rather high, so that the wound is placed as much in a depending position as circumstances admit. The patient should lie alternately on his right and left side for a few hours at a time, so as to change the direction of the urine and other discharges.

After the first twenty-four hours, the edges of the wound being a little swollen, urine frequently passes two or three times by the urethra; after twenty-four or thirty-six hours more it passes entirely through the wound. Subsequently, it may be expected, in the cases of adults, to pass in part through the urethra, by about the eighth to the twelfth day; and to cease issuing through the wound in about three weeks after operation. There is much difference, however, in this matter; many weeks elapsing in some instances before the final healing of the perineal wound, which, indeed, in some few instances remains permanently fistulous; while in others healing really occurs by first intention. It would be unjust to the memory of Mr. Crichton to pass over the last-named circumstance without remark. It was a favourite subject with him; nevertheless, it appears to me difficult to regard it as one of great importance. He records thirty examples of it as occurring in his practice, a proportion which is extremely large. Of the cases presented to him, he selected the most healthy and vigorous for whom to attain this result; making his incisions free and clean, so as to offer surfaces adapted to unite readily. No tube was passed through the wound afterwards; a piece of wet lint was applied to it, and the legs fastened together. Occasionally retention of

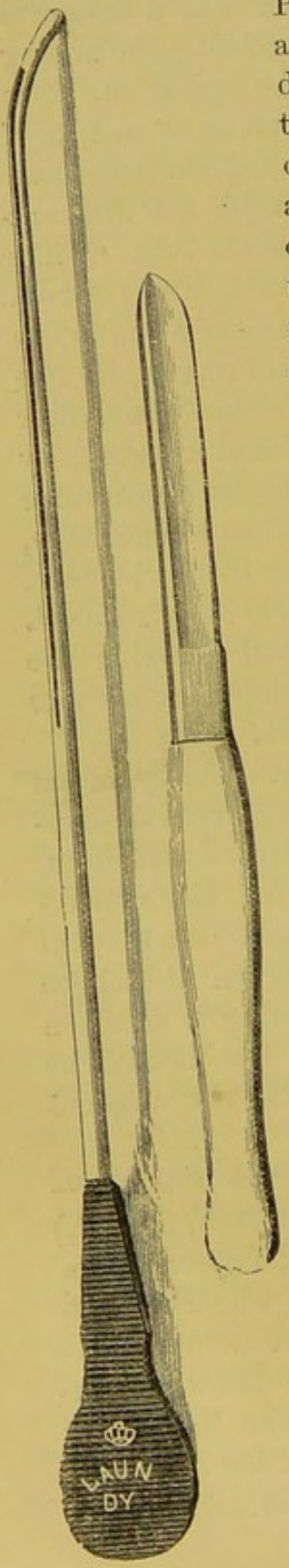
urine occurred, with a good deal of pain, in which case the patient was put into a hot hip bath, which was a favourite remedy with him in all cases of severe abdominal pain arising within twenty-four or thirty-six hours of the operation. But if the stone was large, and had been difficult to extract, or if the patient was feeble, he generally employed the tube, and made no attempt at early union. It is remarkable how different are the opinions of operators as to the value of the tube. While some believe it to be a *sine quâ non* to success, others attach no importance to it. That it can prevent access of urine to the newly-cut surfaces, as has been written concerning it, no one can seriously imagine after reflection, and certainly not after observation, since urine may be constantly found trickling by its side, as well as through it. It is undoubtedly a guarantee against retention, and may be made useful against hæmorrhage, but it is also sometimes a source of irritation to the bladder, and I have seen a patient greatly relieved by its early removal.

For the various accidents accompanying and following the operation, as well as the difficulties and dangers sometimes encountered in its performance, see Chapter VI.

KEY'S OPERATION ON THE STRAIGHT STAFF.—The operation performed on a straight staff by Mr. Aston Key merits description here, as a modification of the ordinary lateral operation, the consideration of which is now concluded. Mr. Key's operation finds favour with many of his former pupils; and is still preferred by them, as it was by that able surgeon himself to the end of his career. The mode of performing it is given here in his own words, which clearly delineate the method he adopted, and which is followed at the present day by the surgeons of Guy's Hospital.

'The mode of conducting the operation is as follows:—An assistant holding the director,' (or straight staff, fig. 37,) 'with the handle somewhat inclined towards the operator, the external incision of the usual extent is made with the knife (fig. 38), until the groove is opened, and the point of the knife rests fairly in the director, which can be readily ascertained by the sensation communicated; the point being kept steadily against the groove, the operator with his left hand takes the handle of the director, and lowers it till he brings

Fig. 37. Fig. 38.



the handle to the elevation described in Pl. III.,' (that is, until the sound makes an angle with the horizon of about thirty degrees,) 'keeping his right hand fixed; then, with an easy simultaneous movement of both hands, the groove of the director and the edge of the knife are to be turned obliquely towards the patient's left side; the knife having the proper bearing is now ready for the section of the prostate; at this time the operator should look to the exact line the director takes, in order to carry the knife safely and slowly along the groove; which may now be done without any risk of the point slipping out. The knife may then be either withdrawn along the director, or the parts further dilated according to the circumstances I have adverted to. Having delivered his knife to the assistant, the operator takes the staff in his right hand, and passing the fore-finger of his left along the director through the opening in the prostate, withdraws the director, and exchanging it for the forceps, passes the latter upon his finger into the cavity of the bladder.'

'In extracting the calculus, should the aperture in the prostate prove too small, and a great degree of violence be required to make it pass through the opening, it is advisable always to dilate with the knife, rather than expose the patient to the inevitable danger consequent upon laceration.'[1]

[1] *Treatise on the Section of the Prostate Gland in Lithotomy.* By C. Aston Key. Lond. 1824. Pp. 28–30.

Figs. 37, 38. Key's knife and staff, from his work, plate iv.

CHAPTER III.

THE OPERATIONS OF LITHOTOMY PERFORMED IN THE CENTRAL PORTION OF THE PERINEUM.

Numerous Attempts made to improve on Lateral Lithotomy.—The Bilateral Operation of Dupuytren.—The Medio-bilateral.—The Median.—Dr. Buchanan's Method.—The Recto-vesical Operation.—Modifications.—Cutting and Crushing combined.—Lithotomy as applied to Children.

THE preceding chapter has been devoted to the Lateral Operation, in order to describe it fully, because many of the minute details of management are common to it and to other forms of Lithotomy, and are therefore given once for all; and because it may fairly be regarded as the standard with which such other modes of operating, next to engage our attention, should be compared.

For the problem has been presented for years, and is still presented to us, although less urgently since the success of Lithotrity for the smaller stones has been completely established:—

Is the Lateral Operation the best mode, in all cases, of extracting, through the perineal region, a calculus from the bladder?

That its results have not satisfied the expectations, or, at all events, the wishes, of many surgeons, is evinced by the numerous efforts which have been made from time to time, by the most experienced operators, to discover a better method. Witness the Recto-vesical Operation of Hoffman, Sanson, and Vacca—the Bilateral of Dupuytren—the Medio-bilateral of Civiale; and the Median of the Italian surgeons, with that form of it adopted here of late years, to say nothing of the endless lesser modifications which have been many times proposed, forgotten, and reproduced.

One thing strikes a careful observer; it is that all the other operations which have at any time held a position, or are exciting attention, in the surgical world, are essentially operations performed in the centre of the perineum, and not on either side, or lateral division of it. All are central in the sense in which it is opposed to *Lateral.*

True, one is called Bilateral, but we shall soon find that it possesses characters which refer it distinctly to the central group.

During the last fifty years especially, there has been a growing conviction that incisions made in the side of the perineum are attended by serious dangers, which may be avoided by incisions limited to the centre.

First, it has been believed that severe hæmorrhage is less likely to follow incisions in the centre than in the lateral division of the perineum, because the great vessels lie in this latter portion, provided further that the median incisions do not much involve the bulb.

Secondly, it has been believed that the capsule of the prostate is less likely to be divided, and consequently that the cellular interspaces between the pelvic viscera are less likely to be opened by incisions in the centre than on one side only of the perineum.

Unquestionably, it must be agreed by all that the anatomical necessities of the region, if alone considered, demand that, in the preliminary incisions of all Perineal Lithotomy, central or lateral, the operator should avoid the upper and outer parts of the perineal space, and that he should confine the deep ones within the limits of the prostate gland. But there is another necessity, not an anatomical but a vital one, less obvious, possibly, to the casual observer, but not a whit less urgent, and with which the former must be reconciled, viz:—the important fact that the internal opening must be sufficiently free to admit the instrument and the stone to pass without the exercise of so much force as to hazard the destruction of the tissues at or about the neck of the bladder. It is the clashing of these two opposed considerations, the vital and the anatomical, which will, probably, always maintain a difference of opinion and of practice in Lithotomy. One school

will be most influenced by the dangers to which Anatomy demands attention. Another school will be most impressed with the injury which the tissues suffer when incisions have been unnecessarily limited. The difficulty is to reconcile them; to find precisely the safe medium of action. It must vary in different cases; and the knowledge and the judgment of the operator must decide the question in each.

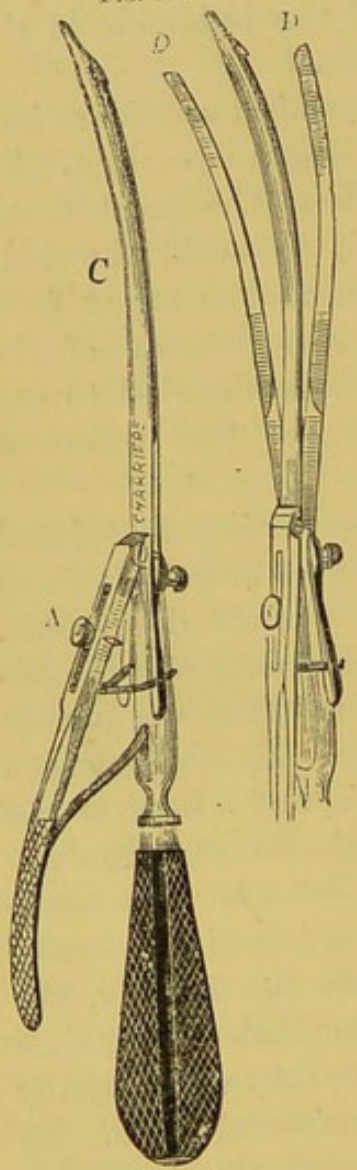
It was under the influence of anatomical considerations that Dupuytren was led to devise his Bilateral Operation. To avoid the arterial branches springing from the great trunk of the pudic on the lateral boundary; to avoid the bulb above and the rectum below; to avoid by two minor incisions springing from the central axis any division of the prostatic capsule by the single large incision directed to one side, he planned the following procedure, and first performed it in 1824.

DUPUYTREN'S BILATERAL OPERATION.—Having introduced a staff with a median groove, he made a crescentic incision above the anus with the horns of the crescent downwards. Each extremity reached midway between the anus and the adjacent tuber ischii, and the middle or highest point was distant from the anus about ten or twelve lines. By this incision were divided the skin, the superficial fascia, and a little of the external sphincter. In the next, the membranous urethra was opened transversely, and sufficiently to admit the operator to introduce the end of a two-bladed lithotome into the groove of the staff. This was pushed onwards into the bladder, the stone felt with it, and the staff removed; the blades being then opened to an extent previously provided for, they were steadily withdrawn in the middle line and in the horizontal plane. By this means an incision nearly transverse, but also somewhat obliquely downwards, was made of the neck of the bladder, and into each lateral lobe of the prostate. In a few years afterwards some slight modifications of this proceeding were made by various operators, but they possess only historical interest, and have no practical value. Fig. 39 shows the two-bladed lithotome which he employed; and fig. 40 a diagram of the incision superficial and deep.

THE MEDIO-BILATERAL.—We next come to a method which

Civiale describes in his 'Parallèle,'[1] published in 1836. 'Being dissatisfied,' he says, 'with the results of the bilateral operation, and shunning the lateral method on account of the anatomical objections referred to,' he first practised a medio-bilateral

FIG. 39.



The double-bladed lithotome, for the bilateral and medio-bilateral operations. A, the screw which regulates the extent to which the blades open. C, the sheath with the blades enclosed. D D, the blades opened.

FIG. 40.

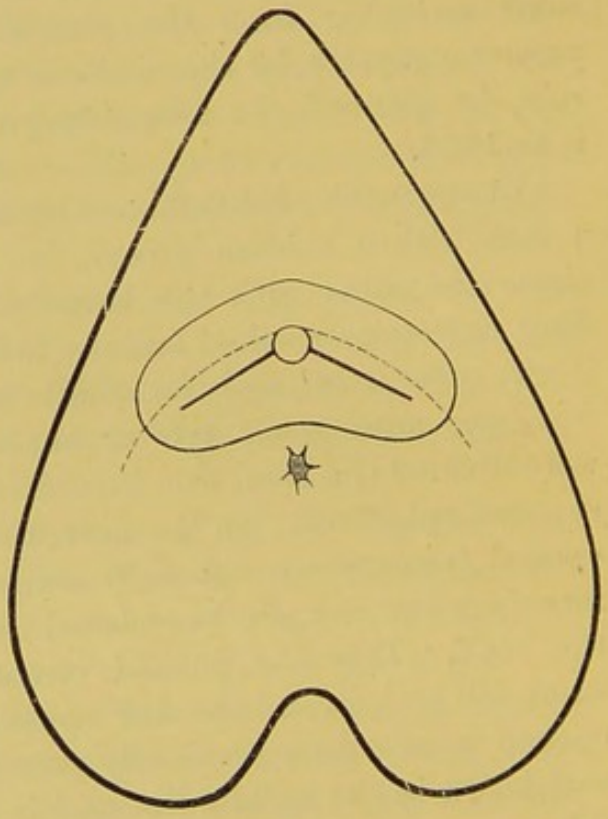


Diagram of superficial and deep incisions in Bilateral Lithotomy. The former is represented by a dotted line, the latter by a black line.

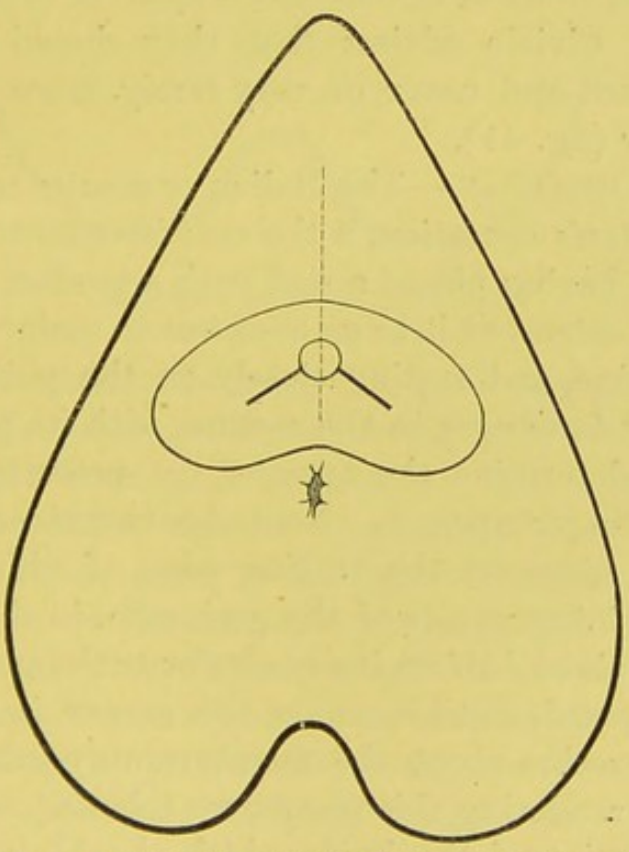
method in 1829, and has performed it ever since. It is remarkable that this operation, although now upwards of thirty years old (1863), appears to be little known in this country.

[1] *Parallèle des Divers Moyens*, &c. Paris, 1836. Pp. 192 and 217.

I believe it has never been even described here, which is still more remarkable, considering its near relationship to the median operation, and the fact that this has been so much discussed here of late years. I have myself witnessed the successful performance of it in its author's hands, and have been, I believe, the first to perform it in this country, in a case which occurred during the autumn of 1861, and have repeated it several times subsequently; but not during the last ten years.

Civiale's method of doing it was as follows:—Having introduced a staff with a median groove, which is firmly held resting against the pubes by an assistant, he made an incision about an inch and a half long in the raphé of the perineum, immediately in front of the anus, and carefully cut down in the direction of the staff, endeavouring to avoid the bulb, until he reached the membranous portion of the urethra. He then

FIG. 41.



Incisions superficial and deep in the Medio-bilateral Operation.

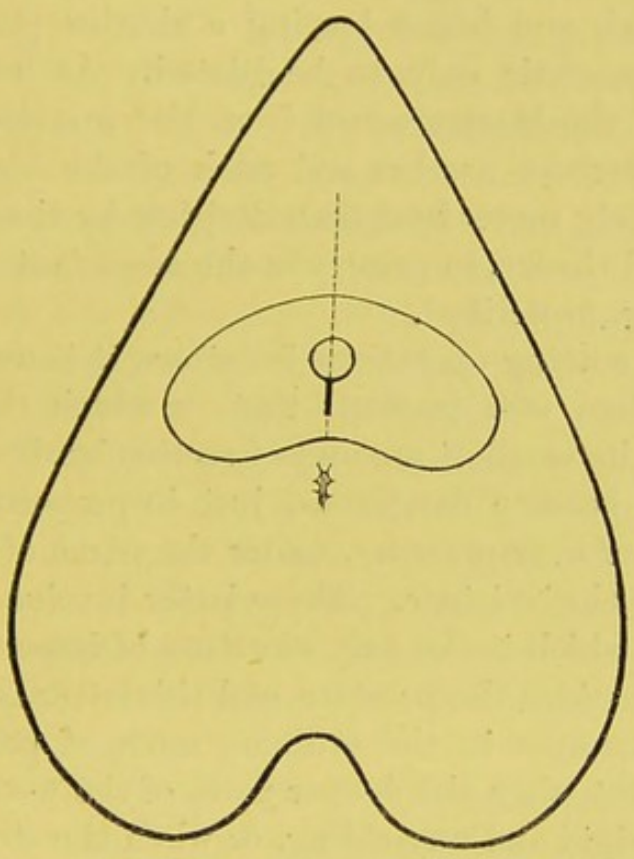
carried his knife into the staff in that situation, by an incision sufficiently large to enable him to insert with ease the end of a

double-bladed lithotome, resembling that of Dupuytren, but straight instead of curved, into the groove of the staff. He then pushed the beak of the lithotome steadily onwards into the bladder, and having done so, drew it outwards in the groove, towards himself, dividing the neck and the prostate horizontally, as well as the deep fascia in its course. The external wound is oval in form, a vertical incision in the perineum always becoming so; hence the skin is not cut transversely by the lithotome in the act of withdrawal. The finger is now introduced, and the forceps upon or guided by it, in the usual way; the external and internal openings are felt to correspond, and to form an easy and direct route for the removal of the stone. I have seen Civiale remove a stone weighing one and a half ounce by this method, the patient, a man forty-five years of age, making a good recovery. The breadth of the internal or horizontal incision is less than in Dupuytren's operation, in which the two blades of his lithotome were extended so as to be one and a quarter to one and a half inch apart. Civiale advises that they should ordinarily be one inch apart, and never or very rarely more than an inch and a quarter (fig. 41).

Median Operation.—The Italian or median method, known here as Allarton's operation, is the next in order to be described. The operator having placed a staff with a median groove in the bladder, and entrusted it to an assistant to maintain strictly in the middle line, and resting closely on the pubic symphysis, places his left forefinger in the rectum, with its palmar surface upwards, to determine the apex of the prostate, placing the point of his finger upon it. Next, he transfixes with a long and straight bistoury, the cutting edge of which is directed upwards, the integuments of the perineum, in the median line, commencing about half an inch anterior to the anus, and carries it steadily onwards until it enters the groove in the staff, and pierces the urethra about the membranous portion, the finger in the bowel rendering this manœuvre tolerably easy. Having pushed the point of the knife, which should cut for a small space at the back, onwards towards the bladder for the extent of a few lines, so as just to incise the apex of the prostate, he cuts upwards, dividing the urethra a little, and making an

external incision from an inch and a quarter to an inch and a half long, according to the presumed necessities of the case. He then introduces a long ball-pointed probe through the

Fig. 42.



Incisions in the Median Operation.

wound into the bladder to serve as a guide for the left index finger, which immediately follows directly into the bladder, and the staff is at the same time withdrawn. The stone may now be felt, and the wound dilated by means of the finger. Mr. Allarton has recommended, if the finger be insufficient for the purpose, the use of Dr. Arnott's hydraulic dilator; and Mr. Teale, of Leeds, has designed and employed a branched metallic dilator. I cannot, however, concur in advising the employment of mechanical force in dilating the structures forming the neck of the bladder, believing it far safer to make an additional section when necessary. Respecting the modes of making the incisions, I prefer dissecting from the skin inwards to the staff as in other operations, to the method by transfixion above described, and have done so in most of my operations by the

median method: maintaining the left forefinger in the rectum during the final strokes of the knife to feel its position, and ensure the safety of the bowel.

The incisions here described differ little from those of the Marian, except in being carried further back than in the ancient method, and hence leaving a shorter portion of the urethra, the prostatic only, to be dilated. As before noticed, the danger of the Marian arose from the practice of forcibly rending asunder the urethra and neck of the bladder, a proceeding infinitely more fatal than division by the knife, which the anatomical theory, so greatly in the ascendant at that time, had, unhappily, proscribed.

Of all the cutting operations for stone, it is unquestionable that the median still presents that in which the bladder is reached with the smallest amount of section by the knife. And it appears to become dangerous, just in proportion as injury by laceration or over-pressure, under the name of dilatation, is superadded to the incisions. These latter involve the bulb to a small degree, which is the only structure of importance divided by the knife besides the prostate, and this latter is only slightly notched at the apex in the ordinary mode of performing the operation. But when the deeper parts of the wound feel more than usually rigid and unyielding, or when the stone proves to be larger than was anticipated, it is advisable to make an incision in the left side in the same direction as in Lateral Lithotomy, but generally less extended, for the purpose of affording more space. This is accomplished after the urethra has been opened, by introducing a long, straight, probe-pointed bistoury, guided by the left index finger, and made to incise as much as the operator deems necessary. Unless this or some similar proceeding be adopted, the opening is certainly small, and feels tight to the finger, and, if the stone is large, appears to me to require an additional incision.

After all, the anatomical axiom laid down at first must not be forgotten, viz. that any operation, the incisions of which lie altogether in the line above the anus and below the symphysis pubis, unless aided by a lateral section, never can afford an opening sufficiently capacious for the removal of large stones without dangerous laceration. Examine the pelvic outlet, and

contrast the want of space in this situation caused by the converging pubic rami, with the room which exists in one of its lateral divisions, and the correctness of this assertion will, I think, be manifest.

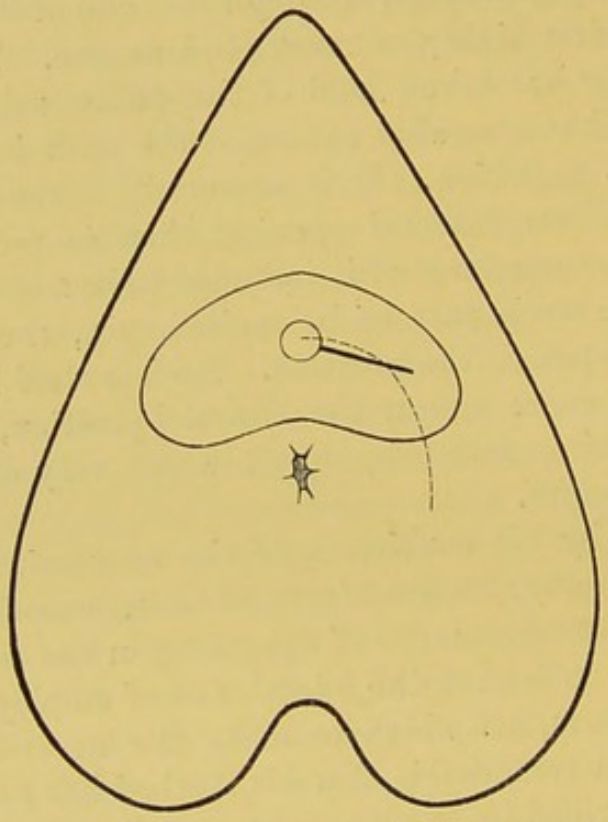
BUCHANAN'S OPERATION.—The Operation of Dr. Buchanan with the Angular Staff. This proceeding, generally known as the operation with the angular staff, is, however, not rendered distinctive solely by the use of that instrument. The angular staff does not constitute the main element which characterises it from other proceedings, although it is one of its features, and perhaps, at first sight, its most obvious one. Thus it is that this character has taken hold of the public mind, and, by its prominence, has somewhat concealed the more important attributes of the operation. It is essentially a central operation, but with a freer internal opening than is provided in the median. The angular staff is intended to be a safe and efficient guide to the deep part to be incised, viz., the membranous urethra and apex of the prostate. Such a staff has been used a century or more ago in the lateral operation, a fact which detracts nothing from any merit which may attach to the present procedure.

Actuated by his conviction of the anatomical dangers of Lateral Lithotomy, Dr. Buchanan, of Glasgow, called attention, in 1847, to the advantages of operating in the central part of the perineum instead of the lateral, and of employing a staff of rectangular form, on which to make the necessary incisions. It is somewhat remarkable that his method has never been yet correctly described in our language, and I am indebted to Dr. Buchanan for a description in French, which he informs me is the most accurate now existing. I must confess that until I became acquainted with the latter I had not a correct idea of the proceeding. It may be briefly described as follows :—

Instead of possessing any curve, the terminal portion of the staff, three inches in length, is directed at a right angle to the shaft, and contains a deep lateral groove. This is introduced into the urethra, and by means of the left forefinger in the rectum the angle is made to correspond in situation with the apex of the prostate, so that the gland can be felt just beyond, between the finger and the staff; the latter being well de-

pressed, the angle is brought near to the surface and is readily felt in the perineum. The staff is then carefully maintained in this position by an assistant. The operator keeping his finger still in the rectum, enters a long straight bistoury opposite the angle of the staff, and therefore immediately in front of the anus: he holds it in his right hand, with the palm upwards; the blade horizontal and the edge directed to the left; and he pushes it straight into and along the groove as

FIG. 43.



Incisions superficial and deep in Dr. Buchanan's Operation.

far as to the stop at its extremity. He thus enters the bladder at once, taking care to keep the blade parallel with the horizontal or grooved portion of the staff throughout the whole of the thrust. Next he withdraws the bistoury slowly, but, as he does so, cuts outwards and downwards a distance rather more than equal to another breadth of his blade, and then directly downwards to the same extent, describing, in this manner, a curved line equal to about one-fourth of a circle round the upper and left side of the rectum (patient's left), in which his finger still remains. An external wound, surrounding the

corresponding part of the anus, about one inch and a quarter in length, results from the operation. The knife is a long straight bistoury, about a quarter of an inch wide, with three inches of cutting edge, and the point sharp at the back as well as at the front, so as to penetrate with facility.

This is essentially a median operation, all large arterial branches in the lateral part being avoided, while the bulb is not cut, but the left half of the prostate is incised to a small extent.

Thus far it is, as expressed by Dr. Buchanan himself, about equal to the half of Dupuytren's Operation. If the stone is large, an incision is made on the right side of the prostate, which has the effect of converting the proceeding very nearly into the operation referred to. But it is also capable of being extended in another way, since if the incision by the side of the rectum and through the prostate be continued much beyond the extent described by its author, in the original direction, it becomes a lateral operation placed very low in the pelvic outlet.[1]

[1] Dr. Corbet, of Glasgow, has added an external grooved director connected with the handle of this staff; after the introduction of the latter into the bladder, the point of the director has only to be pressed through the tissues into the angle of the staff, which it infallibly meets, and a route for the knife is made from the skin of the perineum to the bladder. (*Medical Times*, Dec. 16, 1858.) Sir James Earle adopted the same system for Lateral Lithotomy. See a descriptive plate in his *Practical Observations*, 2nd edition, London, 1803. Mr. Avery contrived a very ingenious apparatus by which a director was *forced outwards* by mechanism from the angle of the staff after the latter had been securely placed in the bladder; when the point of the issuing director had made its appearance through the skin, the operator commenced to travel along its route into the bladder. It may not be inappropriate to mention that Mr. John Wood, of King's College Hospital, has designed and employed a staff, the lower part of which consists of two blades, which, at the will of the operator, may be made to expand a little in order to stretch the urethra and afford a wider groove for the knife.

I hope I am not presumptuous in venturing to regard—I believe in common with many practised lithotomists—all these contrivances as entitled to rank rather among the curiosities of surgical appliance than as valuable aids to the operator. Elaborate mechanism cannot countervail the want of surgical tact. Where the latter exists, such aid is worse than useless. 'Tactus eruditum,' the priceless and incommunicable heritage of experience, can only be acquired by the use of simple instruments; by discarding complicated apparatus for all those purposes which can be attained by that most wonderful and intelligent instrument, the human hand.

The Recto-Vesical Operation.—The patient is placed in the usual position, and a large staff with a median groove held firmly in the middle line. Taking a strong, straight, sharp-pointed bistoury in his right hand, the operator introduces it flat on the palmar surface of his left forefinger into the rectum, and feels with its tip the line of the staff. When about an inch and a half or an inch and three-quarters of the blade is concealed within the bowel, with the right hand he raises its edge, and carries the knife upwards to the groove in the staff, propelling the blade at the same time with the left forefinger. He thus divides, at this first incision, the upper wall of the rectum, the sphincter ani, and the integuments and subjacent tissues for about an inch in the middle line of the perineum. He should reach the groove of the staff in this first incision, and having done so, he next directs the nail of the left fore-finger, so as to enter the groove near to the membranous urethra, and guide the point of the bistoury into it there, the edge being now downwards. Having securely placed it in the groove, he pushes the blade from him along the staff, directed by the left forefinger, dividing the prostate and neck of the bladder so as to reach the trigone. The exact extent of this incision must depend on the size of the stone, and, as it may be presumed that this method should be employed only when the stone is unusually large, the incisions must of course be free. In no case, however, is it permissible to place in danger the peritoneal pouch, which limits the posterior border of the trigone. The finger can now easily examine the stone and guide the forceps in the extraction. The wound is favourably placed as an outlet for all discharges, and no hæmorrhage need be feared.

There are some variations in the manner of performing this operation, but the foregoing is the mode which has generally been regarded as the most successful, and the most likely to be free from disagreeable after consequences.

Such are the methods of performing Perineal Lithotomy, which, after a careful consideration of the numerous proposals and modifications which have been made and practised, I have concluded to be the typical forms which are or have been employed in modern times. Numerous others might have been

mentioned with which the names of several surgeons are connected, and who possibly may regard my selection as incomplete. Thus it may be considered by some that I should have included among them the Prerectal method, formerly introduced in Paris; but it is difficult to admit that it possesses claims to be regarded as a new type, or, indeed, that it manifests much improvement on any old one. This, however, is a matter of opinion. The operation so named is a modification of the Bilateral, in which the curved incision and subsequent dissection are carried so close to the anus and rectum, that the first stage consists in a delicate dissection downwards of the upper surface of the rectum; a method adopted with the design of leaving the bulb untouched. The urethra is opened at the apex of the prostate, which is then incised with the two-bladed lithotome in the ordinary manner.[1]

Attempts have also been made by several surgeons, both English and French, to combine cutting and crushing, so as to empty the bladder at one operation. The object has been, first, to open the urethra in the perineum, anterior to the prostate; a proceeding which we know involves very little, if any, risk; and then to introduce a crushing instrument, break up thoroughly the stone, and remove the débris at once. Theoretically this method has a better aspect than in practice. The difficulty in executing it is due in a great measure to the escape of urine by the side of the crushing instrument, so that before the work of breaking the calculus is completed the bladder is empty; when the situation is no longer merely one of difficulty to the operator, but of danger to the patient. Much the same thing may happen in Lithotomy when the stone is crushed by inadvertence in the blades of the forceps; a good deal of instrumental manipulation is requisite in order to ensure the removal of every fragment, while the bladder is in some risk of being injured, or of becoming inflamed. As in the case of applying screw forceps to a stone too large to extract after the incisions have been made in the lateral operation, the risk of danger consists in the liability of the empty bladder to

[1] The Prerectal method is described by its author, Nélaton, in his *Élémens de Pathologie Chirurgicale*, tome v., p. 229. Paris, 1859.

sustain severe injury.[1] Recent improvements which have rendered the aspirator now employed in Lithotrity more efficient than formerly, tend greatly to diminish the necessity, if any existed, for removal of the débris of any ordinary stone by a perineal wound.

Lithotomy as applied to Children.—In considering the various methods hitherto described, the common practice has been followed of assuming an adult to be the subject of the operation in each instance. And there is little occasion to modify them for the cases of children, the same procedures being applicable, for the most part, at all ages. Nevertheless, there are certain points of importance to be attended to in the application of Lithotomy to children, which will be briefly mentioned here.

First, as to the kind of operation most generally applicable to the cases of infants and boys; the lateral is generally, and no doubt correctly, held to maintain its superiority, as a rule, over other methods. The median and the medio-bilateral are both admissible. But especially where the stone is large, the lateral operation affords the opportunity of making a freer opening, and in a direction in which the incision is less liable than that of the median to injure the seminal ducts. At the same time, a lateral section carried beyond the limits of the prostate, which is an extremely small organ at this period of life, is almost free from danger, since it is beyond all question necessarily practised in almost all infantile cases, while the death-rate among them is not more than half what it is in adult age, at which time such sections, it is commonly believed, are extremely dangerous.

In the performance of Lateral Lithotomy in children, the employment of one knife only is especially indicated. An exchange of the scalpel for the beaked knife exposes to some risk from the possibility of finding difficulty in the attempt to place the beak of a second knife in the opening made by the first, and thus of missing the groove of the staff altogether. The deep incision in the urethra and prostate should be made

[1] See also the subject considered in Chapter VI., under the head of Difficulties arising from the Extreme Size of the Calculus, with drawings of instruments for crushing it in the bladder, in Lithotomy.

with clearness and decision, and with sufficient freedom to admit the tip of the operator's index finger with tolerable ease, otherwise he may drive the neck of the bladder along the staff, or slide the finger into the cellular interval between the bladder and the rectum. The staff should be strongly curved, and the finger and the forceps should be kept well up behind the symphysis in their transit, in consequence of the high situation of the bladder, which, in very young children, lies, when distended, as much in the abdomen as in the pelvis.

Hæmorrhage should be carefully guarded against, as its results in the shape of exhaustion are particularly dangerous in young subjects. The special sources of difficulty and danger in this operation will be considered in the sixth chapter, on the Difficulties and Dangers met with in Lithotomy.

If the median operation is performed, it is desirable to use a guide into the bladder in the shape of a blunt gorget or some similar instrument, as the operator may find it extremely difficult to introduce the finger into the small urethra of a child, when opened anterior to the prostatic or membranous portions. For this purpose I used with advantage, three or four years ago, an instrument of that kind, tapering in its contour, and having a probe point in its central axis. Mr. Bowman, and Mr. Teale also, about the same time, employed somewhat similar means for meeting the difficulty referred to, which each had encountered. Figs. 23 and 30 present forms of gorget well adapted for the purpose, when made of the small size suitable for children (see page 31). By the use of any of these instruments the incised opening into the urethra is partly dilated and partly torn, a proceeding which appears to be attended by no evil results in children, whatever may be its effects in the adult patient. In the medio-bilateral operation, which I have employed in the young subject, no such guide, of course, is necessary. The two-bladed lithotome glides easily along the staff into the bladder, and forms sufficient room for the finger in its withdrawal by laterally incising the soft parts.

CHAPTER IV.

THE SUPRAPUBIC OR HIGH OPERATION.

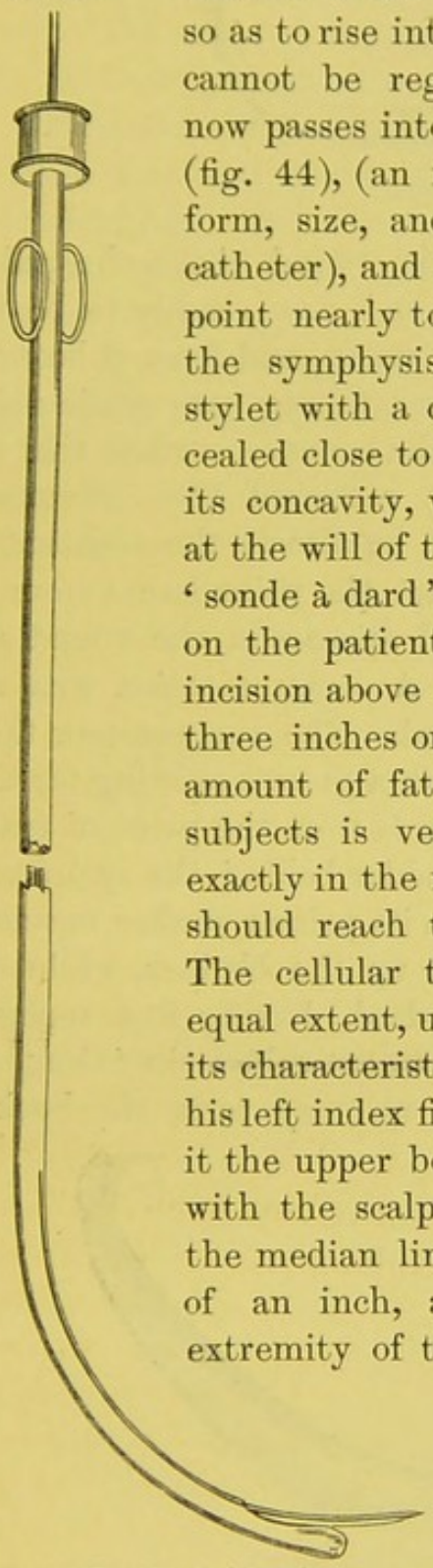
Origin of the Operation.—Method of Performing in Detail.

We now arrive at a consideration of the operations performed above the pubes, of which one is the type, known as The High or Suprapubic Operation. This appears to have been designed by Pierre Franco, and was certainly first performed by him in the year 1561. It was introduced into this country by Proby, at the close of the sixteenth century, and was frequently practised afterwards in the early part of the seventeenth century by Douglas, Cheselden, and others. Subsequently, it was studied with care and frequently performed by the Souberbielles in France while Mr. Carpue, who had witnessed their practice, advocated it in this country. There are two or three modes of performing the operation, but that which appears to me the most complete, and which Civiale informs me he has practised several times, is as follows:—

The patient is placed on a firm operating table of the usual height. He lies on his back, with the pelvis elevated at least four or five inches above the level of the loins and shoulders, so that the abdominal viscera shall not press on the bladder, but rather fall away backwards from it. The bladder, which should be capable of retaining a tolerably large quantity of fluid, is now to be injected to a full extent, so as to bring its apex to the upper border of the symphysis pubis, or above it. In this manner a sufficient space is obtained between the symphysis and the peritoneal investment of the anterior wall of the abdomen, where it quits it to cover the bladder. The limits of this interval admit of great extension, being filled mainly with cellular and fatty tissues of a very loose and exten-

sible character, and this fact it is which furnishes the ground for operating in this situation. It follows, therefore, that if the bladder is not capable of considerable distension so as to rise into the interval in question, the case cannot be regarded as suitable. The surgeon now passes into the bladder the 'Sonde à dard' (fig. 44), (an instrument having very much the form, size, and appearance of a large prostatic catheter), and by depressing its handle raises the point nearly to the level of the upper border of the symphysis. It contains within it a strong stylet with a cutting point, which latter is concealed close to the apex of the sound, and lies in its concavity, whence it can be made to emerge at the will of the operator. Having confided the 'sonde à dard' to an assistant, he places himself on the patient's right side, and commences the incision above the pubes, which should be about three inches or more in length, according to the amount of fat at this spot, and which in some subjects is very abundant. It is to be made exactly in the median line, and at its lowest point should reach the top of the pubic symphysis. The cellular tissue and fat are divided to an equal extent, until the linea alba is recognised by its characteristic glistening appearance. Placing his left index finger on this, and verifying through it the upper border of the symphysis, he divides with the scalpel the linea alba at this point, in the median line, from a quarter to three-eighths of an inch, and then introduces the bulbous extremity of the aponeurotome (fig. 45), which by its form enables the tendinous structures to be incised without any risk to the parts beneath. The division is accomplished by directing the aponeurotome upwards to the extent of one and three-quarters to two inches. The operator now takes the 'sonde à dard' from the hands of

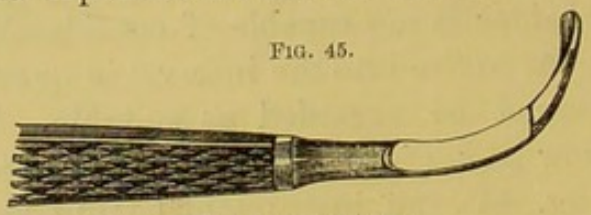
Fig. 44.



The 'Sonde à dard.'

the assistant, who has hitherto held it in its place; and with the right hand depresses its handle between the thighs of the

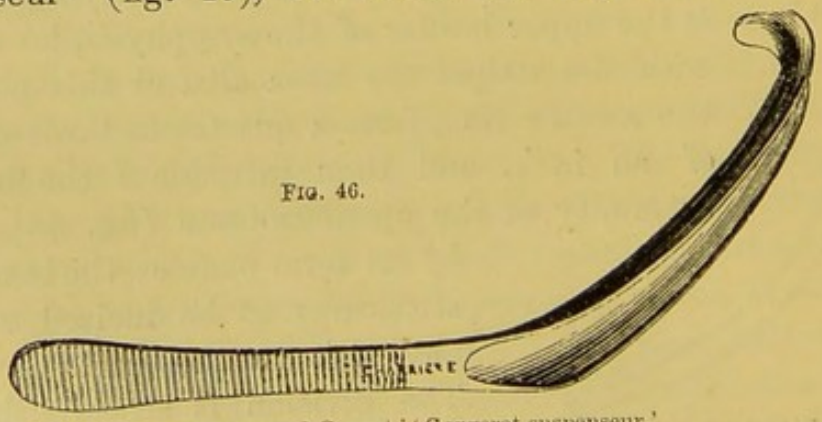
FIG. 45.



The Aponeurotome.

patient, directing the point to the wound above the pubes. With his left hand he seeks the end, now readily to be felt through the tissues still remaining uncut, and fixes it between the thumb, index and middle finger, taking care while doing so to remember that it is from the concave surface that the point will be protruded. Having rendered the instrument quite firm between his two hands, he directs the assistant to press the handle of the stylet so that the point issues from its place for two or three inches, and appears in the wound immediately above the symphysis. A communication with the bladder is thus perfectly established. The surgeon now takes an ordinary scalpel, and placing it in a groove existing for that purpose in the stylet, cuts downwards from the point of transfixion nearly to the neck of the bladder behind the symphysis. His forefinger is then applied, with its palmar surface upwards, to the top of the wound, to hook up the bladder, while the assistant withdraws the 'sonde à dard,' having first replaced the stylet in its sheath. An instrument called the 'Gorgeret suspenseur' (fig. 46), but which we may term the hooked

FIG. 46.



The hooked Gorget,' 'Gorgeret suspenseur.'

gorget, now replaces the finger, and is committed to an assistant standing on the left side of the patient. It is very important

to maintain the top of the bladder steadily in place throughout all subsequent movements, and that the peritoneum, which is quite close to the wound at this point, should be preserved from injury. The surgeon now searches the interior of the bladder with his fingers, ascertaining the position and size of the stone, and introduces the forceps for its removal, which is generally tolerably easy, and may be effected by careful traction upwards and backwards. In a few cases with stones of extreme size the fascia has been divided laterally to a small extent in order to afford additional space. I found this necessary in a case in which I operated, that of a gentleman aged sixty-seven, for a large, rather flat, uric acid stone, in 1877.

CHAPTER V.

CAUSES OF DEATH FOLLOWING LITHOTOMY.

Causes of Death at different ages must be considered separately.—Causes of Death in Adults.—A. Deaths from Error or Mischance in the Operation.—Deep Incision may produce Hæmorrhage, or divide tissues too deeply: 'Infiltration of Urine' not so produced.—Mechanical Violence in removing Stone.—Cheselden's Directions; Martineau, Pouteau, Keith, Humphry.—Perforation of Bladder by Staff.—B. Causes of Death not under control of Operator.—Organic Disease of Urinary Organs.—Exhaustion of Vital Power.—Peritonitis.—Septicæmia.—Tetanus.—Causes of Death in Children: why differing from the preceding.—Peritonitis: very rarely, Infiltration.—Exhaustion, &c.

We now arrive at the important subject of the causes of death following the operation of Lithotomy. And this will be studied with advantage before coming to an appreciation of the different modes of performing it already described. A careful consideration of numerous facts leads me to take views of this question which differ somewhat from those generally held respecting it.

In the first place, it is impossible to regard the deaths following Lithotomy as a single aggregate or class, relative to which any leading particulars can universally apply. Nothing can be more deceptive than a method of dealing with the results of Lithotomy, whether numerically or otherwise, by which cases of all ages are treated indiscriminately in one category. The causes of death are not the same in adult life and in the period of youth; indeed, they vary so much as to render a separate consideration of them necessary. Nevertheless, it has been the custom to regard the fatal contingencies of all ages in the mass, without making this distinction. The differing liability to death at the two terms of life has, on the other hand, been amply demonstrated.

I shall commence with a consideration of Lithotomy among adult patients. Afterwards the causes in children shall be investigated separately.

Regarding adult cases, I shall divide the causes of death into two classes, the necessity for which must be obvious; viz.—

A. Causes of death originating in errors or mischance in the performance of the operation itself.

B. Causes which are very slightly, or not at all, under the control of the operator, and existing for the most part in defective conditions of the patient's constitution.

A. Causes of death originating in errors or mischance in the performance of the operation itself.

a. The 'deep incision' may be such as to produce fatal bleeding, either at first, or occurring as 'secondary hæmorrhage' some days after. Probably this does not often happen as the result of any reckless use of the knife, although such an event is possible; and when it does arise, is more commonly due to the physical necessity for making a free opening for a large stone. But it may be also due to mischance, as from the irregular distribution and presence of a large artery in the ordinary course of the incision, an occurrence, however, which is usually to be controlled by the use of the ligature.

b. The 'deep incision' may also divide the prostate and neck of the bladder so extensively as to open the cellular interspaces between the pelvic viscera, and produce, as it is said, urinary infiltration there. Thus the great majority of writers on causes of death after lithotomy coincide in regarding 'infiltration of urine' as the most common cause of death, a statement that I venture not only to call in question, but to regard as the source of serious error in practice. Infiltration of urine may be one of the causes of destructive inflammation of the perivesical cellular tissue, but it must be a rare one. The doctrine based on this belief is as follows:—If the internal incision passes beyond the limit of the prostate in any direction, so as to open up the cellular interspaces behind the deep fascia, urine is almost certain to find its way into them, and if it does so, fatal inflammation will result; in order, therefore, to avoid this danger, the internal incisions must be extremely limited.

But infiltration by no means necessarily occurs when urine passes over the newly made section of cellular *spaces* so called. In fact, cellular *interspaces* between muscles and viscera do not exist, except when made by the anatomist for the necessary purpose of demonstrating the planes of cellular tissue which unite adjacent organs, and facilitate freedom of movement between them. I very much doubt if urinary infiltration ever occurs when they are otherwise uninjured, in a person of fair health. To judge from the language held respecting this subject, one would imagine that hollow intervals exist between the organs in question, over which urine had only to be poured in order to be drained mechanically into them! Even in the child, where the cellular connections are of the loosest and most delicate kind, and where the bladder is active, powerful, and irritable, urine flows constantly after lithotomy over a wound which affords free access to them: nevertheless, with what extreme rarity do we meet with urinary infiltration in the child. But if the cellular connections are first injured or inflamed, a condition is produced in which urinary infiltration may perhaps take place with fatal effect.

I am aware that this doctrine is opposed to the generally received notions on this subject. I speak with great respect for existing views, but careful pathological study of the subject has convinced me that the true cause of death in the majority of cases, the cause that it most behoves the operator to guard against, is violence in opening up the internal part of the wound and laceration of the tissues there, and not the primary passage of urine into the cellular connections about the neck of the bladder. Happy is it if it be so, since the former it is in his power to avoid; the latter occurrence, were it common, would be a danger inherent in the operation, and unavoidable with a stone much above the average size.

c. Mechanical violence inflicted in the removal of the stone, especially when the opening is of insufficient size, is another cause.

This probably affords the true explanation of certain appearances revealed by autopsy, and formerly regarded as the results of infiltration produced by too great freedom of incision. Thus, after a large stone has been with difficulty extracted, the

cellular connections of the neck and base of the bladder are found to be disorganised; sloughs of the connective tissue appear bathed in fluid seropurulent and urinous, and marks of peritonitis, especially severe in the pelvis, are observed. But there is good reason to believe that, in most cases, urinary extravasation is not the primary cause of the inflammation, but that inflammation produced by injury has been the occasion of the urinary extravasation. In some of these cases, insufficient incision has furnished the occasion for inflicting violence of another kind in attempting to remove the stone. Undoubtedly sound as the rule is, to keep the internal incision strictly within the prostate in adult patients, in practice I am satisfied that the desire to limit it has been carried to an extreme degree, and that another and not less serious danger of arousing inflammation of the same cellular tissue has by this very means been increased; I mean the danger which attends an attempt to drag the calculus through an opening of insufficient size. From what I have seen of the practice of Lithotomy in various hands both in town, in the country, and abroad, I am persuaded that insufficient internal incisions are equally dangerous with those which are too free, and that the tendency of the present day is towards the former extreme. The purely anatomical view of the subject appears just now to be in the ascendant. The structural delicacy and sensibility of the organs involved are not sufficiently regarded. The student is taught to fear beyond all things an approach of his knife to the peripheral limit of the prostate, and, in over-dread of cutting it, he barely divides the prostate at all. Hence, the fatal injury which results from violence inflicted by the forceps and by the stone upon the neck of the bladder, and by the powerful traction upon it, which injures, often irreparably, the surrounding cellular connections, so delicate in structure, and loosely applied, for the purpose of permitting those varied conditions of size which the function of the viscus demands. Inflammation of these delicate structures is easily produced by that forcible dilatation of the neck of the bladder which insufficient incisions render necessary, while the pressure to which they are thus subjected sometimes produces sloughing. And, when inflammation has once extended through these structures, it may soon invade the

peritoneum, which in this manner, probably, is not infrequently implicated. In connection with this subject there is a very significant fact, the bearing of which will be presently examined, viz. that while it is certain that the boundaries of the prostate are almost invariably overstepped by the knife in children, infiltration of urine does not occur in their cases. That the prostate has often been completely divided in the adult with impunity, for the removal of large stones, is certain, and the risk incurred from that cause is unquestionably serious. Danger is always great in a ratio proportioned to the size of the calculus, but this arises quite as much from the violence inflicted in removing it as from the depth of the incisions employed.

Let it not be imagined from these remarks that anyone can deprecate more strongly than myself the making of an incision in the prostate more deeply than the size of the stone demands, but I am very certain that it is safer to extend the incision, when a large stone has to be extracted unbroken, than to inflict the injury which dragging it out by force necessarily involves. The advocacy of small internal incisions by Scarpa, who laid down as an axiom that an incision of five lines into the prostate with dilatation sufficed for the extraction of a stone of more than ordinary size;[1] and a similar recommendation by Sir Benjamin Brodie, in his well-known lectures, as the chief means of preventing urinary infiltration, has greatly influenced professional opinion on this subject. So much so indeed, that almost all subsequent writers have agreed in regarding a free deep incision as a source of the principal danger in the operation, and have thus occasioned indifference to a danger no less grave, which attends incision which is unduly limited. I wish then to point out, that in shunning Scylla we may encounter Charybdis; that an obstacle to successful Lithotomy lies on either side of our path, and not on one side only; that we must preserve the neck of the bladder equally from too deep an incision on the one hand, and from the mechanical injury necessitated by one which is too limited on the other. I fortify my position by reference to the significant fact that the most successful operators have been those who advocated sufficient incision as less dangerous than violent

[1] *Memoria sul Conduttore d'Hawkins*, &c. Pavia, 1825.

extraction. Thus Mr. Martineau, who is well known to have cut eighty-four cases (but including many children) at Norwich, with only two deaths, writes, in that brief and simple account of his method which he presented to the Medical and Chirurgical Society in 1821: 'Should the stone be large, or there be any difficulty in the extraction, rather than use much force, while the forceps have a firm hold of the stone, I give the handles to an assistant, ... while the part forming the stricture is cut, which is easily done, as the broad part of the blade becomes a director to the knife; and rather than lacerate, I have often repeated this enlargement of the inner wound two or three times.'[1] Cheselden himself had recorded a similar opinion. Describing his method of extracting the stone, he says: 'I first feel for the stone with the end of them' (the forceps), 'which having felt, I open the forceps, and slide one blade underneath it, and the other at the top; and if I apprehend the stone is not in the right place in the forceps, I shift it before I offer to extract, and then extract it very deliberately, that it may not slip suddenly out of the forceps, and that the parts of the wound may have time to stretch . . . . and if I find the stone very large, I again cut upon it, as it is held in the forceps.'[2] But, on the other hand, it is never to be forgotten —and Cheselden refers to it in the foregoing passage—that the neck of the bladder is susceptible of dilatation to a very considerable extent, if only it be gradually exerted. It yields, first, to the pressure of the finger as it passes through immediately after the knife; secondly, it dilates further in the act of sliding in the forceps upon the finger; and lastly, it gives way still more when the forceps is withdrawn, with the stone between its blades. Its susceptibility of becoming dilated is of the utmost value to the lithotomist; indeed, if it did not exist, and largely too, none but small stones could be withdrawn through any incision limited to the prostate only. But in order to take advantage of it, the dilatation must be made slowly and gently. If done

[1] *Med. Chir. Trans.* vol. ii. p. 411. It seems necessary to state, from the manner in which Mr. Martineau's practice is sometimes quoted, that this series of eighty-four cases did not by any means constitute his entire experience, the remainder of which was by no means successful.

[2] *Cheselden's Anatomy*, 5th edition, 1740 p. 231.

hastily, harshly, and forcibly, under the influence possibly of the contemptible vanity of achieving a rapid operation in the eyes of bystanders, it is not dilatation which has been accomplished, but rupture. And by rupture I do not mean the mere enlargement of the wound in the prostate and neck of the bladder, w ich, probably, is often and legitimately occasioned, but the rupture of the surrounding cellular connections with the numerous veins and the capillary network which traverse them; results of an extremely dangerous character. In this way inflammation of the cellular tissue, pelvic abscess, or it may be phlebitis, are set up; suppuration is produced in a situation where the pus finds its way to the peritoneum, and not to the surface. And when this state of things exists, a deep incision might have proved a safeguard rather than the contrary, by affording exit to the confined matter.

It is wholly impossible, then, to overrate the importance of slowly and gently dilating the neck of the bladder and the incisions which have been already sufficiently made, and of giving abundance of time both in the act of introducing the forceps, and in that of withdrawing the stone. If there be any single proceeding in connection with the practice of Lithotomy, no matter what is the operation performed, which demands more than any other of care, attention, and self-command, I should say it is the manner in which we traverse with instruments the wound in the neck of the bladder. Nevertheless, one may have sometimes observed that the operator rapidly passes and repasses instrument after instrument, especially if any difficulty arise, and pulls and twists, with breathless haste and excitement, the calculus through the narrow outlet. Nothing can be more dangerous, nothing more likely to occasion the evils which have just been described. I am strongly inclined to think that in many hands the forceps, and not the knife, is the most deadly instrument employed in Lithotomy. On this important subject permit me to adduce here two brief quotations from the writings of two experienced and accomplished lithotomists, one of the past and one of the present age. Poteau, during the last century in France, says: 'The extraction of the stone is, perhaps, the most delicate part of the operation, since it has often caused fatal results when it has

been done without sufficient prudence and management. If we permit ourselves to be seduced by the dangerous merit of doing the operation in the shortest possible space of time, the eagerness with which extraction is made occasions a rupture, often mortal; and I am persuad d that the thoughtless anxiety to acquire this false glory, that the public attaches to rapidity in operating, has killed more patients than any other evil manœuvre. It is impossible to proceed too slowly in extracting the stone, and I believe it is to a scrupulous adherence to this precept that I owe in great part the constant success of my operations.'[1]

Dr. Keith, of Aberdeen, after describing the method in which the forceps is to be applied, adds: 'There are few operations to which the adage *Festina lente* does not apply. To Lithotomy it is especially suitable, and to this stage of it peculiarly applicable. At it, "Make haste slowly" should be ringing constantly in the surgeon's ear.'

I cannot forbear to add the remarkable fact that, in the numerous opportunities of discussing the details of the operation of Lithotomy, which I have enjoyed, either personally or by letter, with many of the most experienced lithotomists of the day—and I refer especially to the provincial surgeons of our own country—that this is the single particular on which all are agreed. One, possibly, may attribute his success almost entirely to the use of the beaked, instead of the pointed, knife; another, to the smallness of the internal incisions; a third, to the freedom of the same incisions; a fourth, to the invariable use of the tube after the operation; a fifth employing it only in rare and exceptional cases; but one and all agree in the vital importance of extracting the stone with great care and gentleness, and of giving time in abundance to this part of the proceeding. I may add, that Dr. Murray Humphry, of Cambridge, who has had a large and remarkably successful experience, attributes his success in great part to care in removing the stone. He writes me—after describing in detail his method of proceeding—'the desideratum in the operation is to extract the stone with as little damage as possible to the parts.'

[1] *Œuvres Posth.* tome iii. p. 350.

d. An occasional cause of death connected with the operation is perforation of the bladder producing peritonitis.

I have myself verified this accident in two cases, and have little doubt that it is not a very infrequent cause, while it is certainly one which may be avoided without difficulty. Both cases occurred some time ago at the University College Hospital, and were publicly examined by me in the deadhouse there. (See table in Appendix, Cases Nos. 92 and 324.) I confess the circumstance was at that time new to me, and I think it deserves careful attention. Before the time of these accidents I had often observed 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 anything 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.

I shall now consider—

B. Causes of death which are very slightly, or not at all, under the control of the operator, and existing for the most part in defective conditions of the patient's constitution.

I have re-examined this part of my subject during the last few years, and especially by the light of a much larger experience than I had at the date of the last edition (1870). About two years ago I presented to the Royal Medical and Chirurgical Society, London, a *résumé* of 500 cases of operation for stone on *adult males only*, of which seventy-eight were operations by lithotomy.[1] All these were cases of large stone, or otherwise disqualified by some untoward circumstance for the performance of lithotrity. They were patients exhibiting advanced and grave examples of the malady. Hence among them were twenty-nine deaths following the operation; a number almost equalling those occurring in all the other cases (422) of lithotrity. Regarding the twenty-nine fatal cases of the first series, as well as the fatal adult cases of other operations, I think the following causes of death may be enumerated, and in the order of frequency of their occurrence.

Organic disease of urinary organs, kidneys, ureters, and bladder.

Exhaustion of the vital power.

Peritonitis.

Septicæmia.

a. Organic Diseases of Urinary Organs. Associated with the presence of vesical calculus of large size, a very common condition is pyelitis, or pyelo-nephritis of one or both sides. If of long standing, the affected ureter and pelvis are not merely inflamed, but become dilated, sometimes very largely so; they may even form receptacles for offensive urine. Consequent changes in the renal structure take place; a gradual thinning and disappearance of it, as if from pressure, while small purulent deposits in it occur in the latest stage. The disease, however, originated in the bladder, which might at first be thickened or distended, or finally sacculated, a condition varying

[1] *Trans. of the Royal Med. and Chir. Soc.* 1878, vol. lxi. p. 159.

greatly in degree and extent; but always an extremely grave circumstance in connection with operation of any kind, when the sac or sacs are of considerable size. These conditions should be well known to every student who attends the autopsies of his hospital, and are fully described by me elsewhere.[1] Such changes existing, they are liable to be intensified both by the local effect of an operation on the bladder, and by the constitutional, or febrile, state which follows it. Acute inflammation of the bladder also sometimes results from lithotomy, and appears to aggravate the renal state, although it may not spread upwards by continuity of structure, and death rapidly follows.

Again, the kidneys may be already damaged, although in a minor degree, by pre-existing calculus formation, or one of them may be still the seat of calculus; and thus danger may arise in event of operation. Bright's disease is a very grave complication; while the long-continued presence of saccharine diabetes is undoubtedly a serious element of risk. Death sometimes occurs in any of these cases from uræmic poisoning, through insufficient eliminating power of the kidney; or by acute inflammation and suppuration destroying their structure.

b. Next in order may be ranked *Exhaustion of the vital powers.* In other words, a patient free from any pronounced organic disease lingers a longer or shorter period after the operation, having perhaps afforded good hope of recovery during the first few days, after which he fails to improve, becomes gradually weaker, and dies without acute disease in any organ. Such exhaustion may be manifested slowly or rapidly, and either with or without the occurrence of secondary hæmorrhage, which may often occur insidiously, and before it can be checked; while primary hæmorrhage, on the other hand, is to be regarded as controllable by the surgeon. Nevertheless, the patient may have unavoidably lost more blood than usual, which at advanced years, and perhaps with impaired digestion also, he is unable to restore. This contingency lowers the powers of life, impairs adhesive action in the tissues, diminishes the power of resisting deleterious influences, and prolongs the period of convalescence if it does not endanger life. Hæmorrhage is, therefore, inevitably allied to exhaustion, which ought not to occur very

[1] *Clinical Lectures*, 5th ed. Lect. xvii.

frequently apart from that cause. There are, of course, some old and worn-out cases in which the slender chance of recovery by means of operation is embraced by the patient only in his last extremity; when with powers past recruiting, he must be brought to the operating table. These are exceptional, however; in most cases a patient should not be submitted to this ordeal in an exhausted state. But if hæmorrhage be unavoidably severe, or be not checked by every means at hand, we risk a fatal encounter with exhaustion, and indirectly not a few deaths are thus met with. It follows then, that the surgeon should, during the operation, regard his patient's blood as valuable in the highest degree, and whatever may be his views respecting its loss under other circumstances, he should rest assured that every ounce of blood lost in Lithotomy is, *pro tanto*, a positive injury, at all events to an elderly patient.

It is worthy of remark, however, that not a few of those cases in which death is attributed to 'exhaustion,' no autopsy being made, would by anatomical examination be found the subjects of pyelo-nephritis. No really diagnostic signs of this condition can be established during life: an observation of the physical state of the internal organ alone can enable the surgeon to declare its presence with certainty, however strongly he may have suspected it during life.

c. Peritonitis, as already seen, may arise by perforation of the bladder by the staff, and also as a secondary result of violence, or of sloughing and suppuration at the base of the bladder. But it appears also to arise independently of these local conditions, possibly sometimes by extension from an inflamed bladder, and sometimes as one of the manifestations of blood-poisoning.

d. Septicæmia.—The occurrence of septic poisoning from any cause is not very common in connection with Lithotomy. Among the twenty-nine deaths which occurred in my own cases, only one could be reckoned under this head. In that case, the presence of pyæmia was rapidly manifested by articular swellings, with death on the seventh day. This fact is worthy of note, in connection with the keen interest now felt in researches as to the nature and origin of septicæmia; as an illustration of the small liability to receive infection which some wounds

exhibit. 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 many instances of prolonged contaminated exposure, often amounting to some weeks, only one example occurred.

Indeed, the Lithotomy wound may be regarded, on the other hand, as an example of the 'open-air' treatment; no dressing or covering of any kind has ever been applied in my cases; and as much fresh air as possible has been admitted.

e. Tetanus.—Two or three cases are on record of death by tetanus following the operation of Lithotomy. Beyond the bare mention of this fact, no further remark appears to be necessary respecting this extremely rare event as a consequence of the operation.

THE CAUSES OF DEATH IN CHILDREN.—The causes of death in children are widely different from those which are met with in adults. This distinction, as far as I can ascertain, has not, as yet, been sufficiently pointed out. The causes of death after Lithotomy have been treated as if they were uniform at all ages; although it is very obvious from observation of their cases, that the fatal result in the adult and in the child almost always happens through a different chain of events. This has rendered less distinct in each respectively the danger to be most feared, and, consequently, the cause most to be avoided. On investigating this subject in the adult, we have seen that haste and violence in extracting the stone, and sometimes unnecessarily extended incisions, are the causes of that diffuse inflammation of the cellular connections around the base of the bladder, which proves so generally fatal. We shall find in the child that the danger is not, or is very rarely, due to diffuse inflammation, and that incisions beyond the prostate can scarcely be reckoned dangerous, since they are constantly practised, yet no class of patients exhibits half so many recoveries per cent. We shall find that the most frequent cause of death in children is peritonitis, which is by no means common in the adult; and after that, and nearly as frequent, is constitutional exhaustion.

It will make our path clearer if we first consider the causes

which render Lateral Lithotomy so much less fatal in the child than in the adult, a fact notorious to the youngest student of surgery. I believe them to be threefold. First: Lithotomy is not a very fatal operation in the child, because the sexual organs are not yet endowed with that special sensibility, the development of which constitutes the state of puberty; a sensibility which, depending on most intimate connection between those organs and the cerebro-spinal system, necessarily associates them by the closest ties with all the other vital functions in the economy. So that any shock or injury received by the adult sexual apparatus very frequently involves constitutional sympathies of a very grave character. In the child there is, in fact, no sexual apparatus; that is to say, its condition is at present rudimentary, and the young patient is exempt from the danger which exists in the circumstances pointed out. This is the first and the chief fact in favour of the child. The second consists in this: that the processes of growth, and, consequently, of repair, are more vigorous during childhood than during any other term of life; and injuries are more rapidly and more easily surmounted than when those processes are less active. There are special adverse influences at certain periods of childhood, which counteract, to some extent, the beneficial effect of this, as we shall presently see. Thirdly, the position of the bladder in children favours the continuous and complete discharge of urine, and of all noxious secretions after operation, a fact which is doubtless of some value in their cases.

Now, the liability to death after the operation of Lithotomy in childhood varies very much at different epochs of that period. A table in another part of this work containing 850 cases of children, shows that, from the first to the fifth year inclusive, the deaths are about one in fourteen cases: they then decrease, so that between six and ten years inclusive, they are only one in twenty-three or twenty-four cases. Between eleven and sixteen the mortality gradually rises to one in nine and a half cases, and from the sixteenth to the twentieth year to one in seven cases.

During the first three or four years of life Lithotomy is far less successful than during the subsequent period. The first

detention with its dangers is now encountered, and the excitable nervous system of infancy neutralises some of the advantage which arises from the reparative power of childhood already referred to. But as these two constant sources of disease and death during the earliest years cease to be effective, we find the boy of six to ten years but very slightly exposed to risk from Lithotomy, the mortality being one in twenty-three or twenty-four cases, or little over four per cent. The development of puberty shows its influence in a marked manner between twelve and sixteen, and during the first onset of its influence on the system between sixteen and twenty, before the man is fully developed, and before the body has become established and fortified, Lithotomy is slightly more hazardous than at any period during the subsequent twenty years.

It has been already stated that the most frequent cause of death in children is peritonitis. The bladder in children is an abdominal organ rather than a pelvic one, and has more intimate relations with the peritoneum than the bladder of the adult possesses. On examining its structure also, it is easily seen that the peritoneum is more entitled to its anatomical distinction of constituting one of the vesical coats in the child than in the adult. Hence, violence in extraction tells much more readily and directly on the peritoneum in the former than in the latter. In the adult we have seen that if the peritoneum is inflamed, it is rather by an extension through primary inflammation of the cellular tissue around the neck of the bladder, than by direct irritation occasioned by the operation. The converse condition is the rule with children. The undue manipulation of instruments in the cavity of the bladder, or exertion in withdrawing the stone, appears to excite peritoneal inflammation much more readily than any other lesion. That it does not happen in children by the intermediate step of urinary infiltration, is obvious from the fact that the prostate in them is so exceedingly small as to be almost always, if not invariably, cut wholly through in Lateral Lithotomy, yet without the occurrence of that accident. Indeed, it is not possible that either forceps or finger can pass into the bladder, unless the incision exceeds the thickness of that organ. In considering this matter there appears to be a tendency to for-

get a fact I have already alluded to, viz. the non-existence at this period, except in a rudimentary form, of any sexual organs. I have dissected many prostates in children; the size of one at seven years, let us add therefore at the most favourable age for Lithotomy, may be estimated from the fact that it weighs about thirty grains; while between eighteen and twenty years it weighs two hundred and fifty grains, or nearly nine times as much. And yet no infiltration of urine takes place; lax, delicate and yielding as are the cellular connections necessarily exposed in these subjects.

Here then, again, as in the adult, the fatal injury from the operation is more commonly due to violence than to any other cause, but telling directly on the peritoneum, rather than on the cellular connections of the bladder. Such is the inference I deduce from the study of numerous cases of death in children, respecting which I have been in a position to form opinions. Some corroboration of the views here put forth may be found also in the fact respecting deaths which have been known occasionally to follow the mere act of sounding in children: viz. that it is always due to peritonitis. Fletcher, of Gloucester, in his most instructive record of 'Failures in Lithotomy,'[1] relates the case of a child, six years old, and in excellent health, who died of acute peritonitis in three or four days, after a prolonged sounding for suspected stone. Mr. Crosse also mentions a case precisely similar.[2]

The next cause of death is exhaustion. Young children bear the loss of blood badly, and when it is considerable, an occurrence which, however, is rare, the patient sometimes sinks from subsequent exhaustion. The condition of calculous children also, if the stone has long existed, is occasionally low in the extreme, and they gradually sink without any apparent effort to rally, no active attack having declared itself.

Besides these two principal causes of death, there are occasional examples of fatal result from shock after very prolonged or severe operation; from disease of the kidneys and bladder, from phlebitis and intrapelvic abscess, which demand no special remark here.

[1] *Med. Chir. Notes and Illustrations*, Part I. Lond. 1831, p. 89.
[2] *Treatise on Calculus.* Lond, 1835, p. 43.

CHAPTER VI.

DIFFICULTIES AND DANGERS MET WITH IN LITHOTOMY.

1. Difficulties and Dangers peculiar to the Age of the Patient—those of Infancy.—In Age, Rigidity of Tissues; Enlargement of Prostate, &c. 2. Difficulties from Personal Peculiarity in the Subject—Deep Perineum; Narrow Pelvis; Unusual Distribution of Arteries; &c. 3. Difficulties due to Peculiarity in the Stone—Size; Form; Number; Situation; Encysted Calculi; Contraction of Bladder on Stone. Calculi adhering to the Bladder. Accidents—Wound of Rectum; Removal of Portion of Prostate; Fragments remaining after Operation; Secondary Hæmorrhage; Wound remaining Fistulous; Impotence; Incontinence of Urine; no Stone found at Operation.

THERE are several exceptional circumstances, any one of which may, when present, become an occasion of more than ordinary difficulty to the surgeon in the performance of Perineal Lithotomy. Furthermore, it is certain that the degree of difficulty for the surgeon must be generally regarded as the measure of danger to the patient. There is therefore no duty more necessary, and certainly there is no inquiry more interesting, than that which relates to the sources of such difficulty and danger; because most, if not all of them, may be discovered and identified, not, indeed, by a reference to the practice of any single lithotomist, but by an extended research into the experiences of many. And the value of this inquiry will appear from a fact, the validity of which will be admitted by all, namely, that to be forewarned of the presence of difficulty, and prepared to meet it, considerably diminishes its magnitude in most cases.

For the sake of convenience I shall arrange these difficulties in three classes.

First, difficulties which are peculiar to the age of the patient.

Secondly, difficulties which arise from peculiarity in the subject—and

Thirdly, difficulties which arise from some peculiarity in the stone, or in its relation to the bladder itself.

1. *Difficulties which are peculiar to the age of the patient.*—The period of infancy is one which presents peculiar difficulties to the operator, difficulties not present at any other period of life. The structure of the organs interested is extremely soft and yielding; and the connective tissue which unites them is lax and feeble to a remarkable degree. From this condition arise two sources of difficulty and danger, which the operator has not unfrequently to encounter. First, the staff is liable, if undue force be used, to be pushed through the walls of the urethra, commonly at some point in its floor below the pubic arch, and thus to find its way below the bladder, between it and the rectum, where the mobility of the instrument, permitted by the laxness of the cellular connections there, may lead the operator to believe that its point is in the bladder itself. The same thing may happen in the adult; but from the cause stated, co-existing with the sharp curve upwards of the urethra in this situation in the child, it more readily happens in the latter. If this error is made, and is not discovered in time, the operation fails to extract the stone, and mostly inflicts a fatal blow on the patient. And its not unfrequent occurrence proves that it is by no means a remotely possible danger. There is one great rule which, as far as I know, is the only absolute safeguard against the performance of an operation on a staff which has not been passed into the bladder; and it is, to require clear audible or tactile proof of contact between the stone and the staff on which the patient is to be cut. We may find the stone with a sound, while the patient is on the table, but the staff may be passed immediately afterwards with perfect ease and not find it, the difference of form in the two instruments being considered sufficient by the operator to account for the two different results. It is wise not to be so easily satisfied. I have known occurrences of which the following is an illustration. A patient having marked symptoms of stone had been repeatedly sounded in the country, but no stone was found. The instrument which had

been employed for the purpose had the curve of an ordinary catheter. He was sent to London, and was there sounded with the small-beaked sound, which at once struck a stone in the bladder. Placed on the operating table, the staff passed easily; clear contact with the stone was not demonstrated, but the incisions were made. Until then there was no suspicion that the staff was not in the bladder; but it was soon discerned to be in a false passage, one which had been originally made by the large-curved sound, at the repeated examinations referred to; the opening of this false route had been avoided by the beaked sound, but entered by the large-curved staff. Happily, the operator was able to withdraw the staff, slide it along the upper aspect of the urethra into the bladder, and continue the operation, which was a successful one. When such an occurrence is met with, this is the course to be pursued: the surgeon must not hesitate an instant to withdraw his staff, to slide another staff of any curve that will pass safely into the bladder and detect the stone there, and then to finish the operation upon it. But if, owing to the false passage, he can pass no instrument after a fair amount of endeavour, all proceedings should be suspended without any further use of the knife until another day.

The other difficulty which arises in young subjects from the soft and lax nature of the tissues, is the facility with which the membranous urethra may be separated from the prostate. This sometimes happens, when, after the deep incision, an attempt to introduce the index finger into the urethra fails, and issues instead, in pushing onwards the prostate and neck of the bladder until separation takes place. The accident may occur in two ways. The operator may, through fear of having his deep incision too free, make a section of the urethra and prostate insufficient to admit the tip of his finger, and in attempting to dilate the opening with it instead of incising afresh, the catastrophe occurs. Or, from this insufficient incision, as Dr. Murray Humphrey points out,[1] the forefinger of the surgeon may, in failing to enter the urethra, make a kind of cavity between the bladder and rectum, and he may believe that he is in the first-named cavity. He may pass the

[1] See Lecture in the *Lancet*, April 23, 1864.

forceps into this, and even feel the stone, thinly covered by the coats of the bladder, and attempt to make extraction. But, secondly, in the act of opening the membranous urethra, he may lose his hold upon it with the nail of the left index finger, and repeat the incision once, or even twice, before he fairly gets his knife into the groove of the staff, and runs it on towards the bladder. The urethra meantime may have shifted its position slightly, and three or four adjacent separate notches have been made into it. If only a small amount of force be employed in the subsequent attempt to pass the finger into the urethra, its separation from the prostate may also take place. This source of danger has been pointed out by Sir William Fergusson in some valuable clinical remarks on the operation in children.[1]

The remedy, when this accident has occurred, is first to ascertain that the point of the staff is still in the bladder, and then to make a free incision of the prostate with a sharp knife —for these soft tissues are not easy to cut, and require both point and edge for a perfect section—so that the finger may be introduced into the cavity: this will generally be successful. A pre-acquaintance with the danger, however, will be the best safeguard against its occurrence.

A difficulty which sometimes presents itself in the cases of children (very rarely in adults) is prolapsus of the rectum during the operation. Young calculous patients are frequently subject to this affection from the straining which their complaint occasions, and when a considerable protrusion occurs at the moment of operating, some embarrassment may be occasioned. All that is necessary, however, is to press up the bowel without haste, so as to ensure its fair return, to put a small pad on the anus, and direct an assistant, placed on the patient's right side, to keep his finger firmly on the pad until the operation is completed.

The other extreme of life is also liable to its peculiar difficulties. There are two which are met with, and only in elderly subjects; namely, unusual rigidity of the neck of the bladder, and hypertrophied prostate.

The first has been less generally regarded than perhaps it

[1] Lecture, *Lancet*, July 2, 1864.

deserves to be. In some elderly subjects, the fibrous structures which form the neck of the bladder, and enter into the composition of the prostate and surrounding parts, have become unnaturally rigid and unyielding. In early life the converse condition exists, hence the impunity with which considerable dilatation can then be made. This condition of rigidity varies much in degree in different subjects, and is quite distinct from hypertrophied prostate, but as a rule it corresponds more or less to the advance of age: there are, however, some exceptions. In a marked case the tissues yield little to the finger, or to the forceps; the opening sufficient for the removal of a stone of given size in ordinary cases here feels tense, and inadequate for its purpose. The forceps being introduced, it is perceived that dilatation is not taking place, and unless deeper incision is employed the stone cannot be extracted without violence. In either case risk is incurred by violent laceration, or by extended incision; the smaller risk, however, probably lies, in careful hands, with the latter, although it is undoubtedly true that more force is admissible in this condition than in the normal state of the tissues. It is referred to by Mr. Crichton, in his MS. notes, as usually associated with enlarged prostate, and while he enlarged his incisions he did not hesitate to use more force in extracting than he was ordinarily accustomed to employ. Civiale has remarked its existence, and regards it as diminishing the prospects of success; where this condition is marked, and the stone is large, a second incision may be made through the right side of the prostate, supposing that in the left to be already sufficiently free. This was Liston's practice at University College Hospital; he performed it in nine cases there for very large stones with seven recoveries; among them was one stone weighing $3\frac{3}{4}$ ounces, and another of $4\frac{1}{2}$ ounces.

The prostate enlarged by hypertrophy, or deformed by tumour, is another difficulty presented by age. I am not disposed, however, to rank it high in the scale either of difficulty or of danger. It sometimes prevents the forefinger from entering the bladder; it increases the distance between the operator and the stone, and thus augments the difficulty of seizing and extracting it; and it does the same by placing the stone in a disadvantageous position, that is, lying deeply behind the neck,

or there may be projecting tumours at the entrance of the bladder, situated between the stone and the inner end of the wound. Hence such tumours have not unfrequently been torn away by the forceps in the process of removal, and apparently without any additional risk. On the other hand, deep internal incisions in an enlarged prostate are comparatively free from danger, and there is no fear of reaching its external limit. The gorget is a safe and efficient instrument in these cases for extending the deep incision; it forms a conductor for the forceps into the bladder when the finger cannot reach it, and keeps projecting tumours out of the blades, which might otherwise be lacerated, or brought away in their grasp. When the stone lies deeply behind an enlarged prostate, the curved forceps may be useful, although I have rarely found more than one pair of straight forceps necessary in any case. Sometimes the stone may be brought into good position for extraction, by placing one or two fingers in the rectum, and raising the stone towards the level of the internal wound.

In elderly subjects, also, it occasionally happens that the bladder has become atonied, and has not been able to empty itself by its own efforts for a long period of time. In the gush of water outwards after the deep incision, the bladder collapses rather than contracts, and the stone may be enveloped in folds of the organ, a circumstance sometimes productive of much trouble. Careful manipulation of the forceps, or of the scoop, with pressure by an assistant on the hypogastric region, will generally enable the surgeon to reach and remove it. In these cases, however, it appears to be wiser to operate with a nearly empty bladder than a full one; the stone is then more likely to be found at the neck, close to the internal incision.

2. *Difficulties which arise from some personal peculiarity in the subject.*

Among the first in this category may be noticed the deep perineum. Sometimes this is constituted by a variety of formation in which the bladder is more deeply placed as regards the surface than in ordinary cases; and resulting most commonly from unusual depth in the ischia and pubic rami. The difficulty is also commonly presented when the patient is exceedingly stout, the layer of adipose tissue over the perineum,

and especially on the nates, sometimes adding very materially to the distance between the surface and the bladder. In this case it is necessary to make the external incision longer in proportion at both extremities, remembering that the incision in such a subject commences on a plane three-quarters of an inch to an inch further from the bladder than in an ordinary case. Otherwise, the wound will be too narrow in proportion to its depth, and especially if the stone be a large one. The remarks respecting the use of the blunt gorget in cases of hypertrophied prostate apply here also.

Another difficulty is presented by the unduly narrow pelvis. The pelvic outlet may be congenitally contracted, or it may be deformed by rickets. Cases are on record in which it was impossible to bring any stone through the outlet, but such are extremely rare. Still it is not so uncommon to find the passage sufficiently narrowed to occasion some difficulty in extracting a stone of moderate or large size. The distance between the two ischial tuberosities is always a matter of observation to the lithotomist before operating, and his incisions are placed so as to allow him a fair equal distance between the rectum in the middle line and the osseous boundary on the outer side. But this is not all: it is particularly desirable in such cases to present, in the act of withdrawing the stone, which has usually a short, as well as a long diameter, the short one to the narrow diameter of the pelvis.

In the case of a boy four and a half years old, this difficulty occurred to myself, at the time of the operation, not having observed it previously. There was a large stone, and having made the incision by the lateral method, I found unusual difficulty in extraction. An unsuccessful attempt had been made before, but what the cause of difficulty had been I was not aware of. However, with management, I safely removed it in a few minutes. Ultimately the child died. At the examination the pelvis was removed: there was so much distortion, due to rickets, that the antero-posterior diameter measured only seven-eighths of an inch, on the dry specimen; while the calculus was almost three-quarters of an inch thick, being one inch and an eighth long, and seven-eighths of an inch broad. Had this condition been discovered beforehand, no

doubt the suprapubic operation might have been performed with advantage. The case was published in the 'Medical and Chirurgical Transactions,' vol. xlvii., with a drawing of the pelvis and of the stone. Sir Astley Cooper speaks of a case in which Clive found the ischia so abnormally approximated, that having introduced the forceps and seized the stone, he was unable to withdraw, and consequently broke it and removed the fragments separately.[1]

Another case observed, but not operated upon, is recorded by Mr. Bransby Cooper.[2]

Other difficulties peculiar to the subject are: the unusual distribution of the vessels, rendering serious hæmorrhage unavoidable; the existence of the hæmorrhagic diathesis; the presence of organic disease in the kidneys or elsewhere; of extremely nervous or irritable temperament; of plethora, obesity and debility combined—a not uncommon, but most unpromising condition; and lastly, of great exhaustion from long-continued suffering. The unusual distribution of arteries referred to is a difficulty which cannot be foreseen or avoided. The pudic trunk being defective, its place is sometimes supplied by an 'accessory pudic,' which lies close to the border of the prostate; the arteries of the bulb may be given off further back than usual; the main artery of the prostate itself may also enter the gland in a situation exposing it to the knife in Lithotomy. In all these cases, the skill, the energy, and the patience of the surgeon may be taxed to their utmost, to arrest the hæmorrhage occasioned by the division of these deeply lying vessels (see remarks on Hæmorrhage at page 37). The other conditions named above will be briefly referred to in the final appreciation of various methods of treating varied classes of patients.

3. The third class of difficulties encountered in Lithotomy comprises those which are due to *peculiarities in the stone, or in its relations with the bladder itself.* Other things being equal, it has usually been held, and it was proved by Mr. Crosse, of Norwich, in his comprehensive view of the contents of the Norwich Museum, that, after moderate dimensions are exceeded,

[1] *Lectures on Principles and Practice of Surgery.* By B. B. Cooper. London, 1851, p. 601.

[2] *Op. cit.* p. 599.

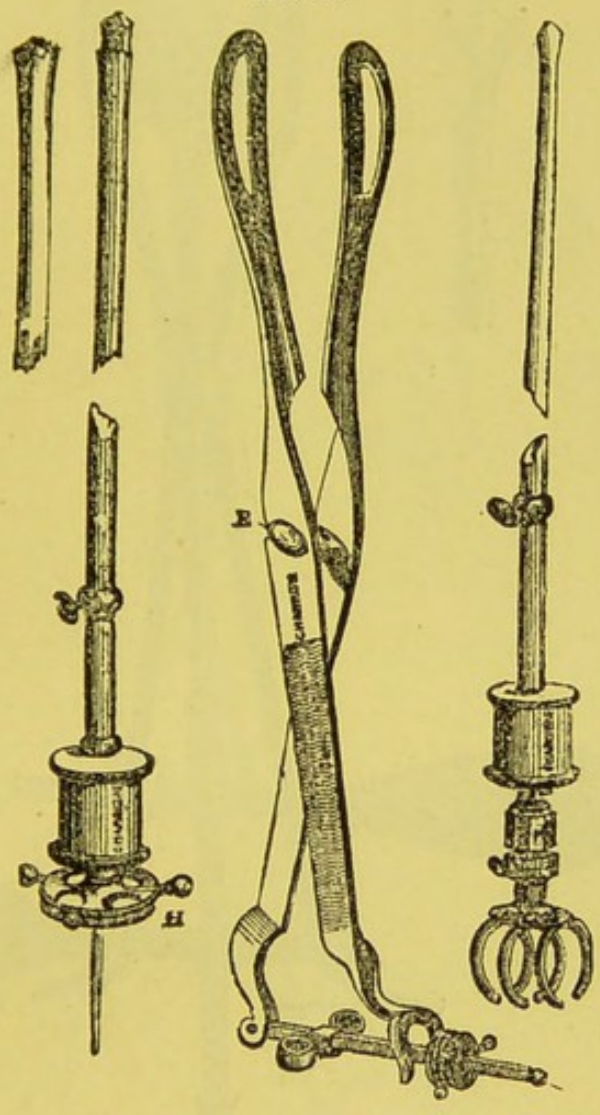
the danger and difficulty of the case exist in proportion to the size of the calculus to be removed. In other words, danger and difficulty exist in proportion to the extent of the incisions, or to the degree of violence employed in extraction. Thus, reckoning all the examples in that museum, he showed that the proportion of deaths to cures when the stone weighed between one and two ounces, was about one to five and a half cases; when between two and three ounces, there were four deaths in five cases; and of the twenty calculi above that size, viz. from three to seven ounces, twelve died and only eight recovered. This rate of mortality must be considered rather high. On the other hand, if we turn to the practice of Mr. Crichton, a remarkable success in this class of patients is exhibited. In the records which I possess of his practice, I find no less than eleven cases, in which he removed, by the lateral operation, stones weighing upwards of four ounces, most of the patients being very feeble and broken down in health. Among them were only two deaths; a very successful result, it must be confessed.

No. 1,	aged 73,	weighing 4 ounces,		cured.
2,	„ 60,	„ $4\frac{1}{4}$	„	do.
3,	elderly,	„ $4\frac{1}{2}$	„	do.
4,	„ 70,	„ 5	„	do.
5,	„ 66,	„ 5	„	do.
6,	„ 65,	„ $5\frac{1}{2}$	„	do.
7,	„ 40,	„ 6	„	do.
8,	„ 45,	„ 6	„	do.
9,	„ 72,	„ $6\frac{1}{2}$	„	do.
10,	about 65,	„ 7	„	death.
11,	„ 55,	„ 8 or 9	„	Broke in extraction, largest fragment weighed 6 ounces, 2 or 3 ounces of débris besides; died on third day.

The greater part of these were cut during the earlier half of Mr. Crichton's career, when he opened the bladder with the cutting gorget, and in some he divided the right side of the prostate as well. His method was, as we have already seen, marked by freedom of incision in these circumstances, and care in extraction. In order to get as firm a hold as possible, after having adjusted the position of the calculus in the forceps, he was accustomed to slip up, by the side and over the end of it, a bent hook or scoop in order to make traction and prevent slip-

ping. Two only of the foregoing series were purposely broken into fragments before extracting, and in each case it was done by simply compressing the handles of the stout and strong forceps which the operator was accustomed to use, and not by means of any unusual or complicated instrument.

FIG. 47.

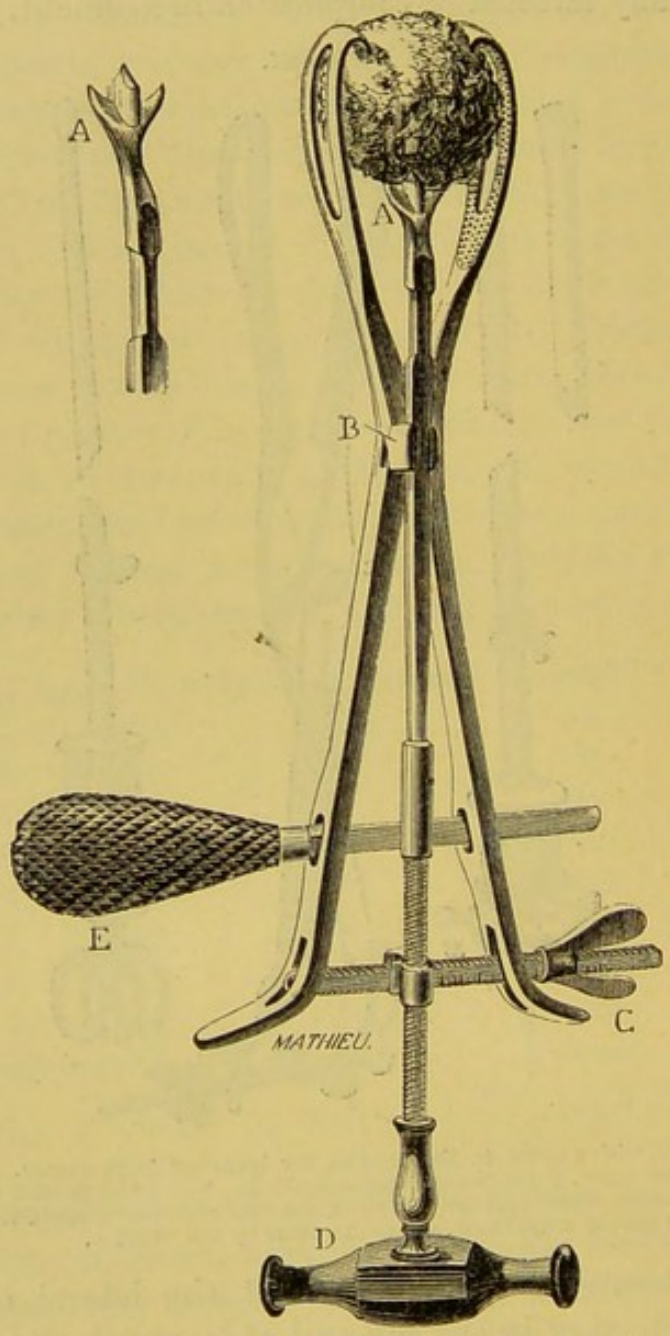


French forceps, with a screw in the handles, for breaking large stones. An apparatus is used for drilling the stone, if the forceps cannot crush it. The figure on each side of the centre represents a perforator, which is introduced through a ring at E, passes between the blades, and is worked in the one case by a drill bow, and in the other by the wheel H.

These results demonstrate what the lateral operation is capable of effecting in the removal of large calculi. Nevertheless, both in London and in Paris, it has been a common custom to employ for stones of about four ounces and upwards, some special apparatus for fracturing the calculus in order to extract the fragments through a smaller wound than would be necessary for the entire stone (see figs 47, 48, and 49). This principle

of action is dictated by prudence. To limit the incision as much as possible, without doubt conduces to the safety of the patient. Still, it is impossible not to be aware that great

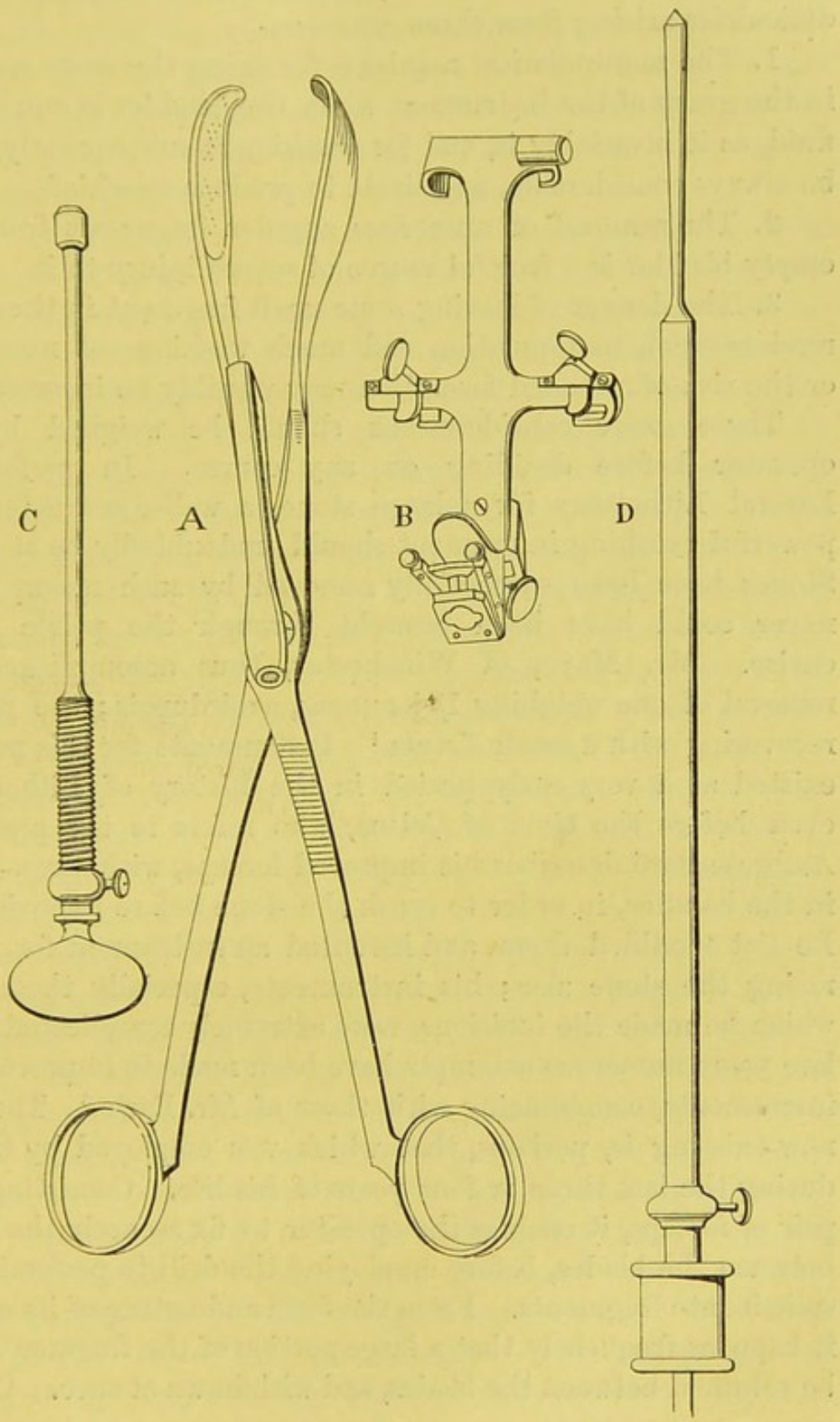
FIG. 48.



Another instrument for the same purpose, acting by pressure and by drilling. A, the toothed extremity of the drill.

additional hazard is involved in the employment of such apparatus in the bladder; and in contemplating it for any particular case, this must not be overlooked. I have witnessed

Fig. 49.



Apparatus for crushing the stone before withdrawing it in the operation of Lithotomy. A. The forceps. B. Portion applied to the handle of the forceps, and fixed there by screws, into which the piece C is inserted. C. Fixes the position of the stone between the blades of the forceps. D. A drill, introduced through the tube seen on the upper blade of the forceps, which being turned either by hand, or by a bow, perforates and breaks up the stone.

its application more than once, and have been impressed with difficulties arising from three causes:—

1. The manipulation requisite for fixing the stone securely in the grasp of the instrument when the bladder is emptied of fluid, as it invariably is, and for crushing it subsequently, must be always considerable, and liable to produce mischief.

2. The removal of numerous angular fragments from the empty bladder is a fruitful source of severe injury to it.

3. The danger of leaving some small fragment in the cavity renders much manipulation and much washing-out necessary, or the risk of a second formation may possibly be incurred.

These grave considerations should be weighed by the operator before deciding on any course. In performing Lateral Lithotomy for a large stone, a well-constructed and powerful crushing instrument should undoubtedly be at hand. Stones have been successfully removed by such means which never could have been brought through the pelvic outlet entire. Mr. Mayo, of Winchester, thus accomplished the removal of one weighing 14¼ ounces, avoirdupois; the patient recovering with a small fistula.[1] Instruments for this purpose existed at a very early period in the history of Lithotomy; even before the time of Celsus, who refers to the practice.[2] Ambrose Paré describes his improved forceps, with screw-power in the handles, in order to crush the stone before removing it.[3] Le Cat modified them, and invented an instrument for perforating the stone also; his instruments, especially those with which he made the incisions, were extremely complicated.[4] Of late years numerous attempts have been made to improve these instruments, commencing with those of Mr. Earle.[5] The best now existing is, perhaps, that which was employed by Civiale during the last three or four years of his life. Consisting of a pair of forceps, it enables the operator to fix securely the stone between the blades, before employing the drill to perforate and split it into fragments. From the form and nature of its action, it happens frequently that a large portion of the fragments may be retained between the blades, and withdrawn at once. Civiale

[1] *Med. Chir. Trans.* vol. xi. 1821, p. 54.
[2] Celsus, *De Medicinâ*, lib. vii. cap. 26.
[3] Paré's *Works*, lib. xvii. cap. 42.
[4] *Parallèle de la Taille latérale*, 1766. See plates and descriptions at the end.
[5] *Med. Chir. Trans.* vol. xi. 1821. With a plate.

reports between twenty and thirty instances of its application, and states that the results were extremely successful. The annexed drawing (page 89) is from an instrument in my possession which he sent me in 1867. He combined its use with the medio-bilateral operation, for all calculi weighing an ounce and a half, or thereabouts, and upwards.[1]

For the removal of extremely large stones, weighing from four to six or more ounces, the choice rests, perhaps, between Lateral Lithotomy with this adjunct, the High, and the Recto-vesical operations. If the bladder is capable of being moderately distended with urine, a stone of unusual dimensions may probably be more safely removed entire in this situation than by adopting the plan of crushing it after the lateral operation is performed. The great source of difficulty and danger in the latter mode is the empty state of the bladder, and I believe it is scarcely realised by those who have merely made or designed instruments for the purpose, and who appear to have overlooked the important distinction between this condition and that which obtains in ordinary Lithotrity, where fluid is mostly present. But if the bladder is habitually contracted round the stone, and does not admit of distension by fluid; those who are most acquainted with the high operation tell us that it is by no means a safe operation to undertake in such circumstances. And it appears to be more common to meet with a contracted bladder than with a dilated one when a stone of unusual magnitude is present. Such was the condition of things in a case which was under my own care in 1857, and from which I possess two calculi weighing $12\frac{1}{2}$ ounces.[2] These formed, for all the purposes of operation, but one calculus, being so closely locked together that it is scarcely possible that either could have been removed separately. The patient was in so miserable a condition when he came under my notice that I could not advise any operative measures, and attempted only to palliate it, and perhaps enable him to regain some vigour. This, however, proved impossible; his urinary organs being all but destroyed by long-existing chronic inflammation. At the autopsy I endeavoured to remove the mass by the high operation, and found it totally impossible, without opening the abdo-

[1] *La Lithotritie et la Taille.* Paris, 1870, pp. 440 *et seq.*

[2] *Trans. Path. Soc.* vol. ix. p. 295.

minal cavity. The bladder had long ceased to be a receptacle for urine, which trickled off as fast as it arrived from the kidneys; the stones being closely enveloped by its thickened and diseased coats. I doubt if any operative means would have been successful in his case; but judging from the examination referred to, it appeared to me that the best chance would have been offered by practising extended incisions on the plan of the Recto-vesical operation. This latter procedure must be regarded, for the majority of cases, as permitting the largest opening with the smallest amount of risk for stones which are unusually large. In the method of performing it, described at page 54, little danger exists from hæmorrhage; the amount of tissue cut is by no means considerable; and the opening is admirably situated, in the very centre of the pelvic outlet. On the other hand, a strong probability exists of the subsequent occurrence of intractable recto-vesical fistula. Experience of this operation has shown that this distressing condition follows, taking all cases together, about once in four or five instances. But when it is resorted to for stones of extreme magnitude, the chances are somewhat greater still that the wound will remain fistulous.

There is a practical point of importance to be noticed in connection with very large stones. It is the very slight evidence of their presence which is obtained by sounding in certain cases. I first became aware of this on examining the patient just alluded to. I was convinced from his symptoms that he was the subject of calculus; but still, although repeatedly sounded by me and by one or two others, distinct evidence of the fact was at first wanting, for a clear note could not be obtained. A sensation indicating the presence of mortar-like matter was felt, on the instrument passing through the neck of the bladder, and after that, nothing.

I find in Mr. Crichton's notes the record of a similar fact. In one of his earliest cases, occurring in March, 1792, the signs, he says, were very indistinct; and, on his proposing to operate, one of the surgeons who had come to assist him left the room, stating that he could not be a party to any operation in such circumstances. Mr. Crichton, however, felt satisfied that a stone was present: operated at once, and removed a hard one weighing six ounces, the patient making a good recovery. He records also a second case almost parallel with the foregoing.

Other characters of the stone causing difficulty to the operator are, unusual form and extreme brittleness. A long stone, and a thin, flat stone, are both difficult to remove, and require careful adjustment in the forceps, or the aid of the scoop, before attempting to extract. I have also had the opportunity of observing that such stones are especially difficult to seize with the Lithotrite. Large round tuberculated stones are also formidable, and for equal weights are obviously much more so than smooth oval stones. A stone, also, which easily crumbles into fragments is always a source of trouble and anxiety. It prolongs the operation, makes much instrumental manipulation necessary, and the fear of leaving a fragment behind is always present. The scoop and the syringe as a rule afford the best means generally of dealing with these cases. The syringe should have a nozzle like that represented at fig. 7, page 15; a form for which we are indebted to Dr. Gross of America. On this account it is that Lithotomy, after the failure of Lithotrity, is sometimes associated with risk and difficulty, and especially if the bladder has proved irritable previously. Similarly, multiple calculi are sources of some difficulty, although less so than are numerous fragments. Instances of two, three, or four calculi are common. I have found upwards of eighty in a single bladder. Examples of between one and two or three hundred are on record.

Next to great size, the unusual situation of a calculus may be a source of much difficulty and embarrassment. A certain proportion of calculi become encysted in the bladder. Not so many, perhaps, as the statements made by operators who have found difficulty in extracting calculi, and who have consequently believed them to be encysted, would lead us to infer. But we have the best anatomical evidence that it is not extremely rare for this to happen. A calculus may be altogether contained in a cyst in the bladder, a small part of its surface only being exposed at the mouth of the cyst. I had the opportunity of watching at University College Hospital an example of this, which was once, and once only, struck with a sound during life, although sounding was repeatedly performed. The patient remained during a large part of 1850 under the care of Mr. Arnott; at death the condition described was found, and it was then obvious that the chance of striking such a calculus

was exceedingly remote, and that no operation could have removed it.[1]

But it is not uncommon, when this condition occurs, that fresh calculous matter is added, little by little, to the exposed surface, so that, in process of time, a calculus is formed, protruding into the bladder, in which situation it increases in size; a narrow neck exists uniting the vesical to the encysted portion, and the whole acquires a form somewhat resembling that of an hour-glass.

One of the most interesting examples on record is that of a man, aged fifty-one, with stone, who applied to Dr. Murray Humphrey, of Cambridge, who operated by Lateral Lithotomy, removing a large stone. Two years and a quarter afterwards, symptoms having recently appeared, Dr. Humphrey performed Lithotrity three times, but this being unsuccessful, he cut him again in the same spot. Two years and a half after he came again with recent symptoms, and Lateral Lithotomy was again successfully performed. In the next year he again complained, and Lateral Lithotomy was adopted a fourth time, still in the site of the old cicatrix, but an encysted stone was discovered, and after many attempts could not be extracted owing to its distance from the wound. In six months he once more showed himself, and this time Dr. Humphrey did the recto-vesical operation: was able to reach the cyst, incised the sac with a hernia knife, dilated it with the tip of his finger, and, with much difficulty, guided the forceps, extracting a stone the size of a walnut. Death occurred in two days with peritonitis. At the autopsy, the sac was found just above the entrance of the right ureter; it was ulcerated at the lower part, and urine had found its way from it under the peritoneum. A second case fell to the lot of Dr. Humphrey, in which, at the second lateral operation, he discovered a cyst behind the prostate; he lengthened his incision, applied a probe-pointed knife to the neck of the sac, and emptied it of softish material with the scoop, and a portion or two by the dressing forceps a day or two after; the patient made a good recovery.[2]

[1] Very fine examples of encysted calculus are contained in the Museum of the Royal College of Surgeons. See preparations Nos. 2019, 2020, 2021.

[2] *Report of some Cases of Operation.* By G. M. Humphrey, M.D., F.R.C.S., Surgeon to Addenbrooke's Hospital, Cambridge. London, 1856.

I exhibited at the Pathological Society, in 1861, for Mr. Cadge, of Norwich, a good specimen of encysted calculus. It was removed by him during life with a portion of the cyst adhering, like a collar to the neck, uniting the two portions, and the patient recovered.[1] Two such cases occurred in Mr. Crichton's practice, who minutely describes his proceedings in the MS. notes; one case in 1842, one in 1844. In all three cases the stone was situated near the neck of the bladder, and in the two latter on the right side. Mr. Crichton says of each patient that he observed when sounding (which he repeated two or three times, the signs being rather indistinct), that the stone seemed always to be fixed at the right side of the bladder. He writes: 'The bladder was cut into, and the presenting portion of the stone laid hold of by the forceps and quickly extracted, broken off at the neck: a grooved director was then introduced into the bladder, and insinuated between the edge of the sac and the encysted portion of the stone, which, by a little perseverance, was so much raised from its confinement as to allow the forceps to get a hold, and another portion broken off and extracted. This was several times repeated till the whole was brought away.' The same proceeding was adopted in both cases; and both recovered. Very recently Mr. Lawson presented a good example of encysted calculus at the Pathological Society, which he had removed with the forceps aided by the scoop; in this case it was partially contained in a sac, and no supplementary portion projected from it.[2]

The following is a brief account of a case which I operated on in May 1869:—

A gentleman aged seventy-four years had suffered for some years with very painful symptoms. I sounded him, found a large stone, and proposed Lithotomy. Having cut him by the lateral method, and extracted a rather large phosphatic stone and many loose fragments, I then explored the bladder, and felt a rough surface like calculus, which I ultimately was able just to reach with my finger, situated just behind the neck of the bladder, a little to patient's right side. It was quite immovable; a small calculous surface was exposed, surrounded by mucous membrane, and a mass of considerable size was

[1] *Trans. Path. Soc.* vol. xii. p. 136. I exhibited a case of my own also (post mortem); see vol. xii. p. 138.

[2] *Trans. Path. Soc.* vol. xiii.

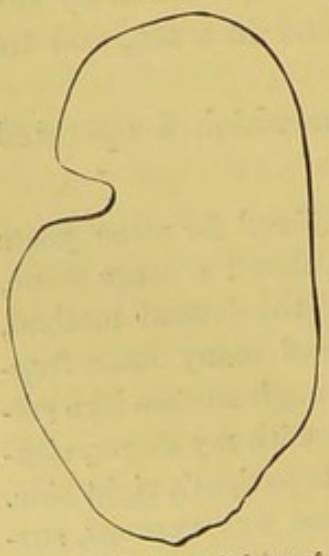
clearly outside the cavity of the bladder. Placing the other index-finger in the rectum, I encountered a hard tumour, corresponding to that felt in the bladder, and movable between the fingers of each hand. It was evident that the mass consisted of an encysted calculus, as large as a walnut, and a small portion of its surface only was exposed in the bladder. Upon this, large phosphatic crusts had formed, become detached, and produced calculi in the interior. I made some attempts to remove the encysted stone, but ineffectually, for it was too deeply embedded to be displaced, except by unjustifiable violence, and I was compelled to be content with emptying the cavity of the bladder.

The patient did very well for a few weeks. His condition was explained to himself and his friends, and I declined to recommend any further operation, having satisfied myself at the first, that it was impossible to do more. He was aged and feeble, and sank in about a month. At the autopsy the condition described was discovered, and I possess now the soft parts, showing the sac filled by a uric acid stone of the size described.

More recently I have operated on another case, which, however, occurred in the bladder of a woman; a fact which enabled me not only accurately to verify the exact condition, but also to deal with it successfully.

A lady, aged 52, was sounded by me in June, 1874, and a stone was easily detected. On July 6, Mr. Clover gave her chloroform. I introduced a lithotrite, intending to crush, but failed to seize and dislodge it from the left side of the bladder, where it appeared to be fixed. Withdrawing the instrument, I dilated the urethra with my finger, and found a calculus of which one-third appeared to be in the bladder, and about two-thirds, as far as I could judge, by means of another finger in the vagina, contained in a sac outside the cavity of the bladder. These conditions were verified in the same way by my assistant, Mr. Foster, and by Mr. Clover, the only persons present. Reintroducing my finger, I insinuated my nail within the margin of the sac, and in about two minutes, by carefully working the finger round the stone, succeeded in turning it out of its bed, entire, into the cavity of the bladder, whence it was readily removed by the forceps after a slight incision

FIG. 50.



Outline of size and form of encysted stone.

in the left side of the urethra. She made an excellent recovery, and is now living and in good health. The calculus, which is in my museum, is is form something like a kidney but with a deeper indentation showing the line of the neck of the sac. An outline of the stone is presented at fig. 50.

More recently still I saw a case with Mr. Savory, in a gentleman of eighty years of age, in which with great difficulty we succeeded, by the use of small lithotrites, in extracting a smallish calculus which was sacculated near the neck of the bladder. Every portion was thus removed from the interior of the sac in five sittings.

The rarity of such occurrences is, however, demonstrated from the fact that few operators meet with more than one or two cases in a lifetime. Deschamps and Brodie each record but one case.

Sometimes a little embarrassment is occasioned to the surgeon by his discovery that the calculus is more superficially placed in the perineum than he expected; on his encountering it, in fact, before arriving at the bladder. A vesical calculus may be found occupying partly the bladder and partly the prostatic urethra; or two or more independent calculi, locked together, may be thus placed. It is necessary, of course, to remove that which first presents, after which there is usually not much difficulty in entering the bladder, and extracting the rest. Indeed the whole calculus may be outside the bladder lodged in a sac which has some communication with the urethra, so that urine finds its way, more or less, into the interior of the sac. The following are brief sketches of two such cases on which I have operated.

A gentleman, aged 44, came to me from China with severe urinary symptoms. I found organic stricture of the urethra, admitting only No. 2 catheter. This was treated by continuous dilatation, and while doing so stone was felt. On February 17, 1878, I divided the stricture externally, doing the median operation at the same time, and finding just outside the neck of the bladder a sac filled with numerous calculi, the fragments fitting by their polished facets. Mr. Clover gave ether and Mr. G. B. Browne held the staff. He made an excellent recovery, and I have recently seen him perfectly well.

On August 3 of the same year, I operated on a gentleman aged

63, brought to me by Mr. Brewer of Huddersfield, who was present. I encountered three large calculi in a cavity close to the neck of the bladder, from which I had considerable trouble in removing them. Their position was well made out beforehand by rectal examination. The calculi fitted each other by polished facets and weighed two ounces. During the first nine days he appeared to be recovering rapidly, then rigors occurred, and he died three days afterwards from inflammation of the lungs, evidently the result of septicæmia.

Examples exist also in the Museum of the Royal College of Surgeons, in preparations Nos. 2026, 2027, and 2039. A large stone may even escape from the cavity of the bladder into the sac of an abscess in its walls, which has recently burst: a very remarkable example of this rare condition is seen, No. 2029.

Spasmodic contraction of the bladder, rendering the removal of the stone difficult, is described by some high authorities. It is regarded as something distinct from the condition which is present when the bladder has been merely emptied of urine, and therefore somewhat closely surrounds the stone. South, Brodie, and Gross speak of it, the two former recording cases in which it has been met with. Great care in the efforts made to extract, avoiding violence either with the scoop or forceps, and even waiting a little, are necessary in such cases. True spasmodic contraction of this kind is probably extremely rare, and when present it is not unlikely that chloroform may overcome it. When the bladder has become preternaturally small, and its coats are habitually applied closely to a large stone, there is sometimes great difficulty in removing it. The forceps must be manipulated with great care, and an additional hold with a well-curved scoop passed between the bladder and the stone, and beyond the latter, aids materially in dislodging it.

Sometimes the stone is lodged in the upper part of the bladder behind the pubic symphysis. Possibly this may be due sometimes to the spasmodic contraction just alluded to, but more generally, I believe, its position there is to be attributed to peculiarity in the form of the viscus, caused by hypertrophic thickening of the coats. The stone is habitually lodged there, and the vesical walls become thickened, partly by the process

referred to, and in part from inflammatory deposit into their structure, impairing their power to dilate or contract.[1] Here pressure above the pubes, firmly maintained by an assistant, will enable the operator to dislodge the stone.

It is not very uncommon to hear of operations for the removal of calculus, in which it is said that the stone was adherent to the bladder. But it is quite certain that evidence resting solely on the sensations of the operator while in the act of removing the stone cannot be regarded as of much weight, since many conditions may occasion difficulty in its removal, erroneously suggesting to the mind the existence of some organic connection between the bladder and the foreign body. It may be said that a kind of organic connection between the inner coat of the bladder and a stone has been observed in the subject, but the phenomenon is excessively rare. A few trustworthy examples are appended in a note below, two of them having been examined by myself.[2]

The mucous membrane of the bladder is, although very rarely, found to be coated with a layer of adhering calculous matter, and this is one of the forms of 'adherent calculus' that anatomical researches have produced. In the Museum of the Royal College of Surgeons is the preparation of a bladder (No. 2024), the mucous membrane of which is studded with small calculi, partially embedded in minute sacculi, but between the calculi the mucous membrane is covered with a thin layer of

[1] Excellent examples of this condition may be seen in the Museum of the Royal College of Surgeons. The preparation No. 2016, for example, is that of a bladder divided into an upper and lower cavity by a partial contraction in the middle; the upper portion was filled by a calculus, which it would have been next to impossible to extract by Perineal Lithotomy.

[2] A case met with in the dissecting-room of the Middlesex Hospital. A man aged 60 years had three calculi in his bladder, two being adherent; fibres of submucous tissue being incorporated with the calcareous substance. They were carefully dissected by Mr. Nunn. See *Trans. of the Path. Soc.* vol. vi. page 250.

A smaller calculus, similarly adhering, was found at the Middlesex Hospital by Dr. Vander Byl, in the body of a woman aged 50. *Trans. of the Path. Soc.* vol. ix. p. 296.

A very large calculus was found adhering to the upper part of the bladder by Mr. M. Henry, at an operation for Lithotomy. The stone was carefully examined afterwards, and a layer of closely adhering membrane of recent formation was found attached to one of its ends. *Idem*, p. 342.

calculous material; at least half the inner surface is thus coated. This condition would be a very embarrassing one in any operation. No. 2025 exhibits a similar appearance, only much less marked in degree. In No. 2023, the prostate has an enlarged median lobe, which is similarly coated: several small sacculated stones co-exist. The following case occurred to Mr. Wormald at St. Bartholomew's Hospital. A lad aged 19 was admitted with symptoms of stone. When sounded, calculous matter was felt with the end of the sound in every direction. The circumstances of the patient were regarded as unfavourable to operation, and he died in a few weeks. At the post-mortem examination a thick crust of concretion concealed the entire mucous membrane of the bladder, and could be peeled off in flakes. The kidneys were the seat of tubercular deposit.[1]

There are several accidental circumstances occasionally met with in Lithotomy, which, not exposing the patient's life to risk, cannot be comprised in a discussion on the difficulties and dangers of the operation; but which are, nevertheless, productive of great annoyance, and even of misery, to those who are, unfortunately, the subjects of them. These will be enumerated here as accidents concurrent and consecutive.

Taking them in the order of their occurrence:—

1. The first accident which may be met with is that of wounding the rectum. It may occur if the incision is placed too low down in the region, within an inch above the anus, especially if the knife is entered close to the raphé, from which, in this situation, it ought to be from three to four eighths of an inch distant. Otherwise it will not happen, if the knife be held with a moderate degree of obliquity, and proper care be taken to guard the position with the left hand, unless the bowel is unusually capacious, as in some elderly subjects; or is distended with fæces, as may happen when the preliminary purge or enema has not acted before the patient is placed on the table. The accident may take place in the first, or in the second incision, or while withdrawing the knife, if the operator enlarges the opening in that act. No doubt also it is more likely to happen if the operator makes a deep thrust at his first incision, with the view of reaching the staff at once; but if the

[1] This case was recorded in *Med. Times*, Nov. 19, 1859.

first incision is carried only through the skin into the cellular interval, and the finger be used to separate the tissues and feel for the staff, before the knife is again employed, the risk of injury to the bowel is less. In any case, however, when an incision into the bowel has been made, and it is only small, no notice need be taken of it; if it is considerable, most authorities have advised that the opening should be freely enlarged through the margin of the bowel and sphincter. But the necessity for this proceeding is by no means proved. Probably, the best method is to leave the parts untouched, and to reserve division of the sphincter until the necessity of it appears from the non-cicatrisation of the wound, as such cases have been known to recover soundly when not interfered with.[1] At worst, usually, a small urethro-rectal fistula remains, which may be much diminished, or even wholly obliterated, by the introduction of a wire heated by the galvanic current, the bladder being first emptied and a vaginal duckbill speculum placed in the rectum. I believe no operator can perform lateral lithotomy on many elderly patients, in whom the rectum is sometimes enormously capacious, and may become distended by flatus or otherwise at any moment, without sometimes making an opening into the bowel. I have had three cases myself among my numerous lithotomies, at upwards of sixty years of age, and think it right to state this fact. Sometimes sloughing of the thin septum between the wound and the rectum will take place, and an opening show itself ten or fourteen days subsequently. Of this I have certainly seen two examples.

2. The removal of a portion of the prostate gland by laceration, or otherwise, is not a very uncommon accident with elderly patients. It may occur in two very different ways: first, it sometimes, but rarely, happens that the section of the prostate divides, or exposes freely, one of those small rounded tumours which so frequently exist embedded in the

[1] Mr. South states that he has seen only two cases of wound in the rectum, both of which healed well without any incision.—*Chelius' Surgery*, vol. ii. p. 606, Lond. 1847. Samuel Cooper says he saw it 'in three or four cases, but no serious consequences were the result.'—*Surg. Dict.* 7th ed. p. 935. Mr. Key only once witnessed this accident, and no bad result occurred. Dr. Gross gives a decided opinion against interference.—*Urinary Organs*, 2nd ed. p. 590.

substance of the organ, especially in elderly patients; under which circumstances the tumour becomes very easily enucleated. Secondly, when an outgrowth, more or less projecting or pedunculated, exists at the neck of the bladder, springing from the prostate into the vesical cavity, it may be caught between the blades of the forceps when seizing the stone, and be torn off in the act of removing it. I have myself witnessed this accident three times, and twice have removed such a tumour myself, and in no one of the cases did it appear to endanger life.[1] Dr. Keith informs me that he has met with it nine or ten times, and he is not aware that material injury resulted in any instance. Mr. Key made a similar observation.[2] Civiale states that he has frequently removed them thus.[3] Nevertheless, it appears to have sometimes prolonged the recovery by retarding the healing of the wound. On the other hand, the patient has been known to pass urine more freely than before, but whether this has been due entirely to the removal of the stone, or whether in part also to the loss of an obstruction, it is not possible to decide. However, there can be no doubt that the accidental removal of these growths should be avoided, and with this object the left index-finger, when exploring the bladder, and subsequently when acting as guide to the forceps or adjusting the position of the stone, should ascertain also, if possible, the presence of prostatic growth, and guard it from inclusion or laceration, when the operator is dealing with a patient of advanced age. If, when such a growth exists, he determines to get rid of it, as is sometimes done, it is better to do so with probe-pointed scissors than by tearing it off, or even than by excising it with the scalpel.

3. It is sometimes discovered within a few days after the operation that one or more calculi, or fragments of calculus, remain unextracted. This is a serious accident and ought very rarely to happen, although, from unavoidable circumstances, it may occur to the most experienced operators. The course to

[1] I had the opportunity of exhibiting, at the Pathological Society of London, three tumours of this kind, weighing five scruples, removed from a patient the subject of two large stones, who recovered.—*Path. Trans.* vol. xiii. p. 155.

[2] 'Remarks on the Lateral Operation of Lithotomy,' *Guy's Hospital Reports*, 1837, p. 23.

[3] *La Lithotritie et la Taille.* Paris, 1870, p. 455.

be adopted must depend, in some measure, on the condition of the patient. When only small fragments are present, they will frequently pass spontaneously by the wound. If otherwise, and the patient is in course of recovery, and his prospects are good, the first step is to ascertain precisely the size of the fragments or calculus remaining. This may be done by a lithotrite, and, if not large, the fragment or calculus can be crushed and removed at once. If it is of medium, or rather large size, it is quite easy within a fortnight of the original operation, to dilate the wound, and remove the foreign body with the forceps. I have done this once only in a case of my own, and assisted a brother surgeon once in similar circumstances. Each case was operated on the second time about nine or ten days after the first, and each made a good though a slower recovery than usual.

Calculous incrustation, always phosphatic, and coating the wound after lithotomy, is sometimes very troublesome. It occurs between the seventh and fourteenth day after, or thereabout. When slight, a few hip-baths, or washing with warm or acidulated water, will remove it. Once or twice I have found it so thick and so extensively deposited, as to be obliged to remove it by the forceps. In one case only it coated the whole track of the wound, from the perineum to the neck of the bladder, and from the internal extremity a small calculus was formed in the bladder itself, and was crushed by me before the end of the fourth week. The wound was some months in healing, but did so at last, and the patient is at this moment in excellent health.

4. Secondary hæmorrhage. Hæmorrhage occurring at, or immediately after, the operation, is an accident liable to occasion considerable hazard; it has, therefore, been considered in describing the steps of Lateral Lithotomy (see pages 37, 38). But it is sometimes secondary, taking place at a period of seven to ten, or even fifteen days after the event, and then it must be regarded as an accident which no foresight could have prevented. Four cases have occurred in my own practice, in two with a fatal result, and in circumstances which, had it not happened, there was every reason to expect a successful issue to the case. One was a case of Medio-bilateral Lithotomy.

The other occurred in a gentleman aged 55, quite suddenly and unexpectedly, on the twelfth day after a lateral operation.

The remedies must depend on the character and continuance of the flow. If controllable by the ligature, no means is so safe and certain; but at this stage such a result is not to be expected, since the external wound has generally by this time become small. The finger should be introduced, to ascertain whether by pressure with its point the source of bleeding can be stopped; if so, a piece of lint attached to a probe, or stick, and dipped in a solution of the perchloride of iron, should be applied to the spot. Sometimes the actual cautery has been found effectual. At the same time local cold applications should be made to the perineum and adjacent region. Mr. South records several of these cases in which pressure with the finger on the pudic artery for several hours was necessary in order to save life. Were a case to occur to me now, I should open up the wound and at once insert the air tampon, described page 19, and I do not doubt it would suffice to arrest the hæmorrhage.

5. Occasionally the wound which follows the operation heals very slowly, and results in the persistence of a fistulous track from the prostatic urethra to the perineum. This is an exceptional occurrence, and most operators occasionally meet with such cases. The fistulous opening depends sometimes on the deposit of phosphatic matter on the raw surfaces of the wound from the urine; a condition already referred to. The deposit may become permanent at the upper extremity of the passage; in other words, may form a calculus there, which, until removed, will assuredly maintain the patency of the fistula. If, then, we have ascertained that no foreign matter exists in the track, the whole internal surface of the fistula should be lightly touched with the actual cautery in the form of a heated wire, or with the galvanic cautery, or with a probe coated with nitrate of silver. After this the patient, having previously learned to do it with facility, should withdraw all his water on every occasion for three or four weeks by catheter, provided he can accomplish it easily, so as to prevent any flow through the fistulous channel. By a perseverance in this plan success may be obtained in several, perhaps in most, cases. It

has been recommended to allow a catheter to remain in the urethra and bladder for some days, with the view of withdrawing all the urine in this manner. But this mode of treatment is not successful. Urine soon trickles by the side of the instrument and so enters the fistula; and the urethra itself becomes irritated, and much purulent discharge is secreted from its mucous membrane, conditions very unfavourable to the healing of any fistula. On these grounds, and from the observation of its effect in numerous cases of urethral fistula, I very much prefer the employment of the catheter by the patient on every occasion of his requiring to pass water. There are still a few cases met with, which it must be confessed appear to be wholly intractable, and these for the most part probably owe their character to the existence of disease in the prostate gland.

6. A result of the lateral operation, which very seldom occurs, is sexual impotence. This condition has been attributed to the division of the seminal duct which lies nearest to the line of incision. There is good reason, I think, to doubt the correctness of this supposition. First, the line of incision ought never to intersect the duct even on the side operated on; the knife must be carried almost vertically downward in order to endanger it; indeed, if it be employed with even a less degree of obliquity than has been previously advised, the vessel will still be safe. Secondly, the duct of the other side must in any case remain intact, for it is difficult to conceive the possibility of an operator dividing both; and if one is left uninjured it will be superfluous to state that sexual impotence following the operation is not the result of the surgeon's knife. The real cause of this happily exceedingly rare sequence to the operation is rather to be sought in some morbid change affecting both the seminal ducts, and which may be produced by the lesion of Lithotomy as it now and then is by other lesions. When prostatitis has terminated in chronic prostatic abscess (I do not refer to periprostatic, so often mistaken for it), and this has involved in destruction all, or nearly all, the structure of the gland, the ducts sometimes become obliterated or sealed by plastic effusion, and loss of sexual function results. The vesiculæ seminales may then be found exhibiting the same condition, having become the seat of abscess, their structures

being injured or atrophied. This condition I have seen, not only following abscess, but also as the result of tubercle in the prostate and vesiculæ. When, therefore, loss of virile power follows Lateral Lithotomy, I believe it is generally due either to sloughing from violence, or to inflammatory action in and around the ducts and vesiculæ seminales, destroying the function of these organs as conduits for spermatic fluid; and not to the mechanical division of one or both of them by the knife. The fact is an extremely difficult one to verify: long-continued and patient watchfulness for the opportunity of dissecting cases can alone determine precisely the actual lesion which has destroyed the function in question.

7. Incontinence of urine occasionally follows the operation. It occurs more frequently in patients below the age of puberty than in adults. Apart from those rare instances of extremely large stone in which the neck of the bladder has been extensively damaged, no very clear explanation of the cause can be afforded, although speculative statements respecting it have been frequently made. Nor, perhaps, is it possible to offer any therapeutical considerations relative to it, differing from those which are available for incontinence occurring in ordinary cases, the numerous and varied modes of dealing with which need not be recapitulated here; the following fact, however, is worth notice:—A very successful case of Lateral Lithotomy for large stone, which I performed in 1869, was followed by this unpleasant consequence for many months. The patient was otherwise in perfect health. Scarcely venturing to hope for good result, I cauterised the neck of the bladder in the summer of the present year, 1870, since which there has been almost no incontinence. The effect was as complete as it was unexpected.

8. A very unfortunate accident remains to be noticed, which is occasionally, but by no means frequently, encountered: viz. inability to discover any stone in the bladder when the operation has been performed.

In the first place, the stone may not be found because it is so small as to be washed out with the first gush of urine from the bladder. I have seen Lithotomy performed for a stone no larger than an apple-pip, and no small embarrassment arising in

consequence of the occurrence named. It has happened, not very unfrequently, that after a long and fruitless search in the bladder, a very small concretion has been found on the floor, or in the receptacle placed to receive the blood and urine, or embedded in a clot, or even adhering to some part of the operator's dress. But this ought not to happen, mainly because cases in which the calculus is so minute should not be subjected to Lithotomy at all. We shall see hereafter in the final application, in Chapter XIV., how necessary it is, before performing any operation, to ascertain the size of the stone, that we may select an operation which is adapted to it.

Again, an operation may prove fruitless because the stone is fixed in a cyst of the bladder, and cannot be detached from its place. This is very rare; because if the presence of a stone can clearly be verified by means of the sound, it is generally sufficiently free in the bladder, although it may be partially encysted, to be removed by some means. See the management of encysted calculi at page 95. More rarely still are the following conditions met with. A bladder is sacculated, and one of its sacs is large, and communicates by a considerable opening with the original cavity. The latter state is rare, such openings being almost always small. But the patient is also the subject of calculus. The stone is usually in the bladder proper, where it is readily struck by the sound, but occasionally escapes into the sac, where there is no possibility of reaching it. Here, as in the preceding case, if its presence cannot be made out satisfactorily with the sound at the time of operation, no incision should be made.[1] Lastly, no stone may be found at the operation, because none has ever existed. The surgeon may have repeatedly sounded his patient, may have satisfied himself and others that he is the subject of calculus, and yet no stone whatever may have been present. Thus, the existence of a polypoid tumour in the bladder, probably with some calculous deposit adhering to its surface, has deceived the surgeon. Such a case

[1] It may be as well to say that there is a material distinction between the terms 'cyst' and 'sac' as used here. By cyst I mean a cavity in the walls of the bladder, fitting to, and embracing closely, the stone which is always lodged in it; by sac, one of those large dilatations of one or more of the vesical coats, found independently of stone, but in which one may sometimes be lodged.

was many years ago cut for stone; the preparation is now in the Museum of St. Thomas's Hospital.[1]

Again, it has happened that a rugose and hardened condition of the muscular fibres of a hypertrophied bladder has misled the surgeon, when sounding, into the belief that he has struck a stone. Still, nothing like the clear and ringing sound of a calculus can be elicited from such a source. The bony walls of the pelvis particularly, according to some authorities, may furnish similarly erroneous impressions to the operator. But in both these circumstances, the tactile impression and the audible sound are dull and heavy, not so clear and defined as the metallic click of a stone. Yet the fact exists that highly experienced and able surgeons have been misled by one or other of these causes.[2] Few have the courage and the honour to enlighten their brethren by publication of the case after an experience of this kind. Mr. Paget, of Leicester, has very recently offered a noble exception to this remark, in furnishing the particulars of an instance in which he operated without discovering stone. In his case, that of a child, the click, although heard by several, was not satisfactorily distinct on any of the occasions of sounding which had taken place, while the symptoms were exceedingly severe. The operator, however, desired to relieve the sufferer if it were possible, hoping that a partially encysted stone might be the cause. Death occurred after two days, and at the post-mortem examination no calculous matter was found in the bladder, but the ureters were enormously dilated. On repeating the act of sounding, the click was reproduced, and it was discovered to be due to the point of the sound impinging upon the iliac portion of the brim of the pelvis, the edge of which was unusually thin and sharp.[3] This case, in some measure, confirms the opinion of Mr. Gutteridge, of Birmingham, who had, with a like admirable candour, previously published the fact that he had 'operated in three cases, wherein the most confident assurance the sense of touch was capable of giving was had respecting the existence of a stone,' and had,

[1] South's *Chelius*, vol. ii. p. 551.

[2] Cheselden, Roux, Dupuytren, and Crosse have operated and failed to find the stone.

[3] *British Med. Journal*, Dec. 14, 1861.

nevertheless, found none. The patients lived, but by subsequent inquiry and experiment on the dead body, Mr. Gutteridge came to the conclusion that the deception is due to the sound striking some part of 'the bony fabric of the pelvis itself;' and he defines the precise spot to be the spine of the ischium, a part rarely touched, except when, the suspected stone not being at first found, a prolonged and extended search is made; and he adds, 'the sound or staff being brought to the ischiatic ring, on either the right or the left side, and kept pressed there, will procure a sensation like that caused by touching a large rough stone.'[1]

After experience and statements like these it may appear somewhat hardy to say that I am unwilling to relinquish my belief in the possibility of distinguishing between the click of a stone, and a sound produced in the manner described. I have repeated the experiment on the dead body several times, and I am quite unable to elicit a note, or to perceive a resistance by striking the sound against any portion of the bony walls of the pelvis, which is at all comparable with the results obtained by striking any kind of foreign body I have ever encountered in the bladder. The question is one of great interest, and is well worthy of further examination. Undoubtedly a certain very small number of patients who are not the subjects of calculus, have been submitted to the incisions of Lithotomy, under the impression that they were so. But I believe that this happens less frequently now than in former times. As the art of diagnosis becomes more cultivated, and the means of exercising it are improved, the number of these cases will be diminished. With our present means and knowledge, I venture to believe the mistake ought not to occur.

[1] A Memoir on the subject, published by Mr. Gutteridge, Sept. 1860.

CHAPTER VII.

THE RESULTS OF LITHOTOMY.

My own Inquiry, embracing 1827 Hospital Cases by numerous English Operators.—Complete Analyses of them.—Affords a True Result of Lateral Method before Lithotrity was general.—Results of Cheselden's Practice.—And Martineau's.—Now that both Crushing and Cutting Operations are employed, results must be different.—Fergusson's Cases.—Keith's.—The Author's.—Results of other forms of Lithotomy.

An inquiry into the results of Lithotomy will in the future be a pursuit of a different character from that which it has been in the past, and will yield different conclusions from those which have hitherto been attained by it. It is much less easy to estimate its capabilities now than it was formerly; for when the Lateral Operation alone was applied to all patients with stone, its results were calculable by enumerating the cases, their ages, and the ultimate fact, whether recovery or death.

Several years ago I made a laborious and extended inquiry relative to that operation in this country; and it is a matter of no little satisfaction that the matter was accomplished then, as the opportunity will probably never recur. The crushing operation has been found too successful for Lateral Lithotomy to become again the invariable and only resource for calculous patients, as it was in old time. Before Lithotrity was much employed in Great Britain, I had the means of ascertaining the capabilities of Cheselden's method, in those districts where it was the only operation practised; and I think I am entitled to say that, by adopting a more rigid system of inquiry than had ever been pursued before, I obtained nearly 2,000 cases of perfectly authenticated examples in the following manner, re-

jecting a large number of proffered data, because they were unaccompanied by all the facts which I considered necessary, or had occurred in circumstances which appeared to impair their value as evidence.

I required the whole of the hospital experience of a district, a written note of every patient, including his age and the result of the operation, and during a long term of years, corresponding with which the Lateral Operation alone should have been employed. On account of imperfect records, many hundreds of cases were rejected, since well-ascertained facts alone could be serviceable. Thus, also, in many reports which I received, the operators selected their best cases for Lithotrity, others for the Median Operation: on this account I did not include Mr. Teale's valuable and well-known experience. Others, again—and this will apply also to the gentleman just alluded to—were men of so great celebrity in their districts, that the worst and oldest examples of the complaint were attracted from afar, and contributed to make such an experience by no means a fair and average product of the neighbourhood. I was therefore compelled to exclude Mr. Crichton's long and valuable list in my possession, because it contained a most unusual proportion of aged patients. But the most considerable sacrifice of this kind which I have made is the exclusion of Dr. Keith's large and admirable experience, and on the same ground.

The experience of the Glasgow Infirmary, numbering 152 cases, is not employed in this department of the inquiry, because a large proportion had been operated on by the method of Dr. Buchanan. So, also, that of the Bristol Royal Infirmary, kindly afforded me by Mr. Pritchard, simply because it was not possible to ascertain correctly the ages of all the patients submitted to operation. The same remark applies to some of the metropolitan hospitals, to which access has been kindly afforded.

Such care is essentially necessary in order to obtain valid numerical results. My table, then, is composed as follows:—

The experience of the Norfolk and Norwich Hospital, including the 669 cases published by Mr. Crosse, in his well-known and valuable work, and 124 more cases immediately

following these, during a subsequent period, and not interfered with by other modes of practice. For these I am indebted to my friend, Mr. Cadge, of Norwich.

The records of the Radcliffe Infirmary, Oxford, up to the present time, for which I am indebted to Mr. E. L. Hussey, of Oxford. The entire experience of University College Hospital, London, from an early date until very recently, for which my best thanks are due to each and all of my esteemed colleagues.

A detailed account of all the cases met with at the Leicester Infirmary, obtained for me by my friend Mr. Thomas Paget. The experience of the Leeds Infirmary, for which I was indebted to my friend, the late Mr. Nunneley. That of the Birmingham General Hospital for the last ten years, kindly placed at my disposal by Mr. O. Pemberton. The records of Guy's Hospital, carefully prepared by Mr. Thomas Bryant, who most readily permitted me to make any use whatever of them. The experience of the surgeons of St. Thomas's Hospital, for which my thanks are due to Mr. Solly, Mr. Le Gros Clark, and for valuable aid in my inquiries to my friend Dr. Bristowe.[1]

I am also a debtor for much kindness and pains to Dr. G. M. Humphry, of Cambridge, in affording me the experience at Addenbrooke's Hospital; an additional number of 183, including 13 deaths, a result which is so much better than any other, viz. 1 in 13 cases, that I am compelled to mention and register it separately as well as collectively. Once for all, let me say that, respecting every one of these cases, I have received, and now possess, exact particulars in writing from the most competent person to furnish it: those cases only excepted which have been referred to as already published by Crosse and South.

The sum total, with Cambridge, is 1827 cases of Lateral Lithotomy, including 229 deaths, or 1 in 7·977, almost exactly 1 in 8. Without Cambridge it is 1644 cases, with 216 deaths, or one in 7·62, in round numbers 7½.

The separate results are as follows:—

[1] A portion of the St. Thomas's cases are the more recent ones (those in which all particulars were present), belonging to the well-known Table published by Mr. South, in his edition of *Chelius' Surgery*, vol. ii. p. 635.

Norwich (Crosse) . .	669	cases, with	91	deaths, about	1 in	7⅓	cases.
Since that time .	124	„	15	„	1 in	8¼	„
Oxford	110	„	14	„	1 in	8	„
Leicester	90	„	8	„	1 in	11	„
Leeds	29	„	4	„	1 in	7¼	„
Birmingham . . .	102	„	10	„	1 in	10	„
Guy's Hospital . . .	230	„	33	„	1 in	7	„
St. Thomas's do. . .	200	„	29	„	1 in	7	„
University Coll. do. .	90	„	12	„	1 in	7½	„
	1644		216				
Cambridge	183	„	13	„	1 in	14	„
	1827		229				

It must be remembered that these ratios of death alone furnish no certain index of the success which has followed the operation at different institutions. Before all things, indeed, it is necessary to know also the relative proportions of young and aged patients included in the number, since the rate of mortality differs so greatly at the different extremes of life, an element so constantly lost sight of in discussing the mortality following Lithotomy. Taking the whole number of 1827 cases, no less than half of them occurred in patients under the age of thirteen years. Applying this rule to any of the separate reports, we have an easy and tolerably accurate mode of testing the relative proportions in question. In metropolitan hospitals, to which many patients from the country are sent up, these being almost always adults, the proportion of aged patients is larger than that in the provincial hospitals. Thus in the records of University College Hospital, instead of half the number of patients being below thirteen years, those below that age formed only two-fifths of the total, from the unusually large proportion of elderly cases. In the Norwich Hospital the proportion of adults is also larger than the average, while that of Cambridge has a little more than the common proportion of children. The metropolitan hospital of Guy's has, however, also an unusually large proportion of young cases.

But for any such inquiry it is necessary to deal with the question of age much more carefully and minutely. We have to examine the proportion of fatal cases after the lateral operation as occurring at several different periods of life. And I have dealt with this subject in a manner somewhat differing

from that usually pursued. Thus it was soon obvious, in studying my figures, that little was to be gained by adopting the usual method of classifying the results of operation during periods of life artifically fixed as from 1 to 10 years, 10 to 20, 20 to 30, and so on, the product of which is extremely deceptive. It was necessary to examine every year separately, then to group the years, and to observe what natural indications the facts presented. The following plan, after many trials, appeared to me best adapted to afford the simplest and truest aspect of the subject at a single glance.

During the years	Cases.	Deaths.
1 to 5, inclusive.	473,	including 33, or 1 in $14\frac{1}{3}$ cases.
6 to 11, inclusive.	377,	„ 16, about 1 in $23\frac{1}{2}$ „
12 to 16, inclusive.	178,	„ 19, „ 1 in $9\frac{1}{2}$ „
17 to 29, inclusive.	162,	„ 22, „ 1 in $7\frac{1}{3}$ „
30 to 38, inclusive.	75,	„ 7, „ 1 in $10\frac{1}{2}$ „
39 to 48, inclusive	100,	„ 17, „ 1 in 6 „
49 to 58, inclusive	191,	„ 40, „ 1 in $4\frac{3}{4}$ „
59 to 70, inclusive	233,	„ 63, „ 1 in $3\frac{3}{4}$ „
71 to 81, inclusive	38,	„ 12, „ 1 in $3\frac{1}{6}$ „
	1827	229

In studying this table, we see what Lateral Lithotomy is capable of effecting at various ages At the earliest ages—the first year only excepted—one death occurs in about fourteen cases, the rate of mortality falling to one only in twenty-three cases between six and eleven years. As we pass from twelve to sixteen years, the death-rate rises, for during the period when puberty is declaring itself, as sexual activity becomes developed, we find the increased susceptibilities thus aroused raising the mortality to one in nine and a half; and from thence to the thirtieth year, being until then about one

in seven cases. As manhood becomes established and the strength increases, the death-rate diminishes to one in ten and a half between the thirtieth and the thirty-eighth year. But during the succeeding ten years, organic morbid changes beginning to set in, and the influence of continued depraved habits to tell on the constitution, the rate rises to one in six. These causes become more active, and at the same time the powers of life diminish, as age progresses from fifty to seventy years, the rate rising to one in four and three-quarters between forty-eight and fifty-eight, and gradually to one in three and three-quarters between fifty-eight and seventy, and finally to one in little more than three between seventy and eighty.

Now let us revert to the two great groups, separated from each other by the event of puberty. The great group of infancy and boyhood, ceasing as adolescence begins, say at sixteen years, and comprising more than half the entire number, were operated on with a mortality of 1 in 15½ cases. Subtracting all these, we shall now learn its product in relation to adults. Regarding this great group as composed of all ages above 16 years,—and it matters little to the result whether we commence at that age or at 20 years,—we find just 800 individuals left. Among these were 161 deaths, giving a mean of rather more than one death to every five cases. This, indeed, there can be no question, is a good average result of the operation as applied to average adult males only, eliminating the disturbing influence of the large number of cases under puberty; and it may be said here that this is the total to which the results of Lithotrity are to be brought, for purposes of comparison, since that operation is applicable to adults alone.

A reference to the experience of some past operators may be briefly mentioned since it furnishes matter of interest in connection with the present inquiry. The first trustworthy record we possess is that supplied by Cheselden himself, and it presents his entire experience. That famous surgeon at the close of his career, reported as follows. Telling us first that '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 10 and 20 years, and of these 4 died. *Only* 46 *were above* 20 *years of age, of these* 13 *died.*[1]

Long after this comes Martineau's (of Norwich) remarkable and exceptional series of successful cases, viz. 84 operations with 2 deaths; this number did not represent his entire experience, which I have learned on good authority at Norwich was by no means equal in result to the portion published, his success being indeed, as regards the total, not above the usual average. Of those 84 cases, however, 6 were females, and 36 of the others were under 20 years of age; leaving 42 cases of twenty years old and upwards, among which were the two deaths.[2]

I have already said that we can no longer examine Lithotomy under the conditions of the past. At the present time, almost all the cases of small stone, and those occurring among the healthy patients, at all events, are submitted to Lithotrity. For some past time, and in the future, Lithotomy in adults must be regarded as an operation almost exclusively applicable to unusually large stones, often in patients with bad health. Instead of looking for one death in four or five cases, which I have shown to be a good result among average adults, we shall find a much larger proportion of fatal consequences. This again will be modified by the habit of the operator in selecting patients for the two methods. If he divides his cases pretty equally between the two operations, Lithotomy and Lithotrity, he will have a much smaller proportion of deaths from Lithotomy, than if he applies the crushing operation to four cases out of five. If he takes this latter proportion, he will have made Lithotrity responsible for some difficult and unhealthy cases, but four out of five will have escaped the knife. His Lithotomy will in this case be performed on *selected bad cases*, and the mortality will necessarily be high. His Lithotrity will have a higher death rate *per cent.*, but the very strong probability is that there will be a smaller percentage of deaths on the *sum total of his stone cases.* Thus it is clear that the mode of selecting, and the ratio of apportioning, patients for

[1] *Cheselden's Anatomy*, &c. 5th ed., London, 1740, p. 333.

[2] *Trans. of the Roy. Med. and Chir. Soc.* vol. xi. p. 402.

the two operations, must be known before the results can be exactly judged.

In illustration of this subject, the experience of Sir William Fergusson may be cited, as reported by himself in his lectures at the Royal College of Surgeons in 1865. The total number of his cases at that time was 271. Of these, 219 were *adults* (but certainly some were females), and 110 of them were treated by Lithotomy, with thirty-three deaths; while 109 were treated by Lithotrity, with twelve deaths; total, 219 cases with forty-five deaths, a mortality of adults treated by both methods of 20 per cent., or one death in every five cases. The remaining fifty-two cases were in children, with two deaths; an illustration, as the operator points out, of the need to report them separately. I wrote to Mr. Henry Smith, who was so intimately associated with Fergusson, for any information he might possess relating to his subsequent experience. He replies that he does not possess any, and believes 'that his additional cases would not amount to very much.'

Another valuable experience is that of the late Dr. Keith, of Aberdeen, so long the respected and successful surgeon to the Royal Infirmary there. At the close of his career, he placed at my disposal very complete records of all his cases of operation for the stone. These had been kept with scrupulous care and accuracy, and I had the opportunity of seeing the calculi themselves at Aberdeen. The total number of all ages was 304 cases, from which must be deducted three cases in women, and twenty-three cases of youths and children; among whom there was one death only. Of the 278 *male adults* remaining, 160 were operated on by Lateral Lithotomy, and among them were thirty-eight deaths, or one in over four cases. Then 118 cases were operated on by Lithotrity, and among them were seven deaths, or one in every sixteen and a half or seventeen cases. Taken collectively, in the 278 adult cases treated by both operations, there were forty-five deaths, or a total mortality of eighteen per cent., or one death in every six and a half cases.

It will be observed that his proportion of Lithotrity to Lithotomy was still smaller than that of Sir William Fergusson. In both cases the predominance of the cutting operation was due

to the fact, that at the outset of the career of each of these distinguished surgeons, Lithotrity had scarcely been accepted in this country, and was rarely attempted.

I can now offer as a contribution to this subject the result of my own experience up to the end of the year 1876, and comprehending every one of the *adult male* cases I had operated upon up to that date, a total of 500 cases. I presented a complete summary of these, together with the stones themselves, to the Royal Medical and Chirurgical Society of London, in the spring of 1878.[1] Of these 500 cases 422 were operations by Lithotrity, and seventy-eight were by Lithotomy; the relative proportions were, therefore, two cut for every eleven crushed, or one cut in every six and a half 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; it should be added that there is one only of twenty years of age, and only twelve patients in the entire list are below thirty years.

The proportion of patients allotted to the two operations respectively is, it will be seen, very different to that which the preceding operators named had adopted. Throughout the series the smaller and middle-sized stones and the more promising cases were reserved for Lithotrity, while, as a necessary consequence, Lithotomy has been employed only for exceptionally large and difficult cases. As, certainly, during my life I have never rejected five cases, if, indeed, so many, as unfit for any operation, it follows that many difficult and almost hopeless cases were to be found amongst those on whom the cutting operation was performed. The number of deaths was as follows:—In the seventy-eight cases of Lithotomy, there were twenty-nine deaths, or about one in two and three-quarter cases. In the 422 cases of Lithotrity there were thirty-two deaths, or one death in rather more than thirteen cases.

Taken collectively, in the 500 adult cases treated by both operations, there were sixty-one deaths, or a total mortality of twelve per cent., or one death in eight and a half cases.

To the late Mr. Allarton I have been indebted for the record of 139 cases of Median Lithotomy at all ages, with thirteen

[1] *Trans. Roy. Med. Chir. Soc.*, 1878, vol. lxi.

deaths, or one in eleven cases. Not to forestall future observations, it is necessary to note that this operation, being usually reserved for stones known or believed not to be very large, we are entitled to claim from it a result better than that of Lateral Lithotomy. This does not include the Norwich cases of the Median Operation, which my friend Mr. Cadge informs me amount to between forty and fifty within about four years, and the mortality from which has been about the same as by the lateral method. But it is only fair to state that there was rather a full proportion of unpromising cases among them.

Dr. Buchanan reported upwards of sixty cases of his operation, performed by several surgeons, with, as nearly as possible, the same result as that exhibited by Mr. Allarton's table.

From the history of the Bilateral Operation, we know that in the hands of Dupuytren and his contemporaries, eighty-five male cases were cut, with nineteen deaths, or about one in four and a half cases. In other hands it is said to have been more successful.

Of the Medio-bilateral Operation we have no large experience to examine. I have performed it in a few cases, believing, at one time, that it might present some advantages over Lateral Lithotomy, but I do not find this to be the case, so far as I can judge. I used it as an exceptional proceeding for large stones not amenable to Lithotrity, and always in elderly and infirm men. The result which my experience afforded me, and which I was not prepared for, was that the hæmorrhage was often unusually large and troublesome to repress. Besides this, the rectum was easily wounded from its necessarily close proximity to the incision, for a large stone, not always perhaps by the knife, but by the removal of the stone tearing the thin septum between the wound and the bowel. On these grounds I have discontinued the operation, having performed it last in January, 1868, and have since substituted the Lateral Operation.

From the history of the Recto-vesical Operation, we learn that a nearly equal number of cases gave a result of about one death in five; and a similar proportion of the patients recovering were the subjects of fistula subsequently.

The Suprapubic Operation has given results said by some to be about one death in four cases. Dr. Murray Humphry,

of Addenbrooke's Hospital, Cambridge, performed it successfully for a boy of fourteen years. He collected from authentic sources 104 cases, of which thirty-one were fatal, equal to one death in three and a third cases. Of course it is to be recollected that this, as well as the preceding operation, is rarely performed for other than very large stones, and mostly in adults. He remarks, also, that 'the dangers of the high operation do not increase in so great a ratio with the size of the stone' as in the lateral operation.[1]

[1] 'Case of High Operation,' *Trans. Prov. Med. Ass.* 1850, vol. xvii. p. 103.

PART II.

LITHOTRITY.

CHAPTER VIII.

LITHOTRITY.—INTRODUCTORY.

General Observations relative to its Rise and Progress.—The Importance of Treatment preliminary to the Operation.—Its Nature, General and Local.

I PROPOSE in this, the second portion of my work, to illustrate concisely the principles and practice of modern LITHOTRITY.

By this term, since custom has popularised it, all those processes may be denoted by which the stone is broken up, crushed, and powdered in the bladder, and by which the débris are removed through the natural canal of the urethra without the use of the knife.

Lithotrity is the product of rapid growth. Sixty years ago it was but a theory. Forty-five years ago it had barely made good its claim to be admitted into the list of recognised surgical operations. Each succeeding ten years has witnessed great improvement in its applications, and its increased capabilities for good.

The Lithotrity of to-day is not the Lithotrity of even ten years ago, but a safer and a better operation—an operation which now is founded on principles, and regulated by well-defined laws deduced from a large experience; no longer consisting, as in its infancy, in the mere experimental application of a crushing instrument to any calculus which, being con-

sidered neither too hard nor too big, might be located in a fairly healthy bladder.

It is, therefore, the Lithotrity of to-day, its principles, and the practice logically deduced from them, which it will be my aim to expound and to illustrate here.

There is reason to believe that calculous matter has been occasionally removed by Lithotrity at various early dates, but no attempt seems to have been made to apply the principle, generally or systematically, until A.D. 1813, when Gruithuisen, a surgeon in Bavaria, proposed a plan for seizing and reducing to powder, by drilling, a stone in the bladder. Subsequently, in 1819, Elderton, a Scotch surgeon, published a somewhat similar proposal. Meantime, in 1817, Civiale, of Paris, designed his earliest instruments; and was closely followed by Leroy d'Etiolles and Amussat, in the production of other instruments for the same purpose. It appears, however, that the first successful operations were undertaken in 1824, the honour of which belongs to Civiale, who performed them before a committee of the French Academy. Improvements in the method and in the instruments were subsequently made by Weiss, Heurteloup, L'Estrange, Costello, Charrière, and others, as well as by Civiale himself, whose experience in the application of Lithotrity must be regarded as exceeding that of any other operator. It is his method which, during my earlier operations, was closely followed and practised by myself; my own experience, however, now very large, led me to modify the character and action of the lithotrite, and the method, to a certain extent, has necessarily somewhat changed with it. With this, as well as after large opportunities of observing the practice of other operators, I do not hesitate to say that the operation has become more rapid and safer still than any previously practised. Still more recently, the proposal of Professor Bigelow to crush more completely, and to remove all débris by larger evacuating catheters—a mode of operating still on its trial—bids fair in competent hands to render Lithotrity more largely applicable, and perhaps more successful, than heretofore. The most modern and improved methods of performing the operation will therefore be described in detail in the next and succeeding chapters.

TREATMENT PRELIMINARY TO THE OPERATION OF LITHOTRITY.—There is one topic in connection with Lithotrity which I do not propose to consider at length here; the practical management of the operation itself being the main object in view. But it is impossible to pass it by altogether. I refer to the preparatory treatment which should precede, in some instances, the application of operative measures.

Among the calculous patients admitted into hospitals in the Metropolis, most show signs of general deterioration of the health; the result of pain, loss of rest, and other depressing influences of their malady. Much may often be done to improve their condition before deciding on, or proceeding to, the operation. Others, however, and especially some patients from country districts, present much more promising signs, even although they may have been for a considerable period the subjects of stone. Nevertheless, it is unwise to admit even these cases to operation after a rest of only three or four days, and the conventional aperient. It is an error, I believe, to operate on country patients, whether in private or in public practice, immediately after their arrival in London. However healthy the condition of such a case, it sometimes happens, if operative proceedings are at once undertaken, that the patient soon afterwards becomes the subject of fever and exhaustion, and he may even fall a victim to the attack.

A period of acclimatisation must be passed through by most of them, during which the system is not in a condition calculated to support favourably a capital operation. Soon after the arrival of a country patient in London, he occasionally becomes feverish, digestion is deranged, and sleep disturbed. Generally, a dose or two of mild aperient, a few days' rest and more than ordinary care in diet, restore him to his usual condition. Many persons, enjoying excellent health, suffer in this way in a change from country to town residence. The change involves altered diet, altered habits, and the presence of numerous sources of excitement, disregarded by the native, perhaps unknown to him, but strongly impressing, and often disagreeably, the sensorium of the stranger. When to these are added the numerous sources of anxiety and discomfort which a patient experiences when he is anticipating the crisis

which is to free him from it, but not without some risk to life, it is not surprising that some nervous derangement should sometimes manifest itself by troublesome symptoms.

Apart from these considerations, but little reflection may suffice to convince us, that in most cases it is unwise to operate on a bladder which is the subject of unchecked chronic inflammation, a condition not infrequent, although often absent, in calculous cases. When it does exist, incautious interference may set up acute cystitis and lead to mischief in the kidneys, and a fatal issue. Hence we should endeavour to allay the irritation of the bladder, to tranquillise the nervous system disturbed by local pains and broken rest, improve the digestive organs, and increase the general strength. If we can accomplish these objects, although at the sacrifice of a little time, prior to operation, we have a right to expect, other things being ordinarily favourable, the ultimate recovery of the patient.

We shall enjoin, then, for a few days, rest in the recumbent posture ; and, according to the necessities of the patient, attention to the secretions, regulated diet, local bathing, possibly, in some few cases, washing out the bladder ; and, if necessary, the use of opiates or other sedatives.

Demulcent drinks, decoctions of roots and leaves exercising specific effects on the bladder, may be also useful. Among them, I know none, in these particular circumstances, so valuable as a decoction of the underground stem of *Triticum repens* ; a pint to be taken in divided doses daily.

One element of the preliminary treatment, especially abroad, is the systematic employment of bougies, so as to accustom the urethra to the contact of a full-sized metallic instrument. Especially if the patient has not been the subject of catheterism previously, first a soft elastic bougie of middle size, and then metallic ones, is passed through the urethra every other day or so, increasing the size on each occasion. A little warm water is injected into the bladder if much pus or mucus is present, and the urine is alkaline ; or water containing a small proportion of nitric acid, or of acetate of lead, especially if phosphates are found in the deposit.

But this preparation by instrument is really necessary only

in exceptional cases. When the urethra is not quite ample, it may be dilated with advantage; or the external meatus may be divided, so that the lithotrite or a large evacuating catheter may pass easily.

Most commonly, if the patient is in fair condition, the removal of his stone, especially if it can be accomplished at a single sitting, will be the best means of diminishing local inflammation, and of inaugurating a new and tranquil state of the bladder, in which it will rapidly regain its healthy tone.

Nevertheless, it is desirable to have favourable conditions present if possible; they are not essential to success, which happily is often achieved in their absence. Such conditions are:—

1. A capacious and not very tender urethra.
2. A bladder capable of retaining 3 or 4 ounces of urine.
3. Absence of the ordinary signs of renal disease; and fair general health.

CHAPTER IX.

THE OBJECTS OF LITHOTRITY, AND THE PRINCIPLES ON WHICH INSTRUMENTS SHOULD BE CONSTRUCTED IN ORDER TO ATTAIN THEM.

Objects of Lithotrity defined.—Principles which guide its Practice.—All evil Results arise from mechanical Lesion.—Lithotrites constructed to avoid producing Injury.—Three Classes of Lithotrites: Fenestrated Blades; Plain Blades; and Intermediate.—The Mechanical Power employed: the Wheel and Screw.—French and English Models.—The Cylindrical Handle.—Size, Materials, &c.

WHAT is the precise object of Lithotrity? is a question which must be proposed and definitely answered at the outset of any consideration of this subject. The object of Lithotrity has been generally held, until late years, to be the reduction of the stone to the form of débris, sufficiently small to be expelled by the patient's natural efforts during the act of micturition.

Of late, the artificial removal of débris has also been employed, and increasingly so; and the object of Lithotrity, according to some surgeons, and including the present writer, may now be defined, as, first, to reduce a stone to fragments sufficiently small to pass through an evacuating catheter which can be introduced into the bladder without injury to the passages; and, secondly, so to remove the fragments without unnecessary delay.

In the performance of the necessary manipulations to effect this object, it will be obvious that any evils connected with the practice of the operation are traceable to mechanical lesion of some kind, mostly tending to excite more or less inflammation of the bladder or urethra; the direct agents in producing it being instrumental interference, or the presence of sharp or angular fragments.

Therefore it must be our aim, first, to reduce the stone to fragments in the most efficient manner without injury to the passages; and secondly, to take care that the sharp and angular fragments cause as little injury as possible to the bladder afterwards by residence therein, removing them, therefore, always when possible; and, finally, to accomplish these objects by the smallest amount of instrumental interference.

These principles are to be constantly kept in view; they will guide us materially in the selection of instruments, as well as in numerous details connected with the operative treatment.

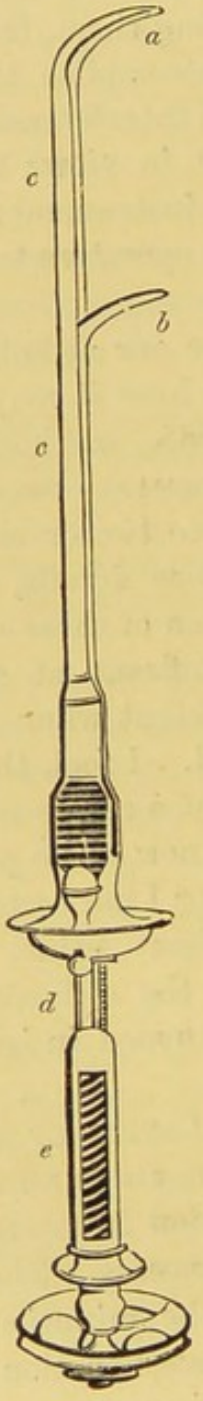
The subject of instruments will first engage our attention. The mode of applying them will follow: and here it may be well to remark that the practice of systematic, methodical Lithotrity—and such alone can be relied on for success—consists not only in the conformity of its proceedings to two or three general principles, but in attention to numerous details, the value of which experience has established. Each of these may be minute in itself, indeed, apparently insignificant at first sight to some minds; but each becomes important when the result of their aggregated influence is regarded. I feel, then, that no apology is due for the attempt to present a circumstantial exposition of these details, especially as I know of no published source where it can be found. Of one thing I am certain, they will not be deemed unimportant, or without value, by those who have a practical acquaintance with the difficulties and the risks which attend Lithotrity when pursued in ignorance of rules and without a method.

Instruments for Crushing Stone in the Cavity of the Bladder: Lithotrites.—The subject of instruments is a most important one, and deserves a careful consideration from every student who wishes to practise Lithotrity with success. There is much more to be gained by a knowledge of the minutiæ of the mechanical arrangements adopted in the construction of the lithotrite than is generally supposed.

It should be remarked at the outset, that every point relating to the form, weight, size, and construction of a modern lithotrite has been arrived at through long years of experience and careful attention to the necessities of hundreds of cases,

and after the occurrence of numerous contingencies, not anticipated at first, but now provided for. No study of Lithotrity, whether it be pursued on the body or without it, is of much value, apart from a preliminary knowledge of the mechanical principles on which lithotrites are, or should be, constructed.

Fig. 51.



A French Lithotrite of the well-known 'Charrière,' model. *a*, female blade; *b*, male blade; *c*, *c*, shaft; *d*, sliding-rod, ending in the male blade; *e*, handle.

In order to save misunderstanding and circumlocution, it may be premised here that all lithotrites will be regarded as possessing the following principal parts: The blades (when acting together often called 'jaws'), the shaft, the sliding-rod, and the handle (fig. 51). The blades are two in number; one distal (from the handle), immovable, continuous with the shaft, called 'the female blade;' the other, proximal, movable, continuous with the sliding-rod, and called 'the male blade.' The shaft is perfectly straight, and forms the longest portion of the instrument, corresponding to the average length of the urethra and two or three inches over. The sliding-rod is received into a longitudinal channel, occupying the entire length of the shaft; it bears at one end the male blade, at the other it is acted upon by the mechanical power employed; and on its upper surface, near to this end, is marked a scale showing to what extent the blades are separated, when hidden in the bladder from the surgeon's eye. The handle not only serves the purpose which its name implies, but contains, or has affixed to it, the mechanical power which is destined to move the male blade.

Up to a recent period, lithotrites were regarded as naturally occupying two distinct classes, arising out of the nature of the work required to be accomplished by the

crushing part, or the blades; while the modes of applying the necessary force, which will be considered hereafter, might be the same, or might vary, in either class.

Class I. Lithotrites with the female blade open or fenestrated; or instruments for breaking the stone into large fragments; which they, the instruments, are incapable of removing from the bladder.

Class II. Lithotrites with no opening in the female blade; or instruments for reducing the stone into small fragments or débris; and which these instruments are capable of removing from the bladder.

But a good modern aspirator being unquestionably superior in most hands for the purpose of removing fragments or débris to the flat-bladed lithotrite, the latter, although still required, is less used than formerly. A safe and efficient lithotrite for reducing the stone to a condition in which it is easily removable by aspirator and evacuating catheter, is what is now demanded. And as it must be fitted to work in the bladder during some minutes before being withdrawn, it is essential that it should be so constructed that the blades cannot be choked with débris, and so rendered unable to close; a condition which may sometimes occur with the ordinary flat-bladed lithotrite, if worked for some time without withdrawing it to be cleared. Hence I have adopted, after several experiments, some powerful, but not large lithotrites, on a principle of construction which is intermediate between these two classes, and avoiding the objectionable points of each; the female blade slightly fenestrated, the male blade partly wedge-shaped: its description will follow that of the others. I have also very recently improved the flat-bladed lithotrite, so that it now is much less liable to choke than formerly.

But before considering these separately, it will be well first to advert briefly to certain principles of constructing the blades which apply equally to all classes.

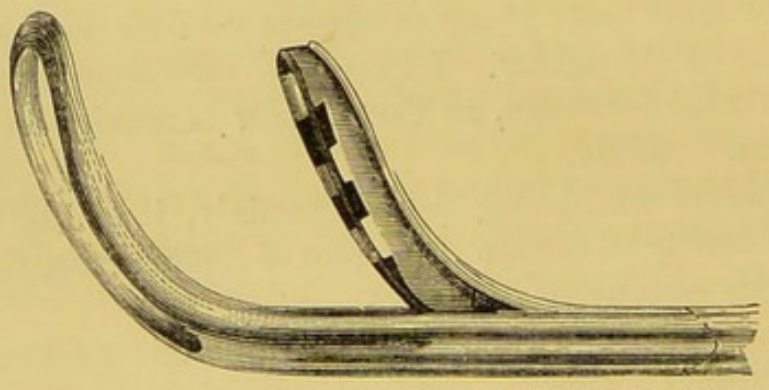
1. The blades and the shaft form an angle with each other which is always somewhat greater than a right angle. But the greater the angle, the greater is the sacrifice of power, and *vice versâ*; power acting disadvantageously through blades whose inclination from the shaft is more than 120°. On the other

hand, the greater the angle the more easily the instrument passes through the urethra.

2. The wider the blades the easier is it to catch a stone or fragment, and the less likely is either when caught to slip from the grasp of the instrument. But power acts disadvantageously through wide blades: a narrow male blade forces its way through a mass which could not be penetrated by a wide one; on the other hand, the grasp of a small fragment is much less certain to be secure when one, and especially when both blades are narrow, than with two wide ones.

3. The surface of the male blade which is opposed to the female blade is roughened, in order to render the grasp more sure, and because pressure between roughened surfaces tends to separate cohering particles; between smooth surfaces it favours their forming into a mass. If the object is to break a hard stone, the male blade may have a toothed surface, that each of the several projections may exert a wedge-like action on the resisting mass. But if the male blade has an acute angular or wedge-like form, although it will act most powerfully and efficiently on a large and hard stone, it is, nevertheless, an objectionable instrument, because, as may easily be proved by experiment, the divided fragments fly off at right angles with great force, and endanger the walls of the bladder, as I have long ago verified. Hence the male blade must not be too narrow in any case, although it should be somewhat angular for large stones, in degree proportioned to their size.

FIG. 52.

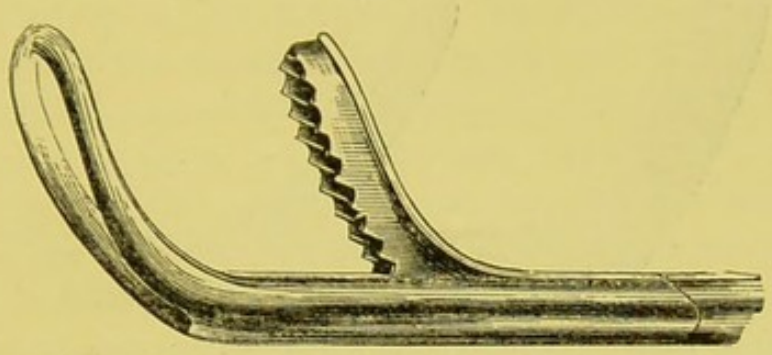


Fenestrated female blade, with large teeth: a large and powerful Lithotrite.

Class I. The lithotrite with an open or fenestrated female blade (figs. 52 and 53).

The peculiar function of the unfenestrated instrument is to reduce a stone into fragments, and not to produce fine débris. It is adapted only for very hard stones, and for those which are of really large size; but its employment requires care, because the edges of the blades are necessarily angular, and may be

Fig. 53.



Fenestrated female blade, with small teeth : rather less powerful than preceding.

sharp; because these edges meet each other accurately, and the mucous membrane may therefore be readily included between them.[1] The jaws are also longer than those of other instruments, and can, therefore, be less readily and less safely turned, or in any way manipulated, in the vesical cavity.

Class II. The lithotrite with plain or entire blades. (See figs. 54 and 55.)

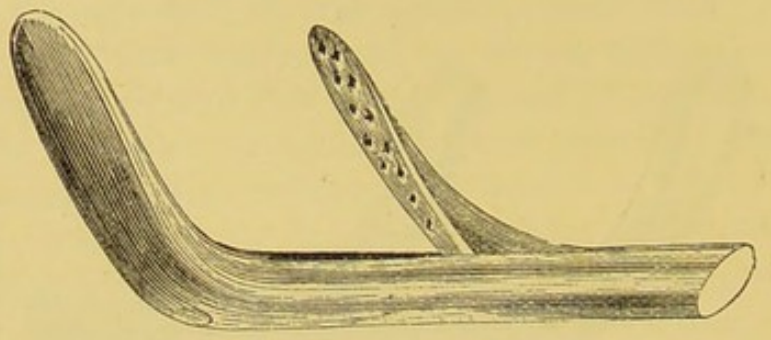
The larger and stronger kind may be used to crush uric acid stones of medium size, say nearly all up to about an inch in diameter, and larger ones if phosphatic; but the special function of this class is to reduce calculous matter, whether existing as such stones, or as fragments produced by fenestrated instruments, to a granulated condition.

A well-constructed lithotrite, with plain blades, for the purpose of crushing stones of small and medium size, has a wide female blade, and a narrower male one, so that the force applied through the latter may act efficiently by its narrow surface, and not be diminished by distribution over a large one. A comparison of fig. 54 with fig. 55 will exemplify this remark. The narrow male blade of fig. 54 will readily make its way through a small stone or fragment lodged against the female blade, the width of which aids in retaining the fragment in

[1] Although always made with sharp and accurately fitting edges, there is no reason why these should not be bevelled; the accident would then be less liable to happen.

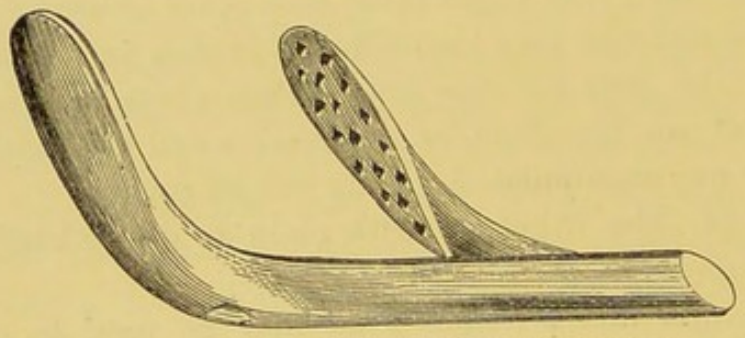
position; while the male blade of fig. 55, nearly as wide as the female blade to which it is opposed, will granulate small fragments admirably, but will be inefficient against a hard mass of more than half an inch in diameter. Moreover, were an

FIG. 54.



Lithotrite with plain blades, but the male blade narrow.

FIG. 55.

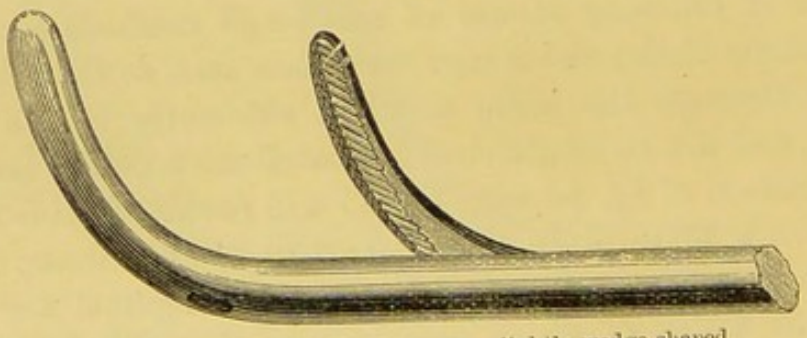


Lithotrite with plain blades, but the male blade wide.

attempt so to use it successful, the jaws of the instrument might become packed so tightly with detritus, as to render its dislodgment somewhat difficult.

An instrument of this class may be rendered somewhat

FIG. 56.



Lithotrite with male blade very slightly wedge-shaped.

more powerful still by making the male blade slightly convex or angular, or projecting in the centre. I have long used this

slight modification with advantage, when a stone has been a little larger or harder than usual. (See fig. 56.)

The occurrence of this condition, viz. 'packing' or choking with débris, is provided against in the lithotrite with a narrow male blade, from the jaws of which it can be generally dislodged at the will of the operator, by a method which will be explained when we arrive at the subject of manipulation. But it is important that the female blade should not be too hollow or deeply recessed, especially at the angle, or that part where the blade joins the shaft, since complete dislodgment of débris from this spot is difficult, and its presence here interferes with the perfect action of the instrument. It is a fault too commonly met with in instruments made both here and abroad. In any case there should be an opening at the angle, as large as the instrument will safely admit, for the exit of débris.

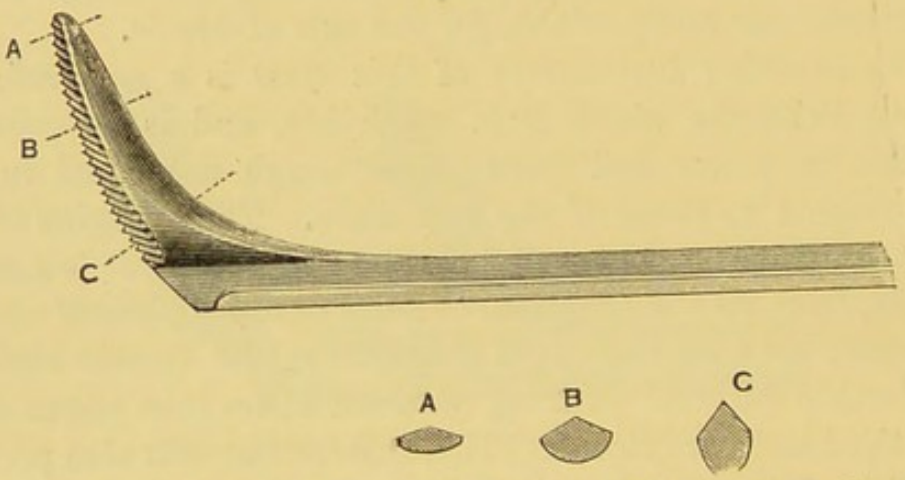
The crushing instrument of this class is a very safe and efficient lithotrite where it is applicable, and is possessed of considerable power and strength, although not equal in this latter respect to those of the first class. The margins of the jaws are not sharp, but well bevelled; moreover, it is scarcely possible, from its construction, to seize or nip a piece of mucous membrane between the edges of the male and female blades, a considerable interval existing between them (the edges only) when the blades are closed. This instrument will also perform the office of the old 'scoop,' when required, as well as any other instrument made. Its blades being flat, much débris may be contained between them without unduly enlarging the calibre: their capacity in this respect is remarkable. Further, the blades are shorter than those of the powerful fenestrated instruments, and will therefore not easily retain their hold on a stone which is much too large for their power; it will be obvious that the shorter the blades, the more readily will a large stone slip from their grasp as the screw power is applied; so that they are to a certain extent able to reject a stone much beyond their capacity to crush. Lastly, it may be remarked that the construction of this instrument, when properly made, provides that if, by any mischance, its power is overtaxed, and fracture of the instrument at some spot is inevitable, this *must* take place at the angle of the male blade (that is, its union

with the sliding rod), so that the instrument can be withdrawn, and only a very small portion, not too large to traverse the urethra, will be left in the bladder. There is no more fear of this occurrence, however, if used with prudence, than with any other instrument; still, it is as well to be aware that this admirable provision exists against possible accident.

Class III. A new lithotrite, differing from any example of those described under Class I. and II., is one which I have recently designed and employed. It equals any fenestrated lithotrite in power, and at the same time avoids the disadvantages of that instrument already pointed out.

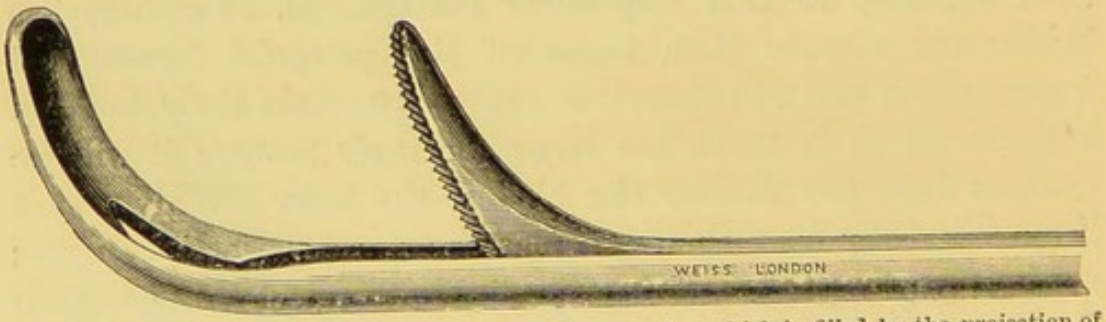
The difference in this new lithotrite consists in making the lower part of the male blade keel-shaped, or like the prow of

FIG. 57.



The male blade, showing that it is almost vertical in profile, and the prow-shaped arm of the lower part, gradually becoming flattened above. Transverse sections of the blade, A, to the upper part; B, at the middle; and C, near the base, show this form.

FIG. 58.



epresents the male and female blades and the opening which is filled by the projection of the lower part of the former when the lithotrite is closed.

a ship, while the upper part is still flattened; so that the instrument may execute powerful cutting and crushing actions simultaneously. The male blade is also placed at almost a

right angle with the shaft, and thus acts at great advantage in comparison with a blade diagonally placed. At the same time, the female blade retains its curve, enabling the instrument to be introduced with as much facility as heretofore. Lastly, I have thickened the sides of the latter, and enlarged the opening to admit the prow of the male blade to enter it and drive out any débris which, with the increased amount of work now required, might otherwise lodge and impact the blades. (See figs. 57 and 58.)

I have extended the same principle to a lighter, and flat-bladed lithotrite also; suitable for crushing smaller stones and large fragments, making it much stronger and less liable to block than other flat-bladed instruments.

Thus much for that portion of the lithotrite which transmits the applied force, by direct contact, to the stone itself. The next subject for consideration is that portion of the instrument by which the force is accumulated and applied.

The screw is now the only mechanical power adopted for this purpose; but force can also be transmitted by direct manual pressure, and by percussion.

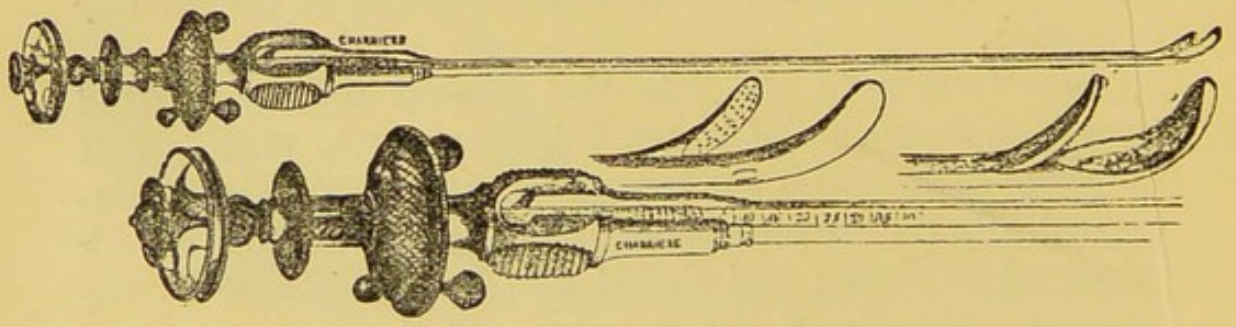
The conditions necessary to the construction of this portion of a good lithotrite are—first, power in abundance; second, power which can be quickly applied, and in small or large quantity at the will of the operator; third, power which can be disengaged and re-applied with ease and rapidity; lastly, all these conditions to be fulfilled, and to be made effective in small compass and without the necessity for harsh movements capable of communicating injurious concussion to the bladder or urethra.

In reference to the rule that a good lithotrite should possess an abundance of power, it is necessary to remark, that the leverage by which the screw is turned should always correspond with the strength of the blades, in relation to the work submitted to them; and should also be apportioned to the muscular strength of the operator. If the surgeon has a powerful hand, the instrument-maker will not increase the diameter of the wheel-shaped handle above an average size; if he is deficient in muscular power, the handle ought to be larger.

The screw is a form of mechanical power which admits of

great pressure being gradually, evenly, and continuously applied. But the production of rapid impulse and percussion are also with practice both compatible with the action of the screw. One great drawback in the original screw instruments was the loss of time expended by unscrewing, in order to open the jaws of the lithotrite which have been closed in the act of crushing. No matter how often the screw is turned home for the latter purpose, so often must it be deliberately unscrewed before the jaws can be opened again for a fresh search. The abolition of unnecessary time and movement is so much clear gain to the process, since there is necessarily a correspondingly diminished chance of producing disturbance of the bladder. It was long a desideratum to produce a lithotrite in which the screw should remain as the mechanical power, and yet no unscrewing be necessary, in which, also, rapid impulse and percussion could be applied. After many attempts, this was first successfully supplied by the late M. Charrière, the well-known surgical mechanist of Paris, in the very ingeniously devised lithotrite, commonly distinguished by his name. Its action provides that, after the male blade has been screwed home, it can be withdrawn instantly to any extent without unscrewing. The movement may be described as follows :—The male blade having been screwed home on a fragment, the operator makes a quarter turn of a movable disc in the handle (fig. 59), when the screw power is instantly detached from the sliding rod and male blade, which may now be withdrawn to the full extent, or moved

FIG. 59.



The handle of Charrière's Lithotrite, showing scale, &c.

backwards and forwards in any way, for the purpose of finding a fragment; when this has been seized, a reversed quarter turn of the disc is made, the screw power is attached, and the

fragment is crushed by screwing home. Supposing, however, that the calculus does not readily yield to screw pressure, and there is reason to believe that percussion may be useful, the screw power is again detached without risking the grasp of the fragment, and a smart tap or two made on the end of the lithotrite communicates direct its effect through the male blade. Or, simple manual pressure may be substituted, if preferred. The attainment of these objects by this lithotrite constitutes a great advance on instruments of the pre-existing construction. Subsequently, attempts to improve this action were made by Weiss, Collin and others. By far the most simple and efficient method is that of Weiss, in which the sliding action is exchanged for that of the screw, and *vice versâ*, by merely touching a button in the handle.

My own design, also of a handle of cylindrical form, has been associated with this, and enables the operator to employ the lithotrite with greater ease, dexterity and nicety, than can be attained with any previously existing lithotrite. It is the power of employing this instrument with the lightest possible hold by the finger and thumb, in any direction, which imparts its peculiar facility for the detection of small fragments. This will be especially shown when that subject comes in due course for consideration; but I may say here, that it is perfectly easy for a practised hand to elicit an audible note from a fragment of calculus in the bladder, the size of which frag-

FIG. 60.

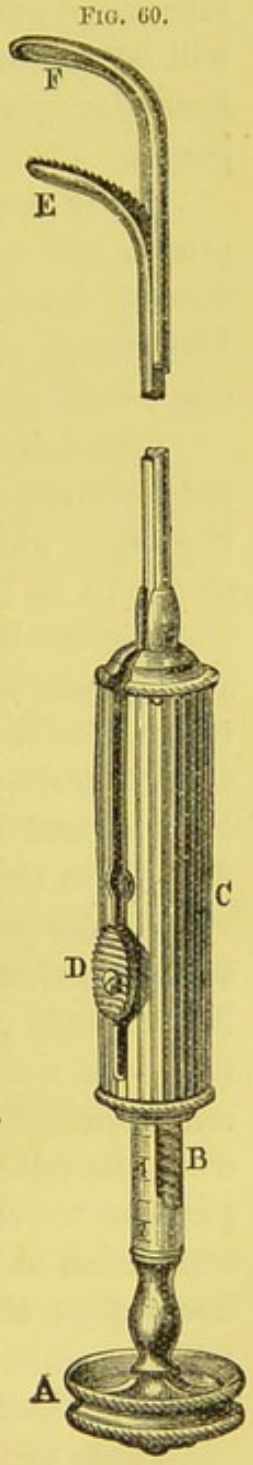


FIG. 60. The author's Lithotrite with cylindrical handle.

A, Wheel-shaped end of sliding shaft, held in the operator's right hand, which directs the movements of the male blade E.
B, The screw.
D, The button which throws the screw into gear or releases it, as desired.
C, The cylindrical handle attached by outer shaft to the female blade F.

ment is not larger than a split pea. This I have demonstrated too often on the patient, not only in my clinical lectures here, but in public in Paris, for the smallest doubt to exist of the

fact. It is one, however, the importance of which cannot be over-stated in relation to the success of Lithotrity. The same cylindrical handle, moreover, enables the operator to hold the instrument with a firm and steady grasp when this is required. On account, then, of these qualities, which have now brought it into very general use, both here and throughout Europe, it will be assumed to be the lithotrite employed in the directions hereafter given, unless a special statement to the contrary is made.

Other methods of applying power by the wheel, rack and pinion, the screw, by percussion, &c., have been employed, but having become obsolete, belong now only to the history of Lithotrity, and will not be regarded as within the scope of our consideration.

Lithotrites vary in size, according to the purposes for which they are required. Powerful adult lithotrites may measure in the shaft about 10 or 11 of the English catheter scale, and about 13 to 16, as the mean of the two diameters (lateral, and from before backwards) of their blades Lithotrites of moderate average power may be equal to 9 or 10 in the shaft, and 12 or 13 in the blades; small ones, 7 or 8 in the shaft, and 10 or 11 in the blades. For boys, 6 or 7 in the shaft, and 9 or 10 in the blades; and the smallest of all, 4 or 5 in the shaft, and about 7 or $7\frac{1}{2}$ in the blades. The two last are not frequently required.

All the parts of a lithotrite should work very smoothly and easily, so that the slightest contact with a small fragment can be instantly perceived, a result wholly impossible if the sliding rod does not work with perfect ease and freedom. All lithotrites intended to deal with hard or large stones should be cut from the solid steel; the best and strongest instruments for this purpose are those of English makers. For reducing fragments and small stones, this costly mode of construction may be unnecessary; the shaft is then forged, or formed from a tube which is drawn into shape, instead of being cut from the solid metal.

Other instruments used in Lithotrity.

These will be simply enumerated here. Their description will be given hereafter, when their practical application is considered.

Aspirators and evacuating catheters. Injecting apparatus. Urethral forceps. Urethral lithoclasts.

CHAPTER X.

LITHOTRITY.—THE SYSTEMATIC APPLICATION OF IT IN THE VARIOUS STAGES OF THE OPERATION.

Position of the Patient; ordinary and exceptional.—State of the Bladder; Injections.—Introducing the Lithotrite.—Finding the Stone; different Methods.—Practical Directions for seizing and crushing the Stone.—Method of Procedure, by Several Sittings, or by One only: the former to be first considered.—Removal of Fragments; importance of removing every portion.—Value of the Aspirator for this purpose; Evacuating Catheters.—Treatment following the sitting.—Impaction of Fragments.—Removal of Foreign Bodies.—Fever; Cystitis; Orchitis; Hæmorrhage; Chronic Retention of Urine.—Use of Ether, &c.—Lithotrity in Children.—Recapitulation of Maxims.

I SHALL now proceed to describe each one of the separate proceedings which are necessary in effecting a single performance of Lithotrity. And in future each application of these proceedings will be denoted by the word 'sitting,' as equivalent to the French word 'séance;' and the word 'operation' will be applied to the sum total of sittings, when more than one are necessary to relieve the patient of his stone.

At the outset it is necessary to consider—

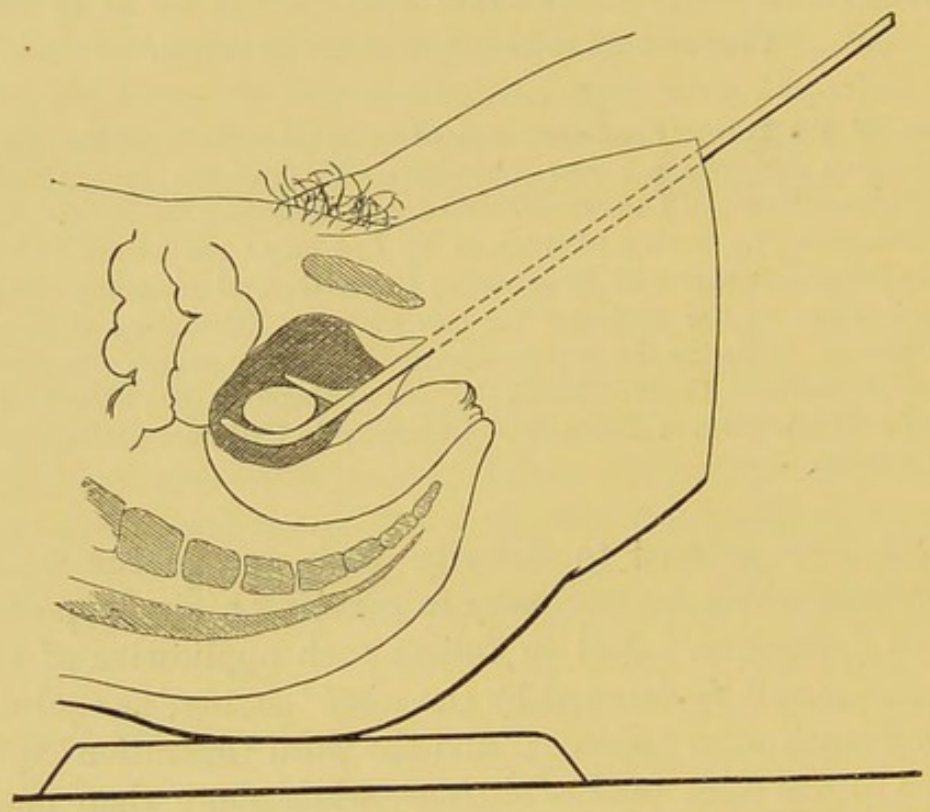
First, the position of the patient during the performance of Lithotrity.

Two positions may be described as necessary in Lithotrity: an ordinary position, and an exceptional or extraordinary. The latter is, however, suitable to many of the cases to which Lithotrity is applicable.

In the ordinary position, a patient lies easily, on his back upon a couch; which, for the convenience of the operator, should be higher than a common sofa, else he must stoop and be otherwise much constrained in his movements. It should be at least thirty inches high; firm and steady. The ordinary

bed is the best so that the patient need not be moved, provided he is placed on a firm mattress, and that the pelvis does not sink, a position fatal to good practice; he should be brought with his right side close to the edge of the bed. The pelvis is to be raised above the level of the shoulders, which must remain on the same plane as the rest of the trunk, the head only being supported by a pillow. A firm cushion, about two

FIG. 61.



The first or ordinary position. Common screw Lithotrite, with a stone rather above middle size.

or three inches thick, should be placed under the pelvis; an excellent substitute, to be found in any bedroom, is a common pillow rolled up tightly in a towel, which is then fastened by pins.

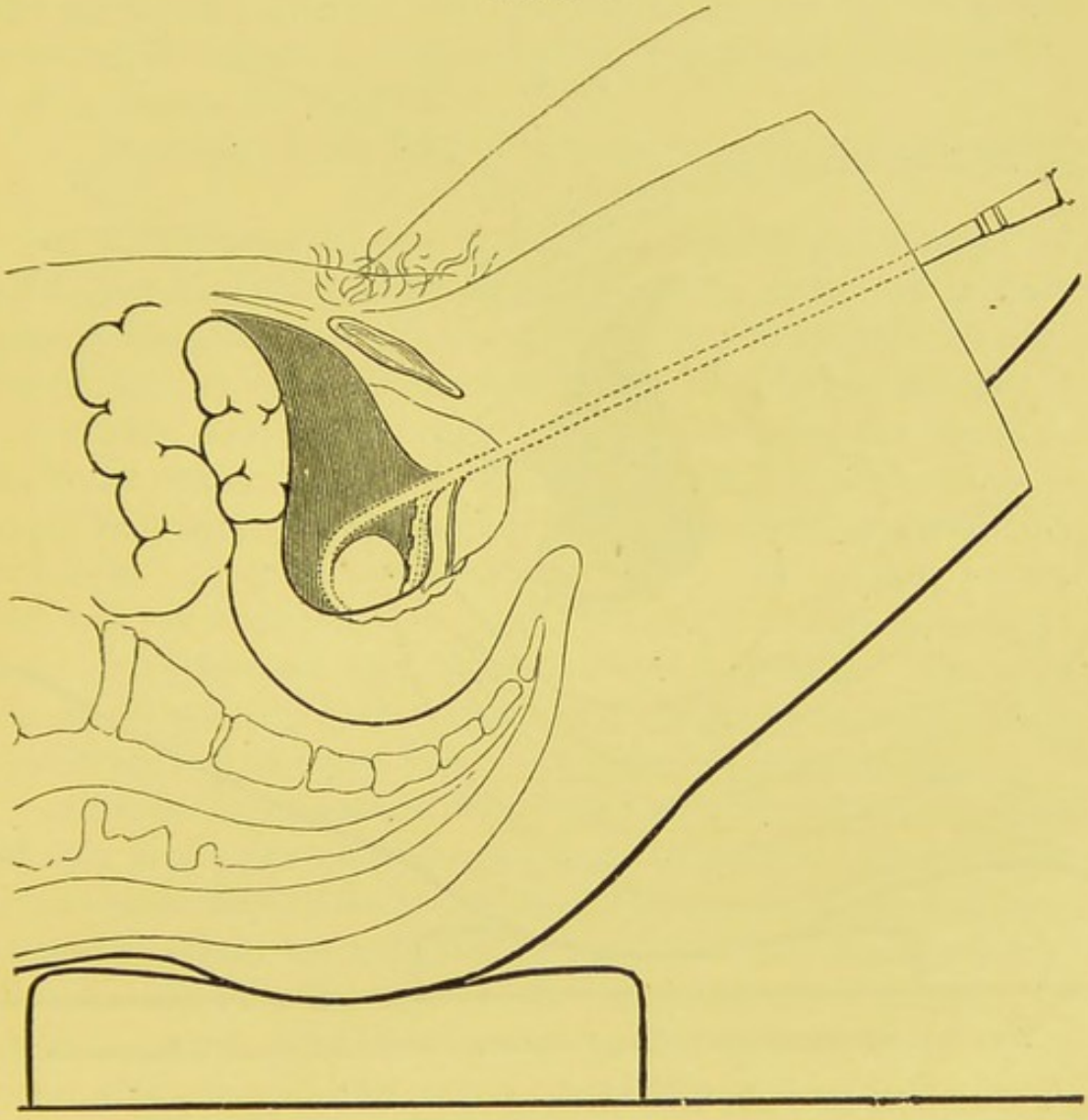
The thighs are to be separated a little, so that there is a clear interval of a foot or more between the knees, and each knee may be supported, or not, on a small pillow, but leaving the space between the legs clear for the operator.

The position thus described constitutes that which is necessary for all ordinary cases; and when the patient is so placed, the stone generally lies a little behind the neck of the bladder,

and may be easily found and acted on by the lithotrite, provided the bladder and prostate are normal.

In the exceptional position, the pelvis is raised from four to six inches above the level of the shoulders; a firm cushion of sufficient thickness is placed beneath the pelvis, so as to support the sacrum and tubera ischii. The thighs are slightly

FIG. 62.

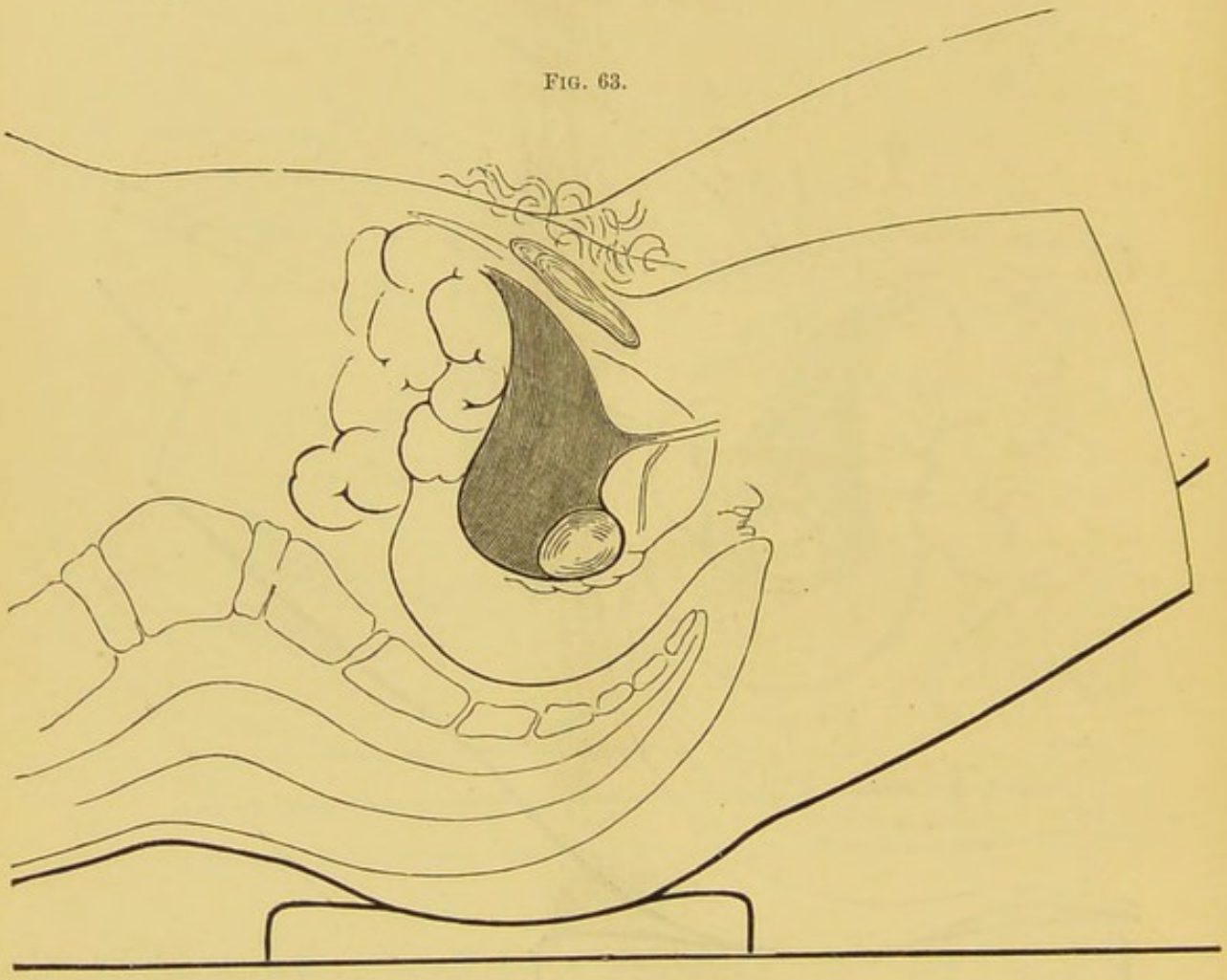


Second position : prostate enlarged ; stone removed by this position to the back of the bladder.

raised; they must not incline from the pubes downwards, or the position of the pelvis will be interfered with. The abdomen, on the contrary, inclines backwards from the pubic symphysis. The stone now lies towards the posterior wall of the bladder, at a little distance from its neck, varying in proportion to the

degree of elevation of the pelvis. This position is generally desirable when there is an enlarged prostate, behind which a stone is frequently concealed; it is so often when the patient is very stout, and the abdomen protuberant, and in searching for last fragments, or for a small stone, in any case where its presence is suspected, and there has been want of success in a previous search by the ordinary position.

FIG. 63.



The first or ordinary position: enlarged prostate; stone not easily seized in this position.

In those few cases in which it may be decided to perform Lithotrity for children, the pelvis should also be a little elevated, otherwise the stone will lie close to the neck of the bladder; the position of this viscus in children rendering that the natural situation for it in the ordinary recumbent posture.

The object of determining the position in Lithotrity is important; namely, to prevent the stone from lying close to the neck of the bladder, which it almost certainly does if the

pelvis sinks a little below the horizontal line of the body. The centre of the cavity and space beneath it, form the area of operation. The neck, which is sensitive, easily injured, and ready to take on inflammatory action, is to be kept free from all unnecessary mechanical irritation: an important principle, hereafter to be considered in its place, which is never to be lost sight of in the conduct of Lithotrity. The elevated position of the pelvis also enables the operator to reverse the lithotrite with facility; since, in order to do so, it is almost always necessary to depress the handle.

2. The state of the bladder prior to commencing Lithotrity. Injections.

It is desirable for the safe and successful performance of Lithotrity that the urethra should possess a calibre of at least average size, and that the bladder should be capable of containing a moderate amount of fluid. It used to be held that if it could not hold four ounces, the area for working the blades is too small, unless the object be to use a small instrument upon small fragments, in which case two or three ounces might be sufficient. A quantity much exceeding eight ounces makes the area of operation too large, in which condition a small stone or a fragment may elude our search readily. The plan commonly adopted was, to withdraw the urine by catheter before operating, and to inject five or six ounces of warm water.

A little experience sufficed to teach me, however, that all this was quite unnecessary; and for several years I have never made any preliminary injections, nor even desired the patient to retain his urine before the hour fixed for operating. Indeed, his very attempt to do so would often defeat the object; added to which, some nervous anxiety beforehand would often compel him to pass water immediately before or at the surgeon's arrival.

Perhaps three or four ounces may as a rule be always present with advantage, especially for young operators. Nevertheless, I am bound to say that, with instruments constructed on the principles laid down, no mischief can be done by proper manipulation in a bladder which is empty or nearly so; and, for myself, I as frequently operate in that condition as not. By not insisting on this preliminary injection of water, much

unnecessary manipulation and the consequent pain and irritation are saved to the patient. The introduction of the lithotrite commences the sitting, the duration of which is thus considerably shortened.

If the patient cannot retain his water more than twenty or thirty minutes, he may require some little preparation by way of rest, &c., a rare necessity; for if an attempt is made to compel the bladder to retain a larger quantity than it tolerates comfortably, uncontrollable contractions of it are produced, pain is occasioned, and the organ is placed in an unfavourable condition for Lithotrity. It is useless to contend with the bladder; and any contest engaged in will certainly end in the discomfiture of the operator. The organ must be coaxed into obedience, not forced. At the same time it is no less certain that the only method of subduing irritation very frequently is, to crush the stone, especially fragments; but experience only can determine the cases in which we should 'prepare' the patient, and those in which we should operate forthwith. With the powerful appliances of modern Lithotrity, the latter alternative is, I believe, now much more commonly presented than the former.

That condition of the coats of the bladder which is most favourable to Lithotrity is one of healthy tonicity, a condition in which the organ contracts upon its contents sufficiently to form a reservoir of tolerably regular form. An abnormal irritability, or disposition to contract, is objectionable on the one hand; a flabby, unexcitable state of the coats is unfavourable, although in a less degree, on the other. It is so, because the stone is apt to be partially enveloped, it may be, hidden in loose folds of the bladder; because the viscus, in place of forming, by its inherent tonicity, a somewhat ovoid figure, is influenced rather by the pressure of surrounding viscera, and may take any irregular form which they determine. Such a condition may, perhaps, be temporarily improved by the stimulus of injection. The urine is withdrawn, a known quantity of water is injected, and if it is much cooler than the blood, say at 70° or 60°, the stimulus to slight contraction is usually increased. The want of tonicity in a bladder presents a state of things which resembles the condition of the bladder in the

dead subject. Useful as the practice of Lithotrity is on the subject, in relation to the manipulation of instruments, it should be remembered that the condition of the bladder is different from that which exists in the healthy living body. In the dead body the stone does not lie at the neck of the bladder, but falls anywhere in the flaccid viscus, which position, and the pressure of adjacent viscera, render the lowest. By depressing the jaws of the lithotrite into the bas fond, the stone of course rolls into it. But this result is by no means a matter of course in the living. When tonicity is active, there is often a constant tendency in the muscles of the bladder to roll a large stone towards the neck, a fact of importance, and the result of this action, though much modified by the position of the body, is by no means altogether counteracted by it.

3. *The mode of introducing a lithotrite.*

This varies materially from that by which a catheter is passed into the bladder, and it is important that the difference should be explained and observed. The difficulty frequently encountered in introducing the lithotrite is generally due to ignorance or neglect of the distinction existing between the two operations.

In catheterism, a smooth continuous curve or sweep is made from the external meatus into the bladder. Throughout the entire movement, the instrument describes a series of continuous curves; the shaft of a silver catheter, at first horizontal (supposing the patient to be recumbent), is gradually moved upwards to the perpendicular, and downwards to the horizontal again, in a direction precisely opposite to the first position.

In passing a lithotrite, the continuous sweep will not be successful in carrying it into the bladder; the terminal angular part constituted by the blades would thus be brought into hazardous contact with the upper part of the urethra before the pubic arch is passed. On the contrary, the shaft of the lithotrite must be maintained in one position for a considerable part of its course. This will appear in describing the movement in detail.

The operator places himself on the right side of the patient, and stands with his back turned partly towards the head of the couch, his left side being to the patient's right. Having

warmed and well oiled the lithotrite, he holds it lightly with his right hand, in a horizontal position, the blades pointing downwards, and raises the penis with his left; and as he introduces the blades into the urethra, the left draws gently the penis over the angular end of the instrument, which descends in this manner down to the bulbous portion of the urethra, the shaft rising gradually towards the perpendicular. Having arrived there, it is not now to be depressed as in catheterism, since this movement raises the point of the blades against the roof of the urethra in front of the deep fascia above the narrow orifice of the membranous portion, while the large capacity of the bulbous urethra favours the malposition described, and, if force is used to overcome the difficulty, laceration will probably take place. This, indeed, is the accident which, more commonly than any other, happens in the hands of beginners, or with those who are not aware of the proper course to be pursued. In order to pass the blades easily and safely through the narrow membranous portion, it is necessary to maintain the lithotrite a few seconds at or near the perpendicular, permitting it to progress slowly in that position. This proceeding is accomplished by permitting a part of the weight only of the instrument to act as the propelling power, while the penis is drawn upwards a little, in the same, that is the vertical, direction. In this position the blades slide through the bulbous portion, enter and traverse the membranous portion, and arrive at the prostate. Then, and not before, the operator gradually depresses the instrument towards the patient's thighs; the blades rise up through the prostatic portion into the bladder, a movement which is rendered more easy if a very slight lateral rotary motion is given to the instrument at this part of its progress. At the same time the fingers of the left hand may be gently pressed on the pubic symphysis to relax the suspensory ligament of the penis; at all events the disagreeable sensation of strain upon it experienced by the patient at this moment is relieved by so doing, and the movement onwards of the instrument is facilitated, especially if the shaft has to be much depressed to surmount any obstacle at the neck of the bladder. In ordinary, that is, normal, conditions, the shaft of the lithotrite at the entry into the bladder forms an oblique line and an angle of

about 20° to 30° with the horizon; and this it continues, as it slides easily and freely down upon the trigone to the posterior wall of the viscus. It will be obvious that the urethra now entirely loses its curve, being occupied throughout by the straight shaft of the lithotrite.

The angle which the blades form with the shaft varies, as has been already seen; in some the blades describe a curve from the shaft to their points. The more angular, however, the union between the blades and shaft, and the smaller the angle so described by their axes respectively, the more necessity is there for following the directions just given.

For those who prefer it, the instrument may be passed on the patient's left side, as in catheterism; but, if so, the operator must afterwards go round to the right side to perform the operation of crushing. It is, however, equally if not more convenient to introduce it on the right side, in which case time and movement are economised to a slight extent.

4. *To find and seize the stone.*—This is a very important subject, about which there has been no little discussion, since practical men have been divided in their opinions respecting the course to be followed.

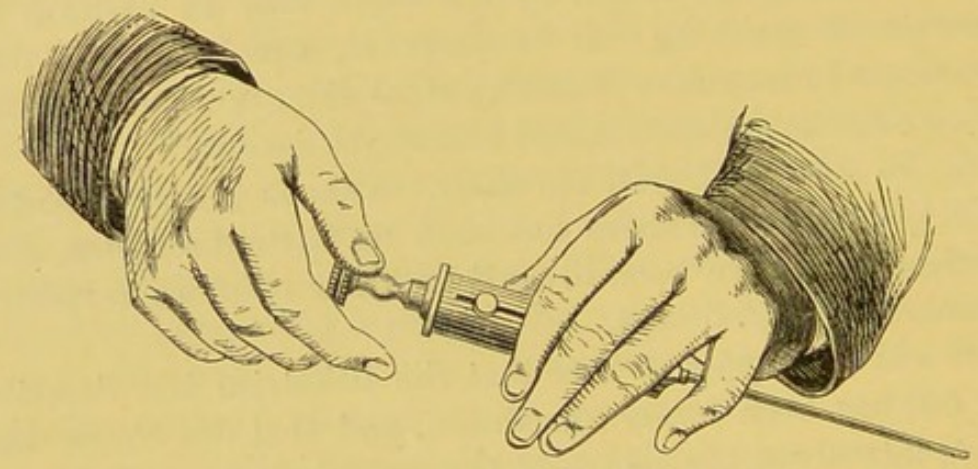
It will be supposed here that the lithotrite last described (fig. 60) has been easily introduced, and that its blades have passed into about the centre of the vesical cavity. The proper method of holding the instrument is the first step to be considered, since the facility with which the operation is performed will much depend on the system of manipulation adopted. The surgeon should be completely familiarised with the lithotrite, and with the best position and action for his hands upon it, long before he ventures to operate in the living bladder, so that he may instinctively hold and manage the instrument according to the rules laid down, and has not to recall them to his memory at that moment. Without doubt, the best method with the existing lithotrites has been ascertained by practice and observation; viz. that which enables the operator (bearing in mind our guiding principles) to exert the largest amount of influence on the stone, with the smallest amount of disturbance to the bladder. Even supposing this were not the case, it would be advantageous to the operator to practise one method

as the rule, and so acquire a facility in the use of the lithotrite, which practice by a uniform method alone can impart; but it is doubly so in the circumstances just stated.

First, the manner of holding and employing the lithotrite when the blades have arrived in the cavity of the bladder.

The left hand being above the instrument, the cylindrical handle is at first lightly held between the thumb and three fingers, the little finger being free, so that a slight rotary movement of the instrument can easily be made on its axis, when necessary. The wheel-shaped end of the sliding rod, which terminates in the male blade, is then held between the thumb, index, and second fingers of the right hand (see fig. 64),

FIG. 64.



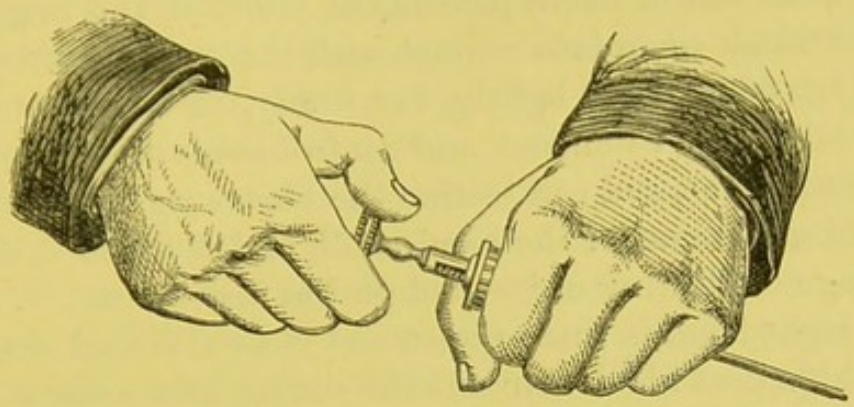
Mode of employing the Lithotrite with cylindrical handle in searching. The left hand holds the cylinder lightly, while the right opens and closes.

so that it can be drawn out, and pressed in, at pleasure; corresponding to which movements, of course, the blades at the other extremity are opened and closed.

If a stone or a fragment be seized, the fingers are to remain on the wheel with slight pressure to keep the stone between the blades, and the thumb is to be extended to draw upwards the button, which act suffices to change the sliding into the screwing action. If the stone or fragment is small, the fingers of the left hand remain in their place; if it is large, and especial steadiness be required, the cylindrical handle is grasped in the palm of the left hand, and perfect immobility is ensured (see fig. 65). A turn of the wheel now screws home the male blade, and crushes what has been caught.

In order to reverse the blades in searching for fragments, it is only necessary first to depress the cylindrical handle, and then to rotate it between the thumb and fingers of the left

FIG. 65.



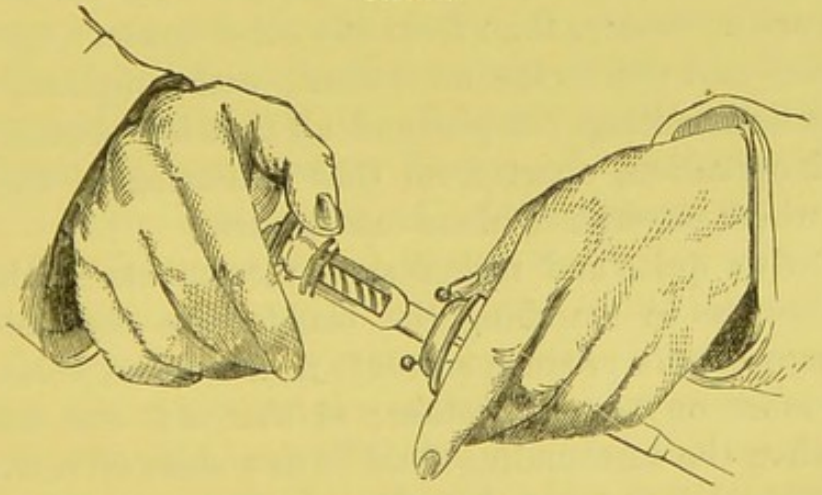
The instrument firmly grasped in the left hand, while the right crushes by screwing home.

hand, the wheel remaining unmoved in the right hand. Indeed, the most complete and exhaustive series of changes in position of the blades is attained in this instrument by rotation with the left hand, while, at the same instant, the right hand is opening and closing the blades in search.

The manner of employing the French instrument may next be described.

The handle is to be held between the thumb and fingers of the left hand, the thumb applied to a knob attached to the

FIG. 66.



Position of the hands in searching with the French Lithotrite.

disc, the index finger to the other knob attached on the farther side; the second and middle fingers are applied to the handle

close to the index finger; the little finger may be free or applied: where ease of movement is wanted, as in searching, it is free; where steadiness and immobility, as in crushing, it is applied. The pulp of the thumb is brought into contact with the knob, the last or distal phalangeal joints of the fingers are the parts which come into contact with the opposite side of the handle (fig. 66). Held lightly, but firmly, in this manner, the thumb and index command and control easily the movements of the instrument, and can incline the blades right or left, with very little movement of the hand itself, and, *à fortiori*, without any change or shifting of its hold on the instrument.

The right hand is free to open and close the blades, to turn the movable disc which converts the sliding into a screw action, and *vice versâ*, and to screw home the male blade for the purpose of crushing the stone. The position is represented in the adjacent drawing (fig. 66).

Next, What is the first proceeding in order to find and to seize the stone?

It is not at all necessary at the present day to describe various systems, so called, of seizing the stone, related as some of these have been to forms of the lithotrite now obsolete. Nothing can be more simple than the process to be followed; and difficulties, if any are met with in the endeavour to accomplish it, usually arise more from the belief on the part of inexperienced operators, that some peculiarly dexterous movements are necessary, than from any other cause.

Quiet and deliberate movement, with simplicity in action, and gentle handling, comprehend all that is essential to ensure a good operation, apart from that education of the sense of touch which experience alone can impart.

Firstly: quiet and rather slow movements of the jaws of the lithotrite in searching the bladder are desirable, because rapid movements produce currents in the urine which keep the stone more or less in motion; so that it is less easily seized than when the surrounding fluid is in a state of rest. We are apt to overlook the fact that the specific gravity of the stone is much less considerable when placed in urine than in air, and that slight currents in the denser fluid act on its position with considerable energy.

Secondly: in respect to the action necessary, and gentle handling, the following details respecting them are given as the result of my own experience.

Let us suppose that the blades of the lithotrite have entered the cavity of the bladder, and that the instrument slides easily and smoothly down the trigone, which in the living and healthy organ is an inclined plane, although quite otherwise in the atonied and in the dead bladder.

In many cases the instrument in thus passing grazes the stone, and the slightest lateral movement of the blades, right or left, will determine on which side it lies. Whether however the stone is felt or not, when the blades have passed gently down in the middle line until a very slight check to their movement is perceived, the lithotrite should rest there for three or four seconds, and then the male blade should be slowly withdrawn, without moving any other part of the instrument, towards the neck of the bladder, until a very slight check is perceived in that direction, followed by another three or four seconds rest for currents to subside. Now the operator should quietly press back the male blade, without changing the position of the lithotrite, and almost certainly the stone will be seized. In other words: open; pause; close—that is all. It is necessary always to remember, when withdrawing the male blade, that it is never to be drawn out roughly, since in this action the sensitive neck of the bladder may easily be irritated.

But suppose no stone is thus found, the operator is again to withdraw the male blade as before an inch or more in the middle line, to incline the blades to the right side about 45°, and then to close them, without altering the axis of the shaft, or otherwise disturbing the central position of the instrument. If still no stone is felt, he turns them, opened, to the left in a similar manner, and then closes them. Observe, that the blades are always to be opened before they are turned, for this reason: if the turn is first made and the blades are subsequently opened, the chance is that the male blade as it is withdrawn will move the stone away; whereas if the blades are inclined while open, the stone, if there, is almost certainly seized. This is one of the many apparently minute but important points of which systematic Lithotrity is made up. To return: it is very rare

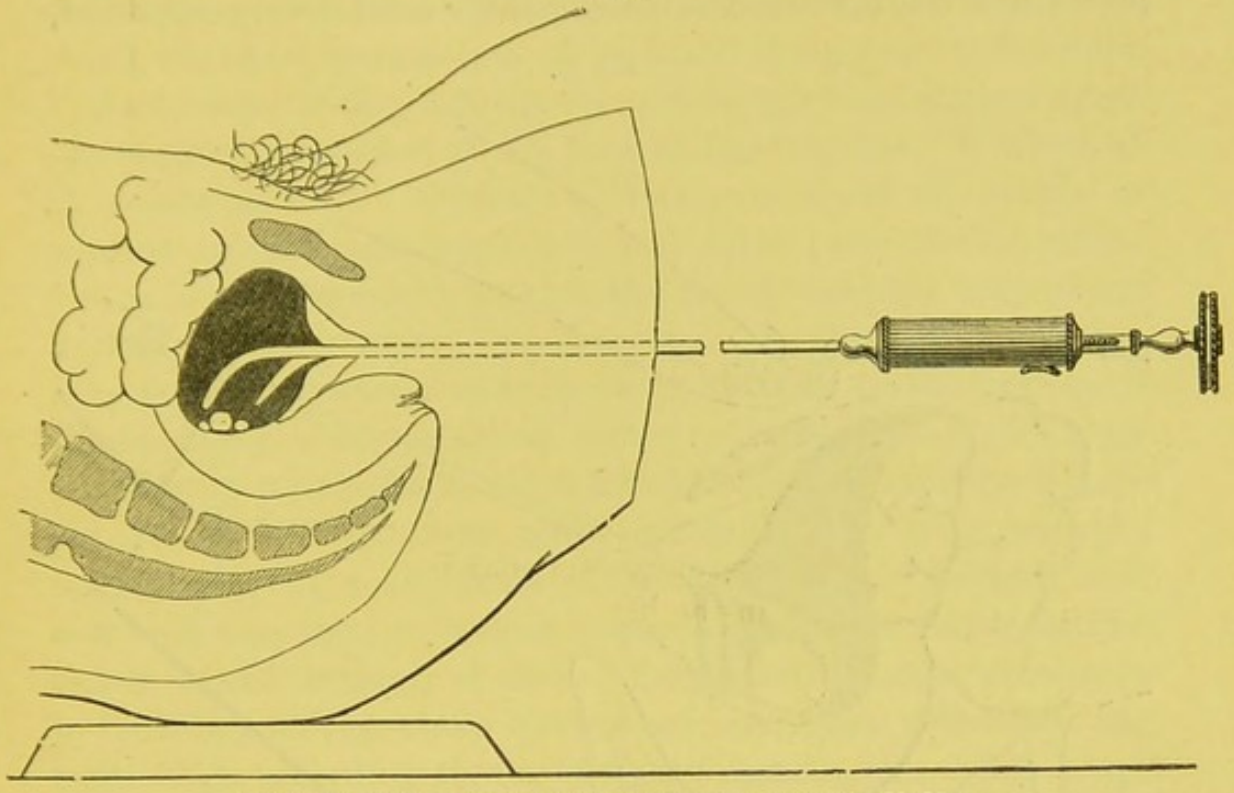
that the stone will elude the search thus far; but if it does, depress the handle of the lithotrite an inch or so, an act which raises the blades slightly from the floor of the bladder, and turn them another 45° to the left, bringing in fact the blades horizontal to the left; close; if unsuccessful, turn them gently to horizontal on the right, and close. These five positions (vertical, right and left incline, right and left horizontal) explore the bladder fully, middle, right, and left, and will almost certainly find any stone of moderate size in a healthy bladder. The object is at the same time strictly to avoid communicating any jerk to the instrument or to the bladder. In all these movements, if properly executed, there has been barely contact of the lithotrite with the vesical walls, at all events no pressure, nothing to provoke undue pain, or cause contractions of the bladder. If, however, there is an enlarged prostate, causing an eminence at the neck of the bladder, a depression behind it, or the stone is very small, or we are exploring for some fragment, at the close of the case, which is suspected to have eluded previous search, and, also, in some cases where none of these conditions exist, the blades are to be reversed so as to point downwards to the floor, and the object sought may then often be secured with ease. If seeking for a small stone or for fragments, we may employ a lithotrite with short blades, which can therefore be reversed with greater ease than one with long blades.

In order to do this properly in the normal bladder, the handle of the lithotrite is depressed another inch or more between the patient's thighs, so that the shaft of the instrument, instead of being directed obliquely a little upwards, is level with, or points below, the horizon; the blades, supposed to have been already brought to the horizontal, as before described, are cautiously brought round to the reversed vertical position, and the floor first lightly swept, with closed blades, in the manner of a sound in searching for stone. Then, if the handle is sufficiently depressed, the blades may be carefully opened and closed two or three times, in slightly varied directions, but without injuring the floor of the bladder; after which an exhaustive examination of its cavity ought to have been accomplished (fig. 67). It sometimes happens, when the prostate

is considerably enlarged, and a stone or fragments have to be sought behind it, that the lithotrite is reversed without depressing the handle.

As a rule, all these movements are to be executed at or

FIG. 67.



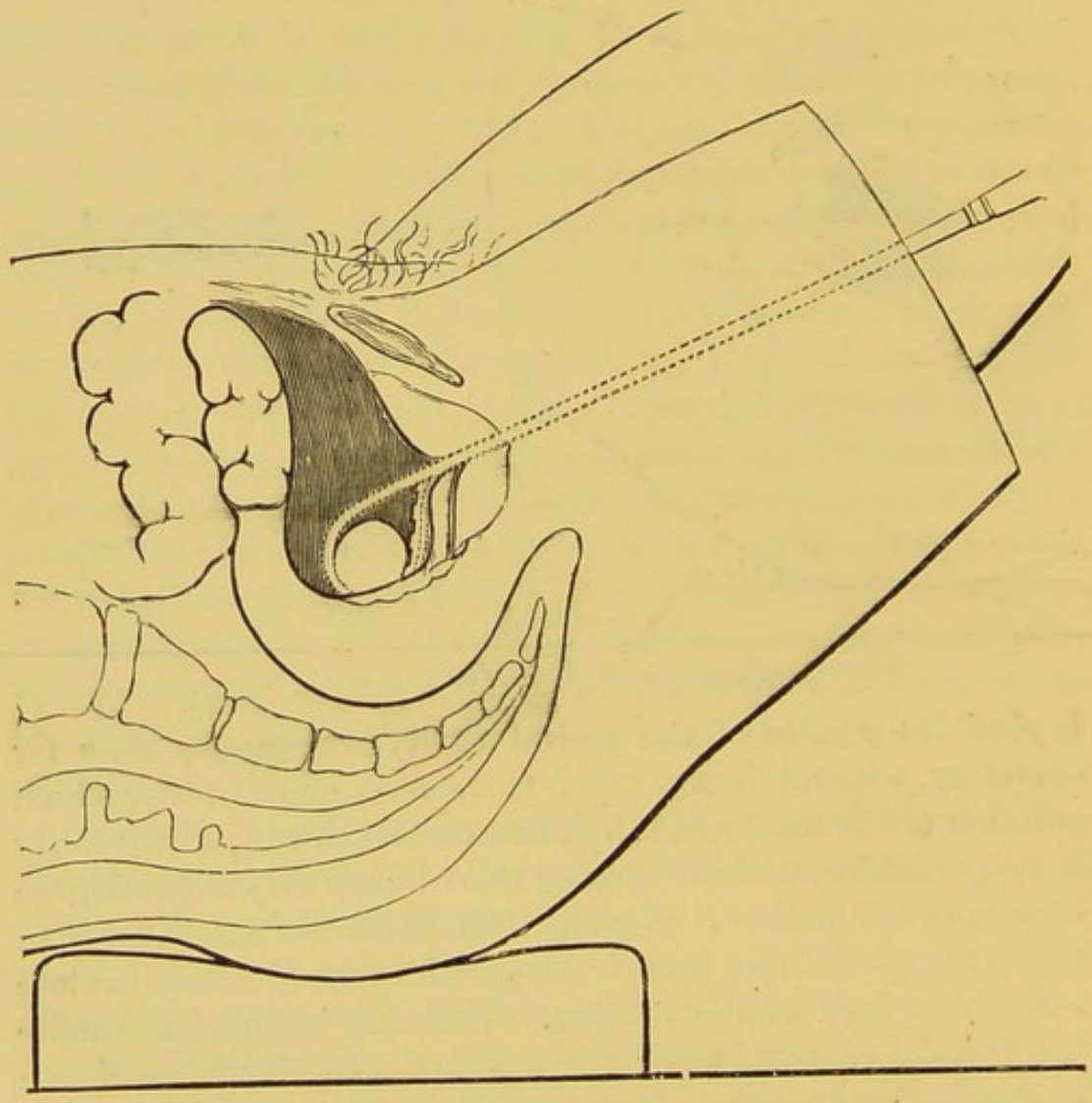
Searching for fragments with reversed blades in healthy bladder.

beyond the centre of the vesical cavity, the proper area for operating, without hurry, rapid movement, or any other which partakes of the nature of a jerk or concussion, and, if in a fairly healthy bladder, without causing more than a very slight degree of pain to the patient. Nevertheless, there are many cases in which the special spot for searching with reversed blades is close behind the neck of the bladder. With the cylindrical handle this is quite easy and safe; the mode of using it will be shown in considering the removal of small fragments. The operator's eye is also to be so familiar with the scale marked on the sliding-rod, that he knows at a glance the exact interval which it indicates as existing between the blades in the bladder.

It is essential to good practice, while manipulating the lithotrite, to maintain the axis of the instrument, as far as possible, always in the same direction. The blades only are to be moved; the shaft should occupy the same inclination, unless

when this is intentionally altered. In screwing home the male blade, the operator is very apt to move the lithotrite also, at each turn of the screw, unless he is conscious of the care necessary to avoid this evil. All lateral movements, all vibration and concussion, necessarily tell on the neck of the bladder and prostatic urethra, where the instrument is most closely embraced,

FIG. 68.



Second position : enlarged prostate. Lithotrite reversed to seize a large stone.

and its mobility is most limited. To that part of the lithotrite which occupies the anterior portion of the urethra much freedom of lateral movement is permitted, and in the bladder the instrument is free, although in a less degree; but the axis, or fixed point, as regards lateral movement, is at the part indicated, which is also the most sensitive spot of the entire passage.

Hence the aim of the operator should be to produce in this situation no motion of the lithotrite except that on its own axis. Few of the details of the operation require more practice to master than this.

A rule has been laid down with reference to the situation of the calculus in the bladder. It is said that the larger the stone, the more certain is it to be found lying near to the neck of the bladder in the ordinary recumbent position, while a small one is usually detected at the back of the trigone. Without at all assenting to the accuracy of this remark, at all events in relation to the small stone, which is often close to the vesical orifice, it may be said here that the act of seizing a large stone in this position requires consideration. In this case, the lithotrite is not necessarily to be pushed onwards to the bottom of the bladder; it is sometimes better to incline the blades from the side on which the stone is felt, then to push on the female portion of the instrument only, by itself, as far as it will go, maintaining the male blade at the neck of the bladder; it is now only necessary to incline towards the stone, and it will be seized almost certainly at once. But if the operator commences by pushing on the whole instrument, and then withdraws the male blade according to the ordinary custom, this blade is apt to be drawn against the large stone, which it therefore fails to catch, and presses it back against the neck of the bladder, producing pain, irritation, and perhaps bleeding. As a general rule, I think it may be said, that by far the most common cause of failure to seize a stone arises from its close proximity to the neck of the bladder (whatever position is given to the patient), and from the male blade being drawn up against it, at each opening of the lithotrite, in the manner just described. In these circumstances, the operator feels the contact of the stone without suspecting its precise locality, each time he withdraws the blade, and is apt to feel embarrassed on failing to seize it when he closes immediately after. In these cases it is essential to draw the male blade gently, but closely, to the neck of the bladder, and to slide the blade between the neck and the stone which lies in contact with it.

The rules already laid down for finding and seizing apply more or less to all lithotrites, as far as the rules can be applied

with less perfect instruments, this general rule applying invariably to all; viz. the more powerful the lithotrite, that is, the larger and longer are its blades, the less readily are we to adopt the horizontal, and still less the reversed, positions of the blades; the more fluid also is it necessary to have in the bladder. As large and fenestrated blades are used chiefly for the initial act of breaking up a large stone into fragments, it is obvious also that there is less occasion for the horizontal and reversed movements, since a large stone may almost certainly be seized by the right or left incline.

5. *The manner of crushing the stone when seized.*—Supposing that a hard stone of an inch and a half in diameter is in the grasp of a powerful lithotrite, the screw is to be gradually turned at first, to make the blades bite, since a sharp turn at this moment is likely to drive the stone out either right or left. As the power is increased, which is still to be done slowly, the resistance is felt to relax, sometimes by degrees, sometimes suddenly with a crack, and the stone is broken usually into four or five large pieces, besides some small débris. This being done, the male blade is again drawn out, taking care not to shift the situation, or alter the axis of the lithotrite, and, almost certainly, one of the large fragments will be picked up. It is then only necessary to screw home, release the screw, and open as before. This process may be repeated two or three times, if the instrument is worked at the same spot, and the patient maintains his position. Since the area within which the larger fragments fall is very limited in extent, and remains unchanged if these conditions are complied with, there is no difficulty whatever in finding the fragments readily, provided the operator is content to work in the centre of the bladder, above its most depending part, as determined by the position of the patient, and not to change the place either designedly or unwittingly. The large and heavy pieces fall invariably in the same place, and may be picked up again and again, if this simple rule of keeping the blades in one place is adhered to. Having now broken up the stone, and, say, crushed two or three times the largest fragments, enough has been done for the first sitting, supposing that we are proceeding according to the system hitherto generally pursued. I shall, however, in the

following chapter enter upon the consideration of 'Lithotrity completed at a Single Sitting,' a method which in my opinion possesses advantages destining it to supersede, to a considerable extent the old system of employing for a stone of medium or large size some four or five separate sittings. Nevertheless it is necessary, at present, to consider the latter before discussing the new mode.

After a sitting, the patient should at once be warmly wrapped up; a hot bottle put to his feet; while a hot napkin, or a flannel wrung out of boiling water, applied to the perineum and hypogastrium, has a soothing effect, and diminishes any want to make water which may be present, and which it is best to discourage for a short time. During the first twenty-four hours, at least, after a first sitting of the kind described, the patient should pass his water as he lies on his back: the large angular fragments are in this way prevented from being driven forcibly against the neck of the bladder. It is because these characters are more marked after the first fracture of the stone than after later sittings, that it is desirable, as a rule, to take every precaution against irritation, local and general, after the first crushing or two. Pursuing this plan, the bladder need not be largely injected at or after the first sitting; in the first place, because it is on this occasion particularly desirable to avoid unnecessary irritation; and, secondly, because the first object being mainly to make fragments, no great amount of small débris capable of removal would probably be found.

6. *The crushing and removal of fragments.*—Supposing that, thanks greatly to management and care, no signs of local irritation, and no bleeding, or only a trace of it, have appeared, and no fever has occurred, it is desirable very soon to deal with the fragments. After a period of from two or three days, according to circumstances, we should, unless the stone has proved so hard or so large as to require another application of the powerful instrument, commence the second sitting by introducing a lithotrite with strong plain blades, of which the male is narrower than the female blade (fig. 54). As the fragments are now large, and, probably, several in number, simply opening and closing in the first position, or in the right or left incline, will almost certainly secure one at each attempt, and

enable us to crush it into smaller fragments, making at the same time a fair proportion of fine débris, a good deal of which generally becomes impacted between the blades of the lithotrite. Much of this impacted material may be brought away in this manner, if the urethra is capacious; if not, it is desirable to diminish the quantity before removing the instrument, inasmuch as, being powder, it is sure to come away easily enough during the subsequent injection; and there can be no necessity to irritate the bladder or urethra by withdrawing the blades largely impacted. By adopting the following manœuvre, almost all this débris may be removed from the instrument at will. The blades are to be carried to the centre of the bladder, the cylindrical handle is grasped firmly by the left hand (see fig. 65), while the right screws the male blade as near home as it will go, and then makes numerous alternate turns of the screw, one turn out and one in, somewhat rapidly: this movement will work the impacted débris out of the female blade on each side of the narrow male blade. This proceeding is practicable with a flat-bladed lithotrite in which the male blade is narrower than the female, and it is one of the important purposes contemplated by the construction described, and forms one of the advantages of the instrument. The patient is now to rest quietly, making water in the recumbent position, as before, certainly during twenty-four hours, so that any sharp fragments remaining may lie quietly in their place undisturbed by movements.

It is quite possible to remove by the flat-bladed lithotrite a large proportion, or even the whole, of the calculous débris, instead of permitting it to come away by any other means. As much as will pass easily between the blades should be brought away, but not more. The removal of large portions thus is not to be advised, as a rule, and for the following reasons. First, nothing is gained by so removing it; all the débris which can be impacted between the blades of an instrument being in a state of powder, or nearly so, can be removed by some form of evacuating catheter, with an exhausting elastic bottle. Secondly, the risk of over-distending and scratching the urethra, together with the serious consequences which such accidents often entail, is increased by this proceeding. Thirdly,

the impaction of fragments in the urethra is subsequently much more likely to take place, if any laceration of the canal has been occasioned by withdrawing débris. Indeed, troublesome impaction of fragments does not very often occur unless the urethra has been previously injured in some way. But all the fine débris and smaller fragments may be removed at the close of this sitting by the ordinary apparatus of Clover, or by one of the numerous modifications and improvements of his original idea, now known as aspirators; and presently to be described.

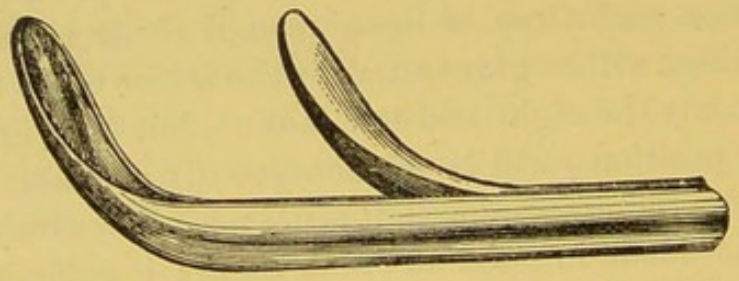
The succeeding sitting or sittings may usually follow at an interval of from two to three days, unless difficulties have arisen; and the kind of instrument employed must depend on the size of the fragments we have to deal with, and these, of course, will depend on the original size and texture of the stone. If there are now many small fragments remaining in the bladder, but too large to pass, it will be advisable to employ the lithotrite with a wide male blade (fig. 55), but constructed in all other respects similarly to that last used. With such an instrument it is scarcely possible to fail of picking up small fragments on each time of opening and closing, and on each crushing these will be granulated by the action of its flat blades; while not only the right and left incline, but the right and left horizontal positions, will be advantageously available in its use. When the fragments are small, it is not necessary always to screw up the male blade in order to crush them; it suffices simply to press it closely home by manual power, a method adopted by some. The screw, however, is smoother in its action, admits of no jerk or concussion, and I prefer it on this account. If a fragment falls between the blades which the scale upon the sliding-rod indicates to be too large for the power of this instrument, it has only to be rejected, and smaller ones found and crushed. In a few minutes much granulated matter will have been made by the application of this instrument to the smaller fragments, and this, or, indeed, probably all which remains of the calculus, may be removed by aspirator, if not at the third, at least by the fourth sitting.

7. *Removal of the last fragments.*—This is an extremely important crisis in the operation, and one which it is important

not to neglect. It sometimes demands more skill and nicer manipulative power than any other part of it.

Supposing that after three or four sittings, or more if the size of the calculus has demanded them, it has become obvious that very little calculous matter remains in the bladder, we have now to take care that the last fragments are entirely removed. As long as any remain, there will almost invariably be some pain in passing water, especially at the close of the act, while the urine may be cloudy and often tinged with blood, and quick movements of the body give pain. As long as these symptoms persist we may suspect that some portions still remain behind, and these must be found. The best method of proceeding is to introduce, as before, the lithotrite with plain blades, taking care to have only a small quantity of water in the bladder, at most one or two ounces. The best form for the purpose is that in which both the blades are short and wide, and their ends not in any degree tending to a point. The form represented by fig. 69 is greatly preferable for this purpose to

FIG. 69.



Lithotrite with short and wide plain blades for small fragments.

that of fig. 54, p. 132. If by the ordinary positions of the instrument we encounter no fragment, the handle must be a little depressed between the patient's thighs, as directed for the reversed positions at pages 152–3, and these positions of the blades employed. It will now be seen why the pointed blades are objectionable, as being more likely to irritate the floor of the bladder, and less likely to catch the fragment. A careful search in the reversed vertical position will generally discover its object; if not, the patient's pelvis is to be raised about four inches, that is, to the exceptional position, when with care and perseverance the fragments will be caught and crushed.

This sitting requires sometimes a little longer time than usual; it should never extend, however, beyond five minutes.

I have before alluded to the facility which the cylindrical handle affords for the most delicate sounding, or searching for these tiny fragments; and also to the ease with which a practised hand may demonstrate the practicability of producing an audible 'click' from a fragment no larger than a peppercorn. A gentle but very rapid half-turn of the instrument between the finger and thumb will give a blow sufficient to produce a click, which three or four persons standing over the patient may hear. I have often afforded the proof of this by first producing the 'click' in question, and then instantly seizing and removing the little fragment unbroken, since it is mostly too small to produce any inconvenience in its transit through the urethra, and placing it in the hand of the bystander, who is usually surprised to see how minute a body may thus be detected and removed.

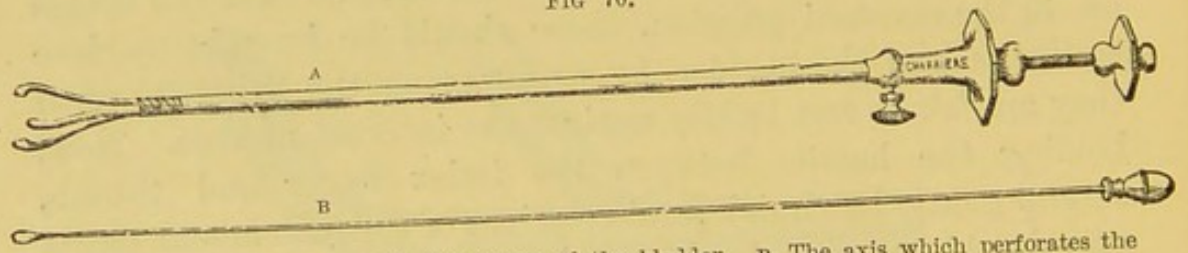
It is at this period of the case that the cylindrical handle of the lithotrite becomes of great value. Supposing the instrument to have been placed in the bladder, and that the blades are in the reversed position, these should be brought up close to the neck of the bladder, by withdrawing the lithotrite until they are felt to rest lightly against the internal meatus. Now, holding the handle between the index finger and thumb, several gentle but quick semi-rotations of the instrument on its axis should be made in perfect silence, and if any fragment is there, a slight click is easily obtained, or the contact felt. All that it is necessary to do, is to open at this spot the blades of the lithotrite, by pushing the female blade towards the centre of the bladder, for about half an inch or so, and then, on closing, almost certainly the fragment is included. You then turn upwards the blades and crush.

It has been supposed to be sometimes useful to employ an instrument of similar form to the preceding, but with a small channel traversing the male blade, and entire length of the sliding rod. In this way, without removing the instrument from the bladder, we may add to or diminish the fluid contents of the bladder, and thus search for the fragment under different conditions of the viscus. I succeeded recently with an exceed-

ingly troublesome fragment which had eluded me at two somewhat prolonged sittings previously, by using this instrument in the following manner:—The patient was seventy-five years old, had a very large prostate and a greatly diseased bladder, with phosphatic calculus, all of which had been removed except this small bit. I introduced the hollow lithotrite, the patient standing and leaning forward, opened the blades about an inch, and then allowed the urine to flow out altogether, through the hollow male blade: on closing the blades (that is, *drawing down the female blade* upon the male, not raising the male blade, an important distinction), I found and crushed the missing fragment. At this time, however, I did not possess my present lithotrite, which has rendered any resort to the instrument in question unnecessary.

There was another resource which was a favourite one with Civiale, to find a last fragment not yet expelled, viz. the employment of the 'trilabe,' or 'pince à trois branches,' one of the earliest instruments designed in the history of Lithotrity. It (see fig. 70) consists of a cylindrical sheath, containing a stem,

FIG 70.



A. The Trilabe, open, as in the cavity of the bladder B. The axis which perforates the centre of the instrument, its roughened head occupying the centre of the space between the open blades. Here it is shown separately from the rest of the instrument.

having three branches at its vesical end, which expand on pushing them outwards, and approach each other closely on being drawn in: in the centre is a fourth branch with a rough head, which can be rotated or otherwise moved independently of the rest. Civiale had an inventor's *penchant* for this instrument, and although for everyone else it had long been obsolete, he was fond of showing it and using it occasionally. This feeling shows itself even in his posthumous work on Lithotrity, in which it is still referred to with obvious satisfaction.[1] His directions for its employment may be expressed as follows. To search

[1] *Op. cit.* p. 103.

for a final fragment, introduce this instrument into the bladder, which should contain about five or six ounces of water; expand the branches a little, and rotate them once or twice by way of searching: meantime the urine slowly runs off through the instrument until the three blades are surrounded on all sides by the walls of the bladder, a cavity of a pyramidal form existing between them. Into this cavity the fragment is almost certainly brought: it may be felt for there by the central branch. The branches are now slowly withdrawn into the stem, the cavity slowly contracts in size, and the fragment is found in its centre, and will be crushed either by them as they finally close, or by rotating the central one.

Nevertheless, while it is a rule in searching for minute fragments at the end of a case to employ a small and light instrument with a small quantity only of urine present, there are some very rare cases in which there is reason to believe a fragment or two may still remain behind, although none has been so detected. It may be from peculiar configuration of the prostate, or that in some bladders the interstices are so numerous from fasciculated muscular coats, that small fragments become engaged in them, and evade all search by that means. In these circumstances the plan now to be considered is mostly successful.

The increased use which I have made during the last eight or ten years of the evacuating catheter and Clover's apparatus, has convinced me that an aspirator forms the best means of removing 'last fragments.' In employing it at the end of a case, the presence of a fragment is almost invariably revealed by the very audible sound which is produced, through contact between the fragment and the end of the instrument, as the water rushes out and dashes against it the bit of calculus, towards the close of the current. This contact is not only heard by the operator, but felt by the hand which supports the catheter. If the fragment fails to issue, he introduces a lithotrite into the empty bladder, and with care may almost certainly crush it at once. The evacuating catheter is then re-introduced and the débris washed out. If after several pressures on the elastic bottle and expulsions of water, nothing more is heard or felt, almost certainly he may conclude that all calculous matter

has been removed. This instrument, or some other allied form of aspirator, has entirely superseded all evacuating catheters worked by the syringe, all double-current catheters, or other ingeniously contrived mechanical devices with an internal endless screw, &c., &c., for giving exit to fragments produced by lithotrity.

FIG. 71. FIG. 72.

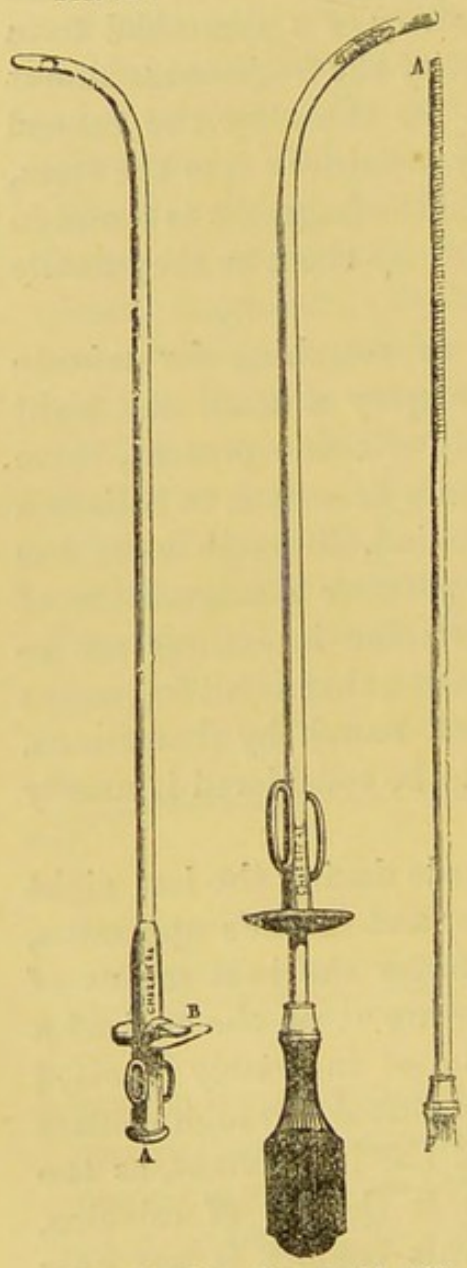


FIG. 71. Evacuating Sound, with lateral apertures. A and B, stopcock and nozzle for injecting.
FIG. 72. Ditto, mounted on metal-jointed stylet. A, stylet removed.

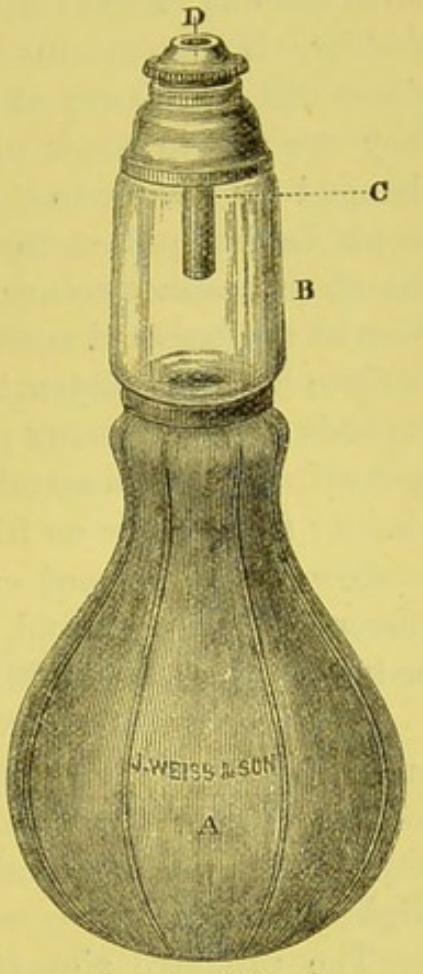
Evacuating catheters should generally be made of silver, and as large as the urethra will admit, with a large oval orifice near to the end; one should have an opening on the convex, and another on the concave aspect of the curve; they may also be placed laterally (fig. 71, 72). There may be a flexible gum-elastic or metal-jointed stylet, perfectly filling the interior, at all events at the lower end where the opening is situated, that the instrument may pass smoothly into the bladder (fig. 72, A). It may be provided with a stop-cock or not (B), but this is mostly unnecessary.

When the evacuating catheter is about to be withdrawn, it should not be forgotten that a fragment may be engaged in the orifice and be protruding from it, an occurrence by no means unfrequent. This is made obvious by the light resistance experienced when the fragment touches the neck of the bladder, and the patient will probably feel a little pain. If the resistance is very slight, it is only necessary to withdraw the catheter slowly and gently and no harm will result; by humouring it, and giving plenty of time, injury may generally be avoided, and no pain will be occasioned. If, on the contrary, the resistance is

obvious, a jointed metal stylet (fig. 72, A), which fits the catheter, being pushed home, the fragment will either be crushed or disengaged, probably the former.

The aspirator of Clover, which I have referred to above, consists of a ten-ounce india-rubber bottle, into the neck of which is fitted a glass cylinder with a perforation at the end, the size of a No. 14 catheter, or larger, together with a series of evacuating catheters. These are of various forms and sizes, each made to fit the glass cylinder, into which they project one inch. They should be as large as the urethra will admit, made of thin silver, and may be provided with gum-elastic stylets. In some cases, the best kind is that which is cut transversely at the distal end.

FIG. 73.



Aspirator of Clover.

A. India-rubber bottle. B. Glass receiver. C. Tube projecting into receiver. D. Aperture of tube to fit evacuating catheter.

Fragments are sometimes more easily drawn into this catheter than into those which have lateral apertures, since the route they must take in the latter is more tortuous. There is very little difficulty in passing such an instrument if the stylet is furnished with a conical silver end, projecting half an inch beyond the end of the catheter.

One of the best forms is that with an oval opening at the side, which should extend half through the thickness of the instrument, so that the diameter of the opening is equal to that of the catheter itself. In other cases, the opening may be placed either on the concave or convex side of the instrument.

In employing the apparatus, let the following instructions be followed:—Having passed the catheter, remove the stylet, and let the urine escape, then attach the india-rubber bottle previously filled with warm water. Compress the elastic bottle

till the resistance of the bladder is felt, then gently press on the catheter so that its internal opening may approach the lowest part of the bladder; allow the elastic bottle to expand as long as the water comes freely away, but if the stream diminishes or stops, reverse the current by pressing the bottle, and if this will not effect a free outflow, inject a little more water, and move the end of the catheter a little towards the centre of the bladder. If the calculus has been sufficiently broken up, several pieces will come away at once, but when they are rather large, they are apt to block up the tube, and the current must be changed frequently to enable them to come away. The fragments having passed through the catheter, fall into the glass vessel, and cannot return when the current is sent inward. As soon as the outward current is seen to slacken, press the bottle to force back the obstruction, for whether the diminished stream depends upon too many pieces, or one large piece, or from contact with a mucous membrane, it is useless to try to empty the bladder further, for no fragments will be removed by a languid outflow. The inward current should be slow, the outward current should be rapid, and the process may be repeated ten or twelve times at a sitting.

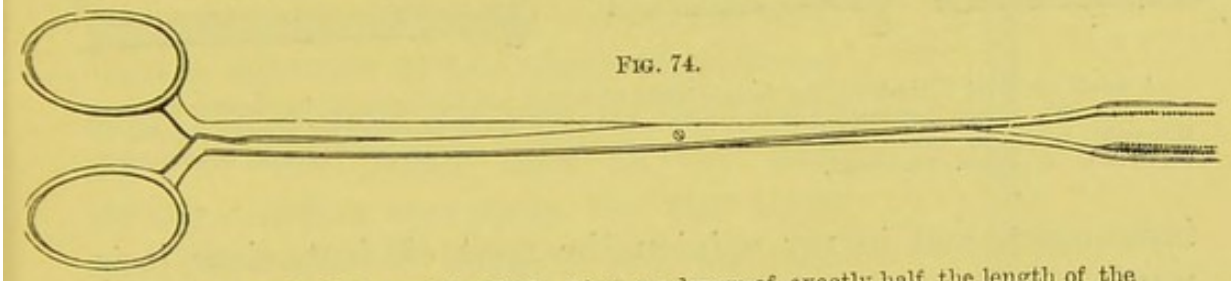
Treatment following the Sitting.—Much might be said in reference to this subject, if every accident possible to occur were to be considered and provided against. Those of the most importance will be considered here: some have been already slightly alluded to.

The principal aim of modern Lithotrity, as by this time will have become obvious, is to crush the stone without risk, not only of danger from the operation itself, but from the occurrence of serious difficulties afterwards: for many of these the manner of performing the operation is answerable. Formerly, a case was rarely conducted to its termination without some grave troubles from the impaction of fragments in the urethra. Now, this is a rare occurrence. Fragments are rarely impacted unless they are sharp and angular, or the walls of the urethra have been lacerated. If care is taken that the patient passes his water, at every act of micturition if possible, in the supine position, for a day or two after each of the first two or three sittings; and if the operator is fairly successful in

pulverising or granulating the stone subsequently, not much risk of trouble will arise on this head. After a short sojourn in the bladder the angular fragments become water-worn, their points and edges are rubbed down, and they pass without difficulty.

Impaction of fragments.—Supposing, however, a fragment to have become arrested in the urethra, and the patient to be able, nevertheless, to relieve his bladder in a diminished stream, the pressure of the urine usually brings it forward in a few hours to the orifice, or near to it. If not, an attempt may be made to remove it, and with a well-made urethral forceps this may be accomplished almost at any depth. The long stems of the forceps should be slightly curved so as to cross each other; in this way an instrument may be constructed seven inches, or more, in length (not including the rings), the blades of which will open sufficiently to seize a fragment two or three eighths of an inch in diameter, without overstretching the meatus

FIG. 74.

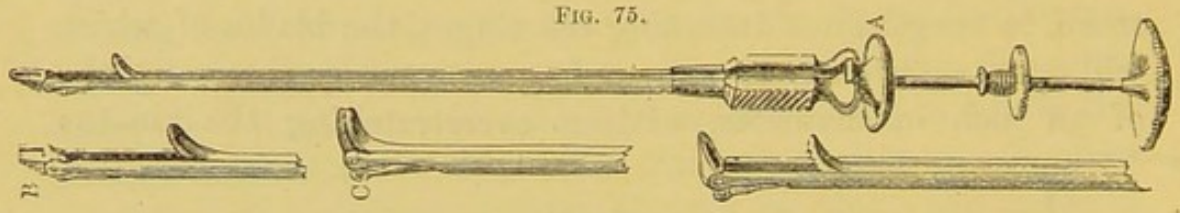


The long urethral Forceps described. They are drawn of exactly half the length of the original.

externus. A drawing of one, made for me by Messrs. Weiss and Son, is annexed (fig. 74). They are $8\frac{1}{2}$ inches long, and will pass to the neck of the bladder in most individuals. Furthermore, the ends of the blades should not be pointed, should not meet each other, and should be slightly scoop-shaped. With this instrument I have extracted large fragments with great ease. All that is necessary for this purpose is to commence with a fair firm hold on the fragment, and then to give plenty of time to the withdrawal, extracting as slowly and gently as possible. In this way it is remarkable how large and sharp a fragment may be safely removed, whereas by force the urethra is lacerated, and the extraction is rendered much more difficult. Sometimes it is necessary to return to the bladder a fragment situated in the prostatic or membranous

portions; but all on this side the last-named spot should certainly be extracted. To effect the former object, a large gum-elastic bougie usually suffices; if not, a large silver catheter, the end of which is cut off, and the opening accurately fitted with an olive-shaped knob attached to a stylet, is passed down until the fragment is reached; the stylet is then withdrawn, the rim of the opening at the end of the catheter surrounds the fragment, and will remove it safely into the cavity on making pressure: sometimes a stream of water forcibly injected will displace it more readily than the instrument. Some operators prefer to extract with a small three-bladed forceps ('pince à trois branches') (fig. 70, p. 162). The small urethral lithotrite (fig. 75) is used by others, but the simplest

FIG. 75.



A small urethral Lithotrite, the female blade of which can be depressed by turning the disc A to the left. After insinuating it beyond the fragment, it can be raised by turning the disc to the right, when, by means of the male blade, the fragment can be crushed. B, female blade depressed. C, the blades closed.

instrument, and in my opinion the most efficient, since it is much more immediately under the guidance of the hand than those which are more complicated, is the long urethral forceps described above. The employment of small crushing instruments in the urethra requires great care and extreme delicacy of manipulation, or more harm than good may be done; and should not be resorted to unless the forceps have really failed. A long scoop, well constructed, is a very useful aid; and is in some circumstances the most efficient means which can be employed (fig. 76).

It is said to be necessary occasionally, but very rarely, to cut down upon an impacted fragment, either in the perineum or near to the meatus externus. If it remains there, obstructing micturition, or if it is lodged in the soft parts surrounding the urethra, which is apt to happen in or about the membranous portion, causing much disturbance, or threatening abscess, it might be removed by incision. Up to the present

time (1880) I have never had occasion to do this; although occasionally I have had to divide the inferior angle of the external meatus to set free an unusually large piece, which was arrested there. The meatus is sometimes preternaturally small, and requires to be divided; if so, this should be done at the outset of the case.

On the other hand, although I have thought it right to retain these practical directions in relation to fragments, it will be clear to the reader that if the principle of clearing out the bladder at a single sitting can be realised in practice, there can be no trouble in relation to impacted fragments.

FIG. 76.

A scoop of the natural size.

Removal of foreign bodies.—With the proceedings for removing fragments of stone, the removal of foreign bodies introduced into the bladder is closely allied. Few of these can be crushed; almost all must be removed either entire, or after division into one or two pieces when necessary. It is more common to meet with them in the female than in the male bladder; always excepting, for the latter sex, fragments of bougies and catheters which, especially when made of that treacherous material the gutta-percha of commerce, are liable to break, and thus to occasion this accident. Pieces of stick, straw, and sealing-wax are occasionally introduced. I removed a considerable portion of the last-named successfully by lithotomy some years ago, not finding by experiment that sealing-wax was very friable at the temperature of the body, and so not performing lithotrity. Nevertheless, a similar case has been so dealt with in Paris since, and with good results.

For the removal of many of the foreign bodies referred to, the French makers have designed several ingenious instruments. Figs. 77 and 78 represent those which are adapted for laying hold of a portion of bougie, flexible and inflexible, respectively, and bringing it away safely. The instrument (fig. 77) is intro-

duced into the bladder with its extremity in the condition shown at *a*; a hook is then made to issue from it and search for the flexible bougie by moving the handle B; the bougie being seized, it is forced into a position which coincides with that of

FIG. 77.

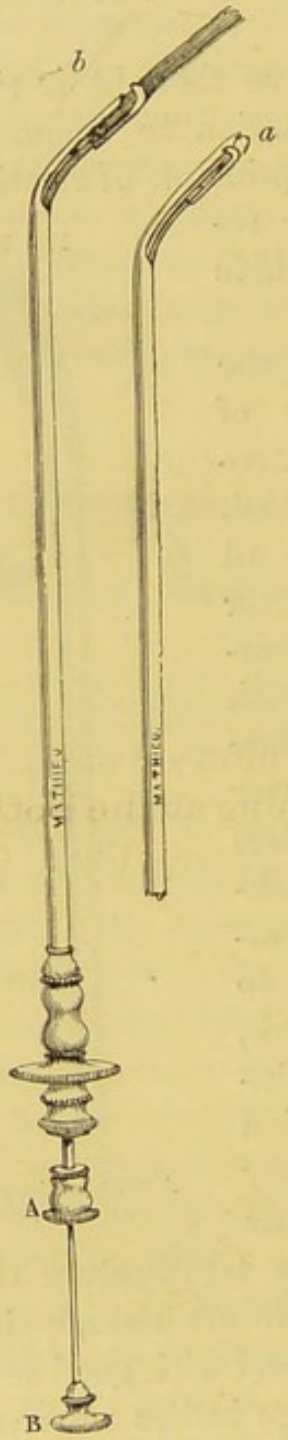
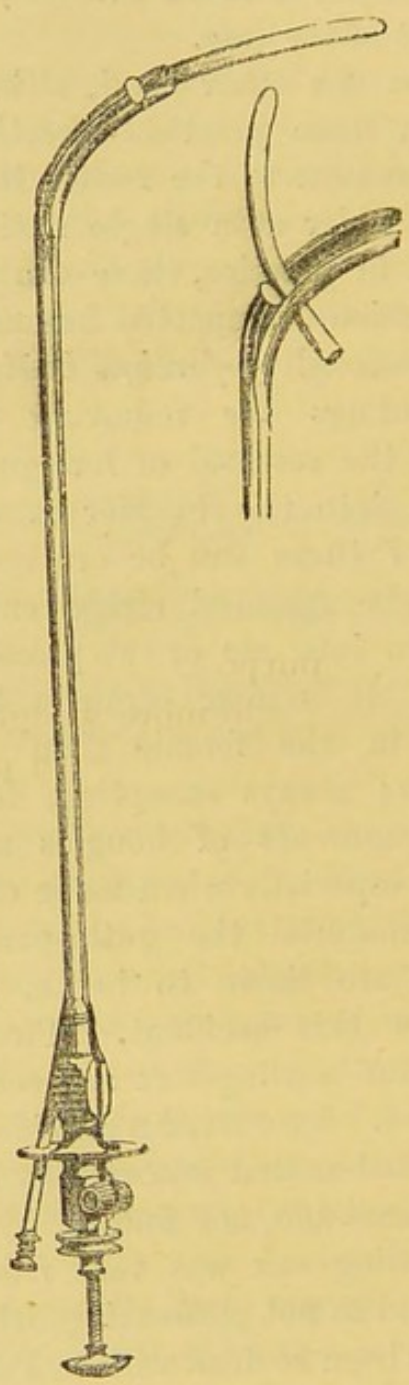


FIG. 78.



the long axis of the instrument, as seen at *b*, which ensures its safe withdrawal. Fig. 78 is another instrument which similarly deals with a portion of metallic catheter or bougie. Figs. 79 and 80 represent instruments ingeniously contrived for a similar

purpose in relation to the female bladder, particularly for the removal of hair pins, or other pieces of wire, so that it is scarcely foreign to the purpose to mention them, especially as it is by no means impossible that they might be useful for the other sex. Fig. 79 acts by seizing, folding, and drawing a wire into a straight tube. Fig. 80 removes them without folding, but by simply seizing and adjusting them to the long axis of the instrument.

I have removed a hair pin from the male bladder in a man aged 65 years, whom I saw in consultation with Mr. R. W. Dunn, by seizing the end of the pin with the blades of a lithotrite and slowly withdrawing it, so that the pin issued as an almost straight wire, five inches long. No bad symptom followed, and the patient went about as usual the next day.[1] This is practicable only with slender and flexible hair pins; but some are made of stout wire which cannot be readily unbent,[2] and which, indeed, are too powerful for the instrument delineated as fig. 79, which was made in Paris, as I once tested in the case of a female patient. Messrs. Weiss, on that occasion, constructed a fac-simile of that instrument, but much more powerful, and with this I could draw any hair pin into the tube of exit. The girl supplied me with a hair pin similar to that which she had passed into her bladder, and thus I was enabled to discover the character of the foreign body to be dealt with, and to learn by experiment that the French instrument was quite powerless to remove it.

Complications occurring in the course of the operation.—It is not my intention to dwell at length on complications frequently arising in connection with Lithotrity, which require treatment on those general principles which it must be assumed are well understood by anyone likely to practise the operation. Some remarks only will be made on those affections which directly result from operations performed on the calculous subject. They may be enumerated as follows:—Fever, inflamma-

[1] *Lancet*, Nov. 28, 1863.

[2] A common pin was removed from a young man *in three portions* by Lithotrity. It was the nucleus to a phosphatic stone. Cat. of Calculi, Royal College of Surgeons, Pt. I. pl. xii. fig. 14. In the Museum, H.a. 14.

There are several examples of pins, bodkins, &c., forming the nuclei of stones in the bladder of women, in the Royal College of Surgeons. *See* H.a. 1, H.a. 2, H.a. 7, H.a. 11, and pp. 127–130 of Pt. II. of Cat. of Calculi.

tion of the bladder or of the prostate, orchitis, hæmorrhage, and retention of urine. With regard to the influence which

FIG. 79.

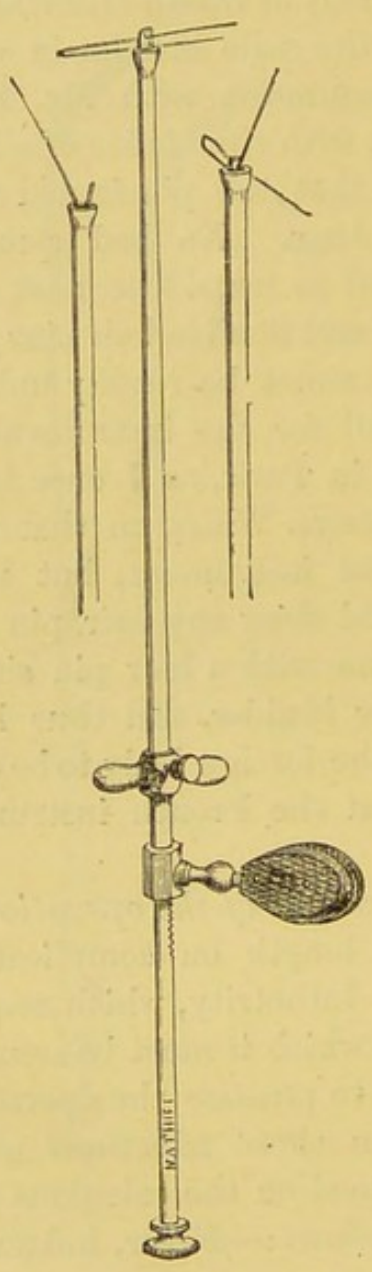
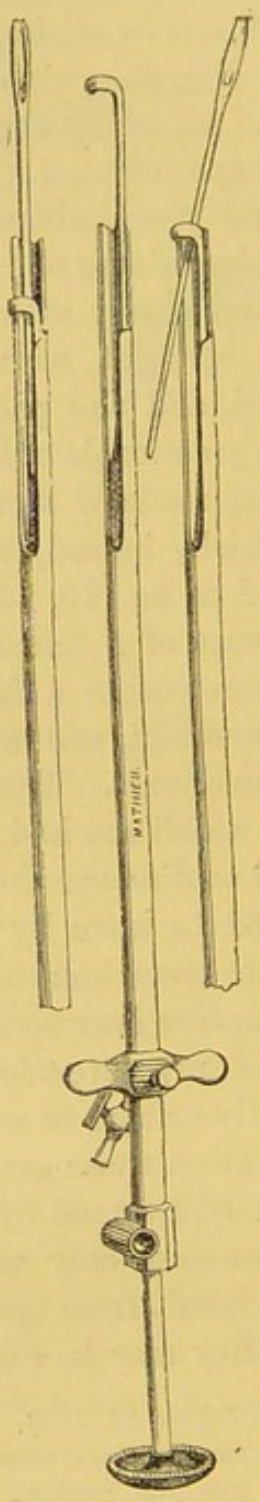


FIG. 80.



certain complications, affecting the patient prior to operation, should have in determining what method of relieving him is to be adopted—such as extreme age, debility, renal disease, diseased

bladder, enlarged prostate, stricture of the urethra, peculiarities in the stone itself—that will be discussed in Chapter XIV., which is devoted to a consideration of the numerous circumstances which should guide the judgment in relation to each individual case which comes before us.

Fever.—It is by no means uncommon, although it is exceptional, that a sitting is followed by a rigor, rapidly succeeded by hot and dry skin, and subsequently by sweating. At the same time there are thirst, an accelerated pulse, and augmented temperature. Pains in the head or back, or in all parts of the body, not unfrequently occur also. This is commonly known as an attack of fever, or of 'urethral fever;' this peculiar group of symptoms being probably often associated with some lesion, however slight, of the urethra. The attack varies greatly in intensity; it may commence in the faintest chill, or in a rigor of great severity, the subsequent phenomena generally corresponding to the initial one. In nine cases out of ten it is not of serious import: it renders the patient temporarily weak, and prolongs the treatment by rendering some postponement of the next sitting desirable. Having occurred once, it should be anticipated at the next crushing by keeping the patient warm at the time, wrapping him up well, and afterwards applying hot bottles to the feet, and giving some warm drink, as hot tea, or a little wine and water, if preferred. A moderate dose of opium is, perhaps, the most useful prophylactic; quinine appears to have little influence in preventing the attack. A drop of the tincture of aconite given at the time, and repeated in two or three hours, has been said to prevent rigors; but I cannot endorse the observation, for it is very difficult to judge of the effect of any single agent in these circumstances. That one in which I have the greatest faith, as a preventive, is the surgeon's ability to operate with ease, gentleness, and rapidity, so as to injure the urethra as little as possible.

Inflammation of the bladder, prostate, or testicle.—When the attack is very severe, it may announce the onset of some local affection, as of cystitis, or of renal implication, or inflammation of the testicle, although it may still be only severe constitutional disturbance resulting from the operation, and not related to any local inflammation; in this case the fever is

more likely to continue or become intermitting. If pain above the pubes, or at the neck of the bladder, and frequent desires to make water are experienced; or, on the other hand, should severe pains in the loins and sickness occur,—counter-irritation to the suprapubic region, or to the loins, respectively, is of service. I know of no better form for these cases than the repeated application of hot linseed poultices, sprinkled with mustard. Hot hip-baths, demulcent drinks, small but frequent doses of liquor potassæ, diaphoretic regimen, and mild nutriment, form the main elements of treatment; opium, if necessary, to relieve pain. The decoction of *Triticum repens*, from a pint to a pint and a half daily, is particularly useful. When the cystitis becomes more chronic, and much pus and mucus are mixed with the urine, the bladder may sometimes be washed out daily, and another crushing performed as soon as possible, since pulverising some of the larger fragments may ameliorate the condition of the bladder sooner than any other treatment. In orchitis, which rarely occurs, fomentation and rest are necessary, and the use of a lotion, one part tincture of opium, three parts liquor of the subacetate of lead, and four parts water. I know nothing which relieves so speedily as this combination. Of course, the next sitting must be postponed until it is better, and be a short one, and more than usual care be taken in manipulating.

Hæmorrhage.—This rarely occurs; a little bleeding sometimes follows the application of instruments, and may even continue for a day or two—but this is exceptional. I once saw severe hæmorrhage occur from the bladder, not from the urethra, probably from peculiarity of constitution, after a short sitting conducted with great care; the bleeding continued in spite of all treatment until the patient's death, which occurred in the course of a week. At the autopsy no sign of injury was discovered by the most rigorous examination, either in the tissues of the bladder or in the prostate; but the whole mucous membrane was greatly congested. The patient had been in the habit, while the subject of stone, of losing blood freely from the bladder after exercise even of a very moderate kind. The usual treatment of vesical hæmorrhage should be adopted in these cases, consisting in rest, elevation of the pelvis, cold, with

or without ice, ice in small pieces in the rectum, even injections of ice-water, or iced solution of matico, if the manipulation does not excite fresh bleeding. The tying-in of a soft vulcanised catheter may or may not be advantageous, which experiment alone can determine. As a rule, all mechanical expedients are to be postponed, until absolute quiet and cold have proved inadequate to obtain subsidence of the hæmorrhage; since it is so much more easy to excite fresh bleeding by mechanical means than to check it; and further attempts to deal with the stone should be postponed until the symptoms have ceased, when the course to be pursued is a question for very grave consideration. The subject of hæmorrhage in all its bearings is a very large one, and has been treated fully elsewhere. A brief synopsis will suffice here.[1] In a case recently under my care, the disposition to bleed manifested itself after the first sitting or two, but it gradually got less as the end of the treatment approached, and the bladder appeared to regain a healthier tone. It was sufficient, however, at the outset to occasion anxiety, but the case terminated admirably well.

Chronic retention of urine.—There is one condition which must always be closely looked for after Lithotrity, especially in elderly subjects. It is the occurrence of retention of urine after a sitting. It may occur very insidiously, occasioning great discomfort and even constitutional symptoms, before either the patient or the surgeon is aware of the cause. The bladder appears to be temporarily atonied; it becomes full and the surplus runs over, and as the urine appears in the ordinary quantity of health, the distension of the bladder is easily overlooked. It is not due to impaction of fragments in the neck of the bladder, but apparently in part to defective power in the organ, resulting from the operation; and in part to swelling of the urethra, or of the prostate beneath it; mostly, but not always, the natural power is speedily regained, but, until it is so, the catheter must be introduced twice a day, or more frequently if necessary, as in all cases where this condition exists from other causes.

As to the time during which the recumbent position should be retained after each sitting, and to the amount of confine-

[1] *Diseases of the Prostate.* By the Author. Lond. 1868, p. 206, *et seq.*

ment within doors subsequently, it is impossible to lay down any rules which can be applicable to all cases. In each it must depend on the liability to local and constitutional irritability which each case exhibits. While in some cases, where the stone is small and the patient has good health and little local excitability, strict confinement to the house is not desirable, in others it has been necessary for a period of some weeks. Often, however, air and some very gentle exercise can be taken between each sitting, with advantage to the patient.

ANÆSTHESIA.—There is a point of some importance indirectly connected with the operation of Lithotrity on which difference of opinion exists.

I refer to the use of ether or chloroform during the sitting; and shall very briefly consider how the condition of anæsthesia affects the operation, because it is quite evident, from the manner in which the preference to perform Lithotrity without chloroform has been viewed by some, that the grounds for that preference have been misapprehended.

First, then, let it be premised that there is no reason why the patient should not escape any degree of pain and uneasiness which attend the crushing of a stone if he be very nervous or susceptible. In these circumstances, it is no doubt better on the whole that he should be spared the excitement and the shock, which might be considerable in his temperament.

But the pain arising from Lithotrity, properly performed, is really not severe. It is uneasiness rather than pain; and when a sitting is no longer than one or two minutes, the demand on a patient's fortitude it not very considerable.

Now the only advantage in not employing ether with which I am acquainted may be thus explained. There are certain circumstances, over which we have no control, and of which we have little knowledge, that render calculous subjects more sensitive on some days than others. Ordinarily the patient may bear the sitting without a murmur, and after it is over state that he has had little to complain of. But on commencing to perform it on another day, although the operator proceeds with the same care and facility as usual, the patient complains much as soon as the lithotrite has entered the bladder: its slightest movements aggravate the pain, and any

attempt to proceed evidently causes him much suffering. In such circumstances nature's plain indication should be followed, the instrument should be withdrawn at once, and the sitting postponed to another day. The knowledge of this condition constitutes all the advantage, whatever it may be worth, which is to be gained by the absence of anæsthesia. Each case, in relation to this matter, must be judged by its own peculiar requirements. My own practice has been, for the last seven years, to use ether in almost every case; it is very rare indeed that I do not do so. At the same time, a very brief sitting ought not to occasion much suffering; and if the surgeon operates without an anæsthetic, watching for any sign of uneasiness on the part of his patient, he acquires almost unconsciously a mode of manipulating which is delicate, careful, and extremely unlikely to irritate the bladder.

LITHOTRITY IN CHILDREN.—Lithotrity can be applied to patients of any age; but there are some difficulties in its employment in the cases of children which those of adults do not generally present. Regarding Lithotrity in the abstract, without reference to age, let us call to mind what are the conditions most favourable to success.

First. A fairly capacious urethra.

Secondly. A bladder displaying moderate tonicity, but not excessively irritable.

Now, neither of these two conditions exists in children, and their absence is the source of most of the difficulties in question.

1. The urethra of the child, say from three to seven, or eight, years, is exceedingly small, and it is during this period of life that half the cases below puberty occur. To crush a stone at this age it is, therefore, necessary to employ a very small lithotrite. Hence, none but small stones are amenable to its action, unless the sittings are numerous. For, in a small lithotrite, the blades must necessarily be short, otherwise they are liable to break; and short blades are incompetent to grasp any but small masses. If used to break down piecemeal a stone of an inch diameter, the time consumed is considerable. Hence in Paris, where only Lithotrity has been largely employed for children, ten, twelve, or more, sittings are common,

and each sitting requires at least double the time which is necessary for an adult, from circumstances next to be alluded to. A case is on record there of a child nine years old, who, in the most able hands, was the subject of no less than seventy sittings.

2. The pyriform shape of the bladder, and its situation in the abdomen rather than in the pelvis, are unfavourable. There is no fixed area for operating as in the adult; no spot where the stone may almost certainly be found; no depression behind the prostate; and the viscus is often much distended and capacious; hence, there is extra expenditure of time in seeking the stone.

The form and situation of the bladder also favour the determination of fragments to the neck, when the patient is recumbent in the ordinary position. The organ is extremely excitable, contracting vigorously and continuously with very slight irritation. Hence, impaction of fragments in the urethra readily takes place after the stone has been crushed. It is common to encounter much difficulty from this cause; obstinate retention of urine not unfrequently resulting, which has sometimes to be relieved by cutting down on the fragment, and removing it through the perineum.

Furthermore, these young patients possess none of that self-command which so often conduces to the success of the proceeding in the adult; and chloroform must always be employed in their cases.

Incontinence of urine after Lithotrity in children is not a very uncommon result, although it generally disappears spontaneously in course of time.

If it is decided to operate in any given case, the urethra should be dilated on three or four occasions previously, the pelvis should be well elevated; and if the stone, when caught, proves to be no larger than a pea, it should be efficiently crushed at a single sitting, care being taken to granulate it thoroughly. Providing it is thus small, the proceeding is generally successful. The child should be confined strictly to bed, have plenty of demulcent drink, an opiate if much straining follows, and warm baths. In cases of my own, in which the stone was quite small, I have crushed it at a single sitting.

Such a result must be regarded as a simpler and safer proceeding, probably, than Lithotomy. But where more than two or three sittings are necessary, the advantage of Lithotrity appears to be very doubtful. The instrument I used, in that and in other cases, is one without a screw; the crushing power being obtained by simple pressure in the palm of the hand; and this is ample for the small concretions to which it is applicable. Fig. 81 represents the instrument, and fig. 82 the mode of applying it. But the usual form may equally be employed.

Boys, from nine to thirteen, are somewhat more promising

FIG. 81.

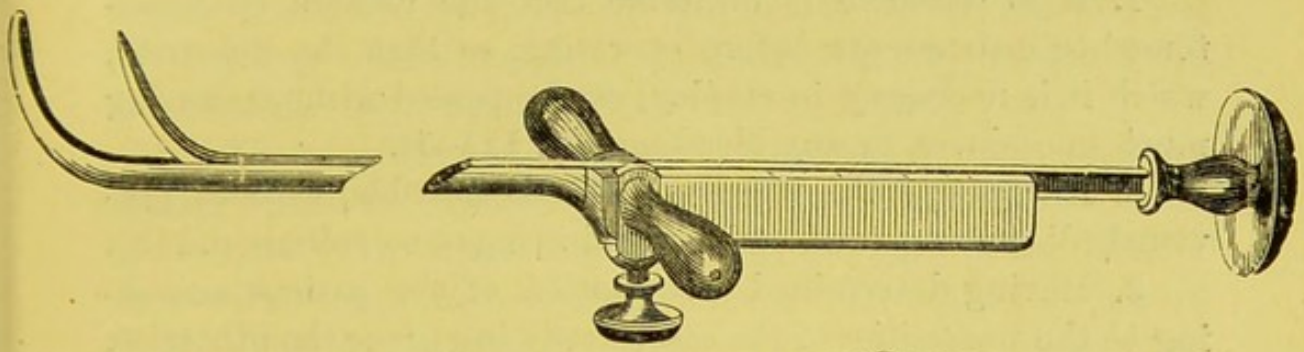


FIG. 82.

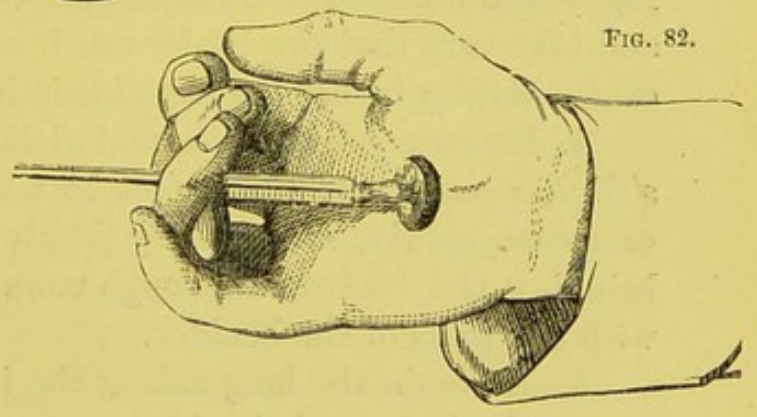


FIG. 81. A small Lithotrite without screw, for young children. Its size is about No. 5.
FIG. 82. The transverse bar is the base of support against which pressure by the hand crushes the stone.

subjects, but in them the same sources of difficulty exist, though in a less marked degree.

Dr. Guersant, of Paris, surgeon to the Children's Hospital, reported twenty-one cases of children, on whom he practised Lithotrity, in which there were six deaths; 'two,' he states, 'from the operation, and four from intercurrent diseases.' Besides these, three others were subsequently cut. Lithotomy in children, following unsuccessful Lithotrity, does not appear to be a promising operation: every one of the three died. It

need hardly be added that English Lithotomy affords results incomparably better than these. The deaths to recoveries between the first and the fifth year are only one to thirteen, and between the sixth and the eleventh year, only one to twenty-two and a half. (See Table, p. 114.)

I shall close this chapter by recapitulating briefly a few of those practical maxims which have been regarded, in this and the preceding chapters, as among the most important to guide the practitioner of Lithotrity.

1. It is occasionally desirable that the urethra be accustomed to instruments before operating, so that the lithotrite, which it is necessary to employ, can be passed without causing much uneasiness, or any bleeding (pp. 123–5).

2. Always operate, whenever this is possible, without previously disturbing the bladder by injecting or sounding (p. 143).

3. Having determined the position of the patient according to the necessities of the case, slowly introduce the lithotrite, and take care that the blades reach or pass beyond the centre of the bladder before the male blade is withdrawn.

4. Execute every movement deliberately, occasionally with a slight pause between each (pp. 150–3); open and close, incline, or rotate, slowly, without any jerk whatever; and all without bringing the blades into rough contact, as far as it is possible, with the walls of the bladder.

5. Maintain the long axis of the instrument in the median line of the body and the blades at or near the centre of the bladder, this being the area for operating mostly to be chosen. In screwing home the male blade to crush, it is especially necessary to keep the instrument steady, to avoid much vibration of it, or much lateral movement of the blades from its axis at each turn; a small deviation at the handle produces a large one at the blades.

6. The position of a large stone is often very near the neck of the bladder. But the position of the stone varies much in different cases. When it is difficult to find or seize, the reason usually is, that the stone lies close to the neck of the bladder, so that the male blade, when drawn out, impinges upon

the stone, instead of including it within the grasp of the instrument. It is necessary then to insinuate carefully, by a lateral movement, the male blade between the stone and the neck of the bladder (p. 155).

7. When the stone is caught, especially if in a large or powerful lithotrite, rotate the instrument a little on its axis before screwing up firmly or crushing, to make certain that nothing is included besides the stone.

8. Having broken a stone or a large fragment, the operator may pick up and crush piece after piece consecutively, without further searching, if he is only careful to work the lithotrite exactly at the same spot—the patient of course not shifting his position—since fragments fall immediately beneath the blades of the instrument, and rest there (p. 156).

9. Never withdraw a lithotrite overloaded with calculous débris; a moderate quantity will come away between the plain blades; but if an impediment is felt at the neck of the bladder on withdrawing, return to the centre of the cavity and unload them. This can always be done with a properly constructed lithotrite (p. 158).

10. After a sitting it is generally desirable that the patient should have a hot fomentation to the pubic region, remain in the horizontal position, and pass his water in that position if he can. If his bladder has not been emptied of calculous débris, he should remain tolerably quiet until it has passed, which usually happens within two or three days of the sitting.

11. The aspirator is now the most serviceable instrument for removing all débris; and is at the same time the most efficient, as a rule, for revealing the existence of a last fragment, as well as for taking it away.

CHAPTER XI.

LITHOTRITY AT A SINGLE SITTING.

Caution in Procedure, the marked characteristic of the early Lithotritists.—Introduction of Anæsthesia shortened the process.—Bigelow's proposal to remove all the Stone at one Sitting.—Cases referred to.—Modifications in Lithotrites necessary, and improvement in the Aspirator.—Rules for employing it.—Risks inherent in the Single Sitting Method, especially with unnecessarily large Instruments.—Illustrative Cases.

In the early stages by which Lithotrity was developed, and especially in the hands of its chief originator and advocate, Civiale, the highest importance was attached, and doubtless rightly so, to the exercise of extreme caution in relation to all instrumental interference with the bladder and the urethra.

The principle pursued by almost all surgeons who adopted the new operation of crushing, at that time, constrained them to proceed little by little, to feel their way cautiously, and accomplish as much progress as they could, but always subject to one important condition—namely, that the operator should do no mischief to the organs by any undue manipulation on his part. This was the practice long before anæsthesia was allied with surgery, and the lithotritist made it part of his business to watch the patient closely during the proceeding to ascertain whether he was distressed by it, and to modify it according to his sensibility and power of endurance. So much had this become a natural condition of the operation that, long after the use of ether and chloroform had become indispensable in all other operations, Lithotrity was performed by many without an anæsthetic agent. Hence, as we have already seen, it was the aim of the operator to cultivate a light and gentle, but quick, hand, to do as much as possible in a short space of time, but also as gently and delicately as he could. Thus several sittings,

varying in number from three or four to ten or twelve, were commonly necessary according to the size of the stone.

In time, however, anæsthesia became adopted also for Lithotrity, and since employing it myself I have gradually diminished the number of sittings, and removed more débris on each occasion, so that from one sitting to four or five became at length as productive as the numbers before named. This progress was naturally in part the result of familiarity with the instruments and their use, acquired by many years of practice. I also employed more and more, during the last eight or ten years, for the same purpose, the aspirator of Clover, and especially when the presence of irritation or inflammation made the removal of all the fragments particularly desirable. At the same time I have been in the habit of saying to younger men, who, as so many have done, accompanied me to my operations for the sake of studying the process, 'Do not attempt on first beginning to do as much as you see that I venture myself to do.' Such, at all events, was my practice until about two years ago; and in Paris the mode of operating then was, as I think, for the most part, it still is, based on the original 'cautious' style, or many-sitting system.

In 1878 Professor Bigelow, of Harvard, U.S., having tried the experiment in a few cases, proposed, as a general rule, that the stone should, if possible, be all crushed at one sitting, and removed entirely by a large aspirator and evacuating catheters, no matter how prolonged the time which might be necessary in order to accomplish the task. He believed that less damage would really accrue to the bladder and associated organs by a long, and even somewhat hazardous, sitting, provided the viscus was emptied of the débris, than by the old process of taking away a little and often, but leaving always hard and broken fragments in the cavity, to produce continued and sometimes serious irritation there during much of the period necessary for repeated sittings.[1]

[1] *Litholapaxy, or rapid Lithotrity with Evacuation.* By H. J. Bigelow, M.D. New York, 1878. It seems to me unnecessary, if not inconsiderate in relation to the origin of the old and well understood term 'Lithotrity,' to invent a new, and not very euphonious one, to designate this proceeding, 'Litholapaxy' (from λίθος, a stone, and λάπαξις, evacuation) implying, as it does, that the

This was a bold, and I think it may be considered a happy, idea. My mind was already prepared by past experience to receive it favourably, although the means Bigelow employed in the shape of instruments, especially the lithotrites he proposed to use for the purpose, are unnecessarily large and clumsy; and I at once tried the plan, and have to a very great extent carried it out during the past twelve months. Having tested it to the extent of 35 cases, I do not hesitate to regard it as, on the whole, in competent hands, successful. Let the stone as to size be within the limit of the surgeon's powers, and let all be removed, or at all events the greater part of it, at the first trial. In attempting this, he should commence by crushing freely with a light but strong lithotrite, removing débris by the aspirator-current afterwards. This done, the lithotrite is again introduced, if necessary, to deal with the remainder, and is again followed by the aspirator. If the rattle of fragments in the bladder against the end of the evacuating catheter still exists after its use, the lithotrite is to be again introduced to break them down, and another employment of the aspirator will perhaps complete the task. If only a few small pieces still remain, it is better perhaps to leave them than to subject the parts to repeated manipulations in order to remove some tiny portion. Such will do no harm, and may be removed at a second sitting.

By this method, instead of limiting the sitting to a term of two or three minutes, it may extend from five or seven to twenty-five or thirty minutes, although a watchful caution must control the period as it becomes extended to the longer term named. The longest sitting I have as yet found necessary is twenty-five minutes, during which I removed 329 grains of a hard uric acid stone from a gentleman of seventy-eight years of age. Three days after I removed 192 grains more in thirteen minutes, completing the case, and the result was quite successful; and when I last heard of him, he was enjoying

evacuation of the fragments is a new practice. Nothing can be more contrary to fact, since evacuation has throughout been an essential part of the process, gradually becoming more in vogue the last few years, and the evacuating instrument itself, and the method of using it, are in principle precisely what they were before, only a larger catheter is now employed. Bigelow uses No. 18 or 20 English scale, instead of 13 or 14 which I have always used.

greatly improved health at the seaside. This and all the other cases referred to have been seen by many of my brethren both in town and country. It is worthy of remark that at present not one of the thirty-five cases has been fatal, but this number is insufficient to prove anything, as I once had an unbroken series of forty-eight cases by the old system without a death. All experienced operators know how large must be the numbers in order to furnish tabular results of a trustworthy nature. In reference to the time occupied in operating, I find I have hitherto removed on the average from 150 grains to 200 grains in ten minutes, of hard calculus (uric-acid or oxalate of lime). Of course, when the stone is friable, as in the case of phosphatic formations, a larger quantity may be removed in a given time.

For the purpose of this mode of operating, I have modified my instruments somewhat. I have designed especially for the purpose one lithotrite stronger than before, making the male blade more wedge-shaped, or rather like the prow of a ship, in part angular, in part more bluff or obtuse; this male blade protrudes through a small opening at the bottom of the female blade, so as to make blocking up impossible. (See fig. 57, page 134). And the original aspirator of Clover, the principle of which is maintained in its entirety, I have considerably modified in a manner so that my new form of it offers three advantageous conditions: first, there is no possibility of air entering it; secondly, it ensures the shortest possible route into it from the bladder; and thirdly, it has a globular trap at the bottom, into which the fragments enter, but which they cannot leave.

The annexed woodcuts and following explanations will demonstrate the mechanism and action of the new aspirator. The apparatus consists of a stout india-rubber bottle (fig. 83, A). On the upper part is a tap (B), and above it a small funnel through which to fill the bottle. At the lower end is a tube, and attached to it are the lower tap (C) and the glass receiver. The tap is constructed thus:—Through the tube is fixed another metallic tube with a large opening on the under side, towards the receiver. The tube projects a short distance at D (figs. 83, 84, 85), to receive the end of the evacuating catheter placed in the bladder. The tap (C) is contained in the interior

of this tube, and is hollow; it is provided with a large opening in one of its sides, so that when once the tap is *in situ*, this opening faces that of the fixed tube containing it, and the end faces the opening D (figs. 83, 84, 85), which fits the evacuating

FIG. 83.

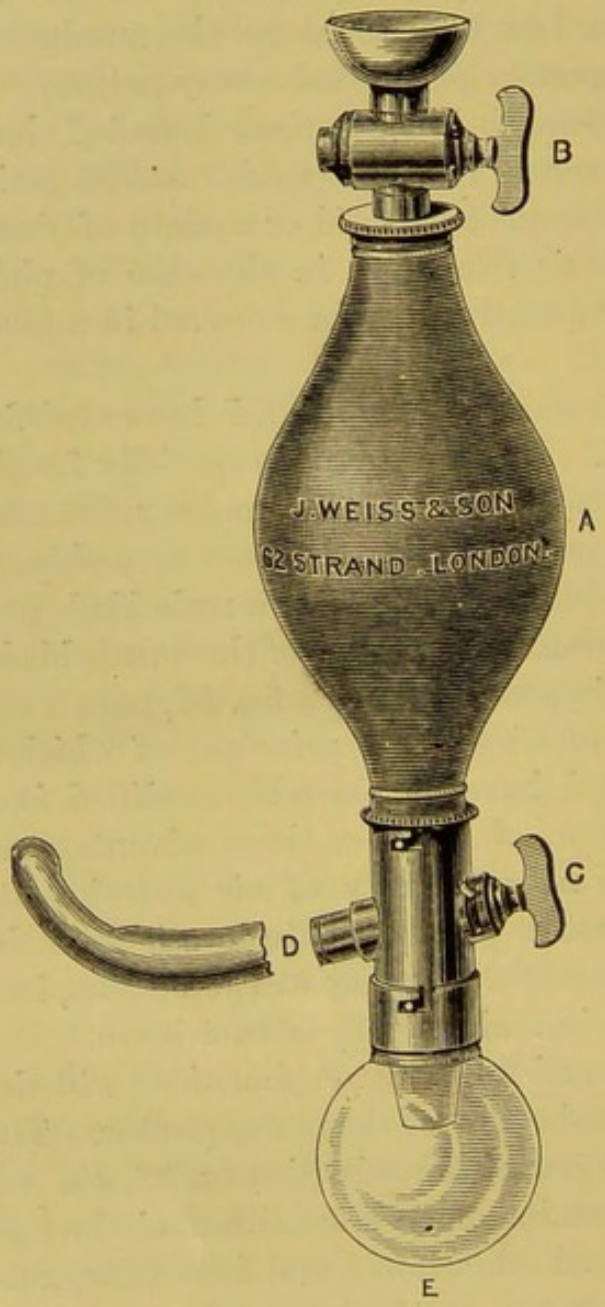


FIG. 84.

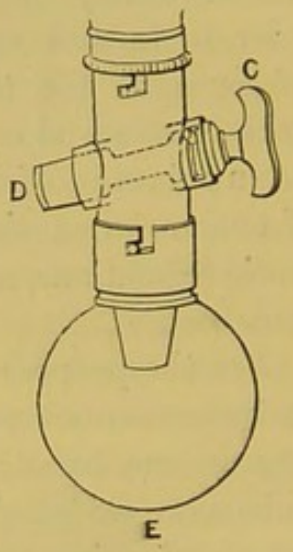
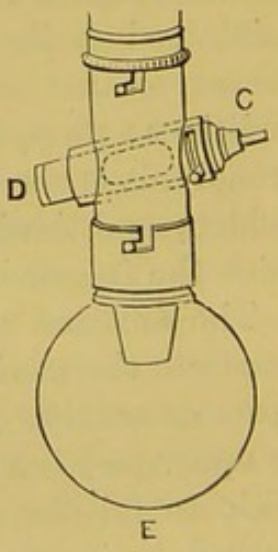


FIG. 85.



catheter. Next there is a spherical glass receiver (figs. 83, 84, 85, E); the metallic tube to which the receiver is fastened goes down into it about two-thirds of an inch. The spherical receiver is about two and a quarter inches in diameter. When the operator compresses the india-rubber bottle, the fragments

enter, fall downwards through the tube, and cannot mount again into the apparatus, in consequence of the projection of the tube into the glass receiver. The apparatus acts thus:—The evacuating catheter being in the bladder, the tube at D (figs. 83 and 84) is easily adapted. If the tap is now turned, as in fig. 84 (C), communication is established between the bladder and the apparatus. If, on the contrary, the same tap is turned as at fig. 85 (C), all communication is closed, and the apparatus can be removed without spilling a drop of water. Nothing is easier than to fill the instrument. The upper tap B (fig. 83) is opened, the lower tap (C) closed, and water poured in by the funnel at the top. The water fills it directly and drives the air completely out; the upper tap (B) is then closed, and the instrument is ready for use.

The change in the situation and form of the lower tap shortens the distance many inches for the fragments to traverse, which thus reach the receiver by the shortest possible route. The current having less distance to travel, has a more powerful action on the fragments, consequently the aspiration is more perfectly made that it has hitherto been. The entry of air into the bladder is impossible, since the current leaves the lower part of the apparatus, and the air bubbles, if any, must rise to the upper part. In consequence, also, of its small size and portability, this instrument can be very easily adapted to an evacuating catheter, without necessitating any change in the position of the patient to be operated on. Further, for those who prefer a portion of flexible tube between the aspirator and the evacuating catheter, a portion is provided; two inches thus interposed, at D, will ensure freedom from any jar to the bladder in using the instrument, and will only lengthen the route *pro tanto*. For myself, I prefer the absolutely direct and shortest route; having no more fear of hurting the bladder with the inflexible evacuating catheter than I have with the inflexible lithotrite.

This apparatus is to be used as follows:—The largest evacuating catheter the urethra will admit is to be passed, and if it be necessary, as sometimes happens, to enlarge a little the external meatus, it should be done at once. No. 15 or 16 may mostly be used; if a larger can be admitted without violence, so much the better. The catheter may have a large

opening near its extremity, either in the cavity or on either side, in which latter case a flexible stylet should fill the interior of the instrument; on reaching the bladder all the urine is withdrawn and the aspirator is attached, either directly, or by means of a short piece of india-rubber tube fitting outside both metal tubes. The catheter is held steadily, or its position may be modified, by the left hand of the operator, who holds the india-rubber bottle in his right: and with it makes pressure, forcing a current of warm water into the bladder. The pressure is then to cease suddenly, when a strong current flows into the aspirator, carrying outwards the fragments, which fall at once into the glass trap below. This process is repeated several times, according to the amount of débris observed to quit the bladder and enter the trap.

If the patient is breathing heavily under the influence of ether, it is desirable to inject during the act of his expiration, and let the fluid flow outwards into the aspirator during his inspiration, which act assists the evacuation of the bladder.

After a large crushing, the end of the evacuating catheter should not rest on the floor of the bladder, as it is then likely to be choked with débris. But after most of the fragments have been removed it is advantageous to lower the end of the catheter, in order to catch the last fragments.

If the outflow of the current is felt to be suddenly checked, and the aspirator ceases to distend, the operator may be almost certain that a fragment of a rounded or cubical form, or a small calculus, nearly fitting the interior of the catheter, blocks the passage and prevents further egress. The piece must be expelled by making smart pressure on the india-rubber bottle, after which the action of the aspirator will probably be resumed.

If after crushing all the stone, so far as the operator is able to judge, and removing the débris largely, nothing is heard or felt in contact with the end of the evacuating catheters, notwithstanding that three or four successive pressures have been made, there is ground for believing that all the fragments may now have been removed. Perhaps there can be no better proof that the bladder has been emptied, than is afforded by the fact, that a succession of outward and inward currents through the

aspirator reveal no sign of the presence of a fragment, either to the operator's hand or ear.

Thus far I have spoken of 'Lithotrity at a Single Sitting' with the favour which my present experience of it, about to be detailed below, warrants me in doing. But no estimate would be a just one which did not point out certain sources of danger, not present in ordinary Lithotrity, which attend Bigelow's method, and which have perhaps been somewhat overlooked by some of those who have enjoyed less considerable opportunities than myself of studying the subject.

First, there is no kind of question, that the instruments which Bigelow uses, and which have been employed here—that is, both lithotrites and evacuating catheters—are unnecessarily large, and are, moreover, too large to be safely passed into the bladder by ordinary hands; and especially since instruments which are two or three sizes smaller will execute the work required to be done. To handle safely such large lithotrites and evacuating catheters, a more skilful and experienced master in the use of instruments for the urethra and bladder is required, than for the manipulation of instruments which are smaller in size.

Secondly: the fact seems to be quite overlooked here—which is not surprising since it appears not to be taken into account by Mr. Bigelow himself—that *large instruments are wholly unnecessary for at least three-fourths of the stones which occur in practice*: while, if stones are found early, as they ought to be almost always, such instruments will never be wanted at all. The smaller and light handy lithotrites which are now used throughout Europe, amply suffice to crush all small and medium sized stones at a single sitting. To accomplish this purpose, all that is further necessary is a more powerful aspirator and a somewhat larger evacuating catheter than before; say a No. 16 (English scale), instead of a 13 or 14. With these a uric acid stone up to an ounce in weight can be readily removed at a single sitting. Nevertheless I have known Bigelow's enormous lithotrites to be employed here to crush a little stone (which one of my smallest lithotrites would dispose of in three or four minutes at the most, and almost certainly without causing irritation), and the débris removed by a catheter of No. 18

(English) size! an application of apparatus which would arouse a smile by its incongruity, were it not that the result has been, to my own knowledge, so disastrous. These large machines, if necessary at all—and I do not hesitate to say that they are unnecessary and undesirable—are only to be applied to the purpose of attacking calculi of rare and extraordinary size; to use them for small calculi denotes an absence of common tact and judgment which it is difficult to understand.

Let it be observed that for the cases given below—and all, large and small, are recorded just as they consecutively appeared in my practice—in no one instance have I used any other instrument than my own lithotrites, one of these being made stronger and more penetrating than before, together with the aspirator already described.

Finally, there can be no question whatever that the extra work necessary to be performed at a single sitting especially demands a practised hand to do it safely. The operation by one sitting, if the stone is hard and weighs 400 or 500 grains, requires more skill and experience to accomplish it safely and successfully, than the old operation by several sittings. This given, the results of the new method will be better than the old, because the irritation caused by fragments retained in the bladder from sitting to sitting is saved to the patient; but it is saved only at the cost of manipulation which is more severe and prolonged than before. If this is attempted by hands which are not experienced, or, at all events, not well trained and skilful, the balance of probability in relation to injury inflicted will almost certainly be larger, and will tell against the patient; and will not be in his favour, as under the old but slower system might safely be anticipated.

CASES OF CALCULUS, OF ALL SIZES, RECENTLY REMOVED BY LITHOTRITE AND ASPIRATOR AT A SINGLE SITTING, OR AS NEARLY AT ONE SITTING AS POSSIBLE.

CASE 1.—A gentleman aged 54. December 16, 1878. Oxalate and phosphate, weighing 97 grains; in 9 minutes. Sent to me by Mr. Spencer Wells, who was present at the operation. Occasionally forms phosphates and washes out the bladder to remove them.

CASE 2.—A gentleman aged 66. December 16, 1878. A uric acid

calculus, weight 84 grains, removed at one sitting; in 7 minutes. He had some fever and impaired health for several weeks, but ultimately recovered; had no more symptoms, and is now in good health. Seen with Dr. Taylor, of Camberwell.

Case 3.—A gentleman aged 43. December 21, 1878. Oxalate of lime, small, in one sitting; 42 grains; no fever or other untoward symptoms after, and quite well at present time. Mr. Spencer Wells was present at the operation.

Case 4.—A gentleman aged 72. December 22, 1878. I had crushed a calculus five and a half years before, and he had been free from symptoms until about twelve months ago. I removed now, in one sitting, a phosphatic calculus, weight 154 grains, in 8 minutes; a slow but sound recovery. He draws all his urine by catheter; Dr. Sutro was present.

Case 5.—A gentleman aged 64. January 6, 1879. Uric acid and phosphatic mixed, which had caused great suffering. Much relieved; he passes all his urine by catheter. Dr. A. K. Longhurst was present. A little removed at a second sitting, a day or two after.

Case 6.—A gentleman aged 69. January 22, 1879. Uric acid, weighing 172 grains; in 11 minutes. Sent to me by Mr. Lathbury, of Finsbury. Successful: this patient had also diabetes.

Case 7.—A gentleman aged 68. January 31, 1879. Uric acid, weighing 114 grains; in 9 minutes: a rapid recovery. Sent to me by Mr. J. H. Walters, of Farringdon.

Case 8.—A gentleman aged 79. February 12, 1879. Phosphatic, weighing 194 grains, in 12 minutes. I had cut him a year before, removing four uric acid calculi. He made a quick recovery, but passes, as before, all his urine by catheter from enlarged prostate. Mr. Clover gave ether on both occasions.

Case 9.—A gentleman aged 65. February 13, 1879. Phosphatic, 116 grains; in 6 minutes. He passes most of his urine by catheter. Sent by Mr. Holberton, of Hampton.

Case 10.—A gentleman aged 69. March 15, 1879. Uric acid, 200 grains; in 10 minutes. A few fragments left were removed at two explorations soon after; a good recovery. Seen with Dr. Bantock, who was present at the operation.

Case 11.—A gentleman aged 65. March 15, 1879. Uric acid. Dr. Bantock, Dr. Muir, and others present. A good recovery.

Case 12.—A youth aged 16. March 28, 1879. Oxalates and urates mixed, rather small. Mr. Cadge, and Mr. R. Harrison present.

Case 13.—A gentleman aged 82. March 23, 1879. Phosphatic, about 60 grains. Dr. Smith, of Great Hadham, present.

Case 14.—A gentleman aged 47. March 28, 1879. Pure triple phosphate, weighing 94 grains; in 7 minutes. Sent to me by Dr. Mitchell, of New Cross, who was present at the operation, as were also Mr. Cadge and Mr. Reginald Harrison.

Case 15.—A gentleman aged 63. June 2, 1879. Phosphatic, weighing 68 grains; in 6 minutes. Mr. Bailey gave ether; Dr. Keyes, of New York, was present. He has to pass a catheter three times a day, not emptying his bladder naturally.

Case 16.—A gentleman aged 66. June 2, 1879. Uric acid, weighing 175 grains; in 10 minutes. Recovery complete. Seen with Dr. G. O. Rees, who was present at the operation.

Case 17.—A gentleman aged 70. June 12, 1879. Uric acid, weighing 198 grains; in 10 minutes. Recovery complete. Sent to me by Dr. Ryott, of Newbury, who was present at the operation.

Case 18.—A gentleman aged 70. June 25, 1879. Mixed oxalates and urates, weighing 214 grains; in 12 minutes. Recovery complete. Seen with Dr. George Johnson, who was present at the operation.

Case 19.—A gentleman aged 60. June 20, 1879. Oxalate of lime, weighing 165 grains; in 9 minutes. Recovery complete. Seen with Mr. Morgan, of Sussex Place, and his son, who gave ether.

Case 20.—A medical man, aged 41. July 16, 1879. Phosphatic, weighing 208 grains; in 15 minutes. I removed ten grains subsequently. He had orchitis and fever, and made a slow recovery.

Case 21.—A gentleman aged 78. July 19, 1879. Uric acid, weighing 329 grains; in 25 minutes. At his age Mr. Clover preferred not to give ether longer, and I postponed the proceeding three days, removing then 192 grains more, in 13 minutes, making a total of 521 grains (or nearly 1 ounce and 1 drachm) of very hard uric acid. Recovery complete. Sent to me by Mr. Quain, of Cavendish Square, and is well now (1880).

Case 22.—A gentleman aged 58. July 31, 1879. Uric acid, weighing 145 grains; in 11 minutes. Recovery complete. Seen with Dr. George Johnson, who was present at the operation.

Case 23.—A French gentleman aged 67. July 31, 1879. Uric acid and some phosphate, weighing 40 grains; in about 7 minutes. Dr. George Johnson and others present. A rather tedious recovery, never emptying his bladder except by catheter.

Case 24.—A gentleman aged 56. August 7, 1879. Uric acid, weighing 106 grains; in 10 minutes. Mr. M. B. Hill and Mr. John Morgan present. Some irritation of the bladder continued, and was troublesome for a few weeks, and then subsided.

Case 25.—A gentleman aged 56. August 13, 1879. Uric acid.

Has some narrowing of the urethra at three and a half inches from the orifice, so that a smaller evacuating catheter than usual had to be attached to the aspirator. Weighed 123 grains; in 12 minutes. Sent to me by Dr. Kidd; Mr. John Morgan and Dr. Lebec, of Paris, present. A good recovery.

Case 26.—A gentleman aged 54. August 19, 1879. Uric acid, weighing 45 grains; in 6 minutes. Mr. John Morgan present. A good recovery.

Case 27.—A gentleman aged 70. August 16, 1879. Phosphatic, weighing 42 grains; in 5 minutes. A good recovery.

Case 28.—A gentleman aged 65. December 5, 1879. Uric acid and oxalate, weighing 40 grains; in 5 minutes. His attendant, Dr. Marsden, of Grosvenor Street, was present. A good deal of irritation followed; and although no phosphatic deposits or cystitis appeared, he passes water frequently, although without pain or blood. Otherwise he is quite well.

Case 29.—A gentleman aged 55. December 3, 1879. Uric acid. I removed 158 grains at a sitting of 10 minutes, leaving a little more in the bladder, which I removed (29 grains) a day or two after. Mr. William Rose, of King's College Hospital, was present. An excellent recovery.

Case 30.—A gentleman aged 62. January 1, 1880. Uric acid, weighing 98 grains; in 8 minutes. Sent to me by Dr. Moore, of Lancaster. A good recovery.

Case 31.—A gentleman aged 57. January 22, 1880. Uric acid, weighing 65 grains; in 5 minutes. Sent to me by Mr. J. E. Williams, of Whitstable. A somewhat tedious recovery, but he gradually attained an improved condition.

Case 32.—A gentleman aged 70. February 28, 1880. Uric acid, weighing 308 grains, in 18 minutes; finding 15 grains more three days after. Mr. Henry Smith, of King's College Hospital, saw this case with me. A rapid and complete recovery.

Case 33.—A gentleman aged 66. March 2, 1880. Uric acid, weighing 78 grains; in 6 minutes. Dr. George Johnson was present at the operation. A rapid and complete recovery.

Case 34.—A gentleman aged 65. March 20, 1880. Uric acid, weighing 51 grains; in 4 minutes. Sent to me by Dr. Handfield Jones. He had orchitis and made a rather slow, but complete recovery.

Case 35.—A gentleman aged 73. April 26. Uric acid, weighing 96 grains; in 9 minutes. Mr. Erichsen and Mr. Furner, of Brighton, were present. A good recovery.

CHAPTER XII.

THE EMPLOYMENT OF LITHOTRITY IN CASES WHERE, BESIDES CALCULUS, SERIOUS ORGANIC DISEASE OR OTHER COMPLICATION EXISTS.

Lithotrity in—1. Organic Stricture of the Urethra—2. Hypertrophy of Prostate—3. Atony and Paralysis of the Bladder—4. Sacculation of the Bladder—5. Tumours of the Bladder—6. Renal Disease—7. Multiple Calculi.

THUS far it has been assumed, in describing the proceedings of Lithotrity in detail, that the cases to which it is applied are those of patients in the enjoyment of ordinary health, or, at all events, that no serious disease besides that of stone is present.

It is now necessary to inquire what modifications of the operation may be necessary for those instances where organic disease of some kind is superadded to the calculous malady, and complicates the case.

These may be enumerated for our purpose as follows:—Organic stricture of the urethra. The prostate gland much enlarged by hypertrophy. Confirmed atony, and paralysis of the bladder. Sacculated bladder. Tumours of the bladder. Renal disease.

1. *Organic stricture of the urethra.*—This condition has always been regarded as an insuperable obstacle to Lithotrity. I have now operated on several cases with success and without any serious difficulty.

The manner which I have adopted for overcoming the difficulty is by employing the plan of 'continuous dilatation' during three, four, or five days before the ensuing sitting. A gum catheter, of small size, is introduced and tied in the bladder,

a proceeding which merely confines the patient to the house, not necessarily to bed. In two days this may be replaced by a larger size, say No. 6 or 7, and in two or three more, by No. 10 or 11. It is then desirable to give ether and to use a rather small flat-bladed lithotrite, introducing it three or four times, and carefully removing the débris made. The catheter is then again tied in, and another sitting may follow in two or three days. The débris should be made fine, and an evacuating catheter of No. 11 in size employed to remove it. When writing the previous edition of this work, I was concluding the treatment of a fourth patient, then lying in one of my wards at University College Hospital, on this system; and he was soon afterwards discharged cured. He had been cut for stone eight years before, and this time had a phosphatic formation of rather large size in his bladder. There was a stricture at five inches from the meatus, admitting, at most, No. 6 on admission.

It is not to be concluded that all cases of stricture will be amenable to Lithotrity; but there is no doubt that for most it may be made successful, and I think always whenever the stone is small. For large hard stones Lithotomy will still probably be preferable.

2. *Hypertrophy of the prostate.*—The coincidence of a moderate development of this condition with calculus in the bladder I have found to be so frequent in elderly patients, and so inconsiderable in its bearing on the operation, that I do not regard it as worth taking into consideration in relation to treatment. But when the gland is very large, and when it is eccentric in form, as through the presence of polypoid outgrowths or of rounded masses into the cavity of the bladder, a serious complication is presented to the surgeon. I am bound to say, however, after operating on a considerable number of such cases, that less difficulty is presented than might be anticipated. Careful manipulation to avoid bleeding, one of the principal sources of evil, is essential, and therefore gentle and restrained movements of the lithotrite must be adopted. At the same time, much of the work must be done with blades reversed, and even dipped deeply behind the prostatic growth; and this is by no means difficult, the depression there admitting access of the instrument as readily, or more so, than in the

healthy bladder. But the fragments are not expelled by the natural efforts, and must be removed by the aspirator, which is now especially useful. The use of the ordinary catheter is often necessary for these patients as a habit, and by its means some of the finer débris passes; and a little washing out daily with the four-ounce gum bottle—not with a powerful syringe,—assists the process, if all has not been removed at the operation. It is by no means unimportant to maintain a gently relaxed condition of the bowels, which favours alike the expulsion of urine and of débris in these subjects, while constipation always adds to their discomfort. If straining or tenesmus occur, morphia suppositories or, better still, subcutaneous injection, can be employed. The frequent use of a very hot bidet is superior to hip-baths, as being less weakening, less troublesome to the feeble and aged patient, and sometimes really more efficient.

Occasionally, during an attack of great frequency in micturition, a vulcanised catheter may be retained for a few days with singular advantage; or the ordinary gum catheter, according to circumstances. Sometimes, however, it cannot be borne.

In one case of an elderly man who had found it necessary to empty the bladder every two hours day and night, having no power to pass any urine by his own efforts; and who was the subject of a large phosphatic calculus, the inlying catheter could not be tolerated Its presence produced extreme distress, while, after crushing and removing very freely by the aspirator, there was increased frequency in the calls for the instrument. Under these conditions I made a small perineal opening, and by it introduced into the bladder a vulcanised catheter, which gave immediate relief, and was tolerated for several days with admirable results. I should have no hesitation in practising or recommending this procedure in similar circumstances. The making of a small opening in the perineum on a grooved staff is a very simple matter, and the wound heals readily when no longer required.

Of the general treatment of such patients I say nothing here, beyond adverting to the need which always exists for the surgeon to be guided mainly in each case by the knowledge of previous habits and constitutional tendencies, which at sixty,

seventy, or eighty years of age are not to be ignored, or much interfered with; and that also, especially for these, a study of diet and habitudes is as necessary as the study of medicine, strictly so called.

3. *Confirmed atony and paralysis of the bladder.*—With either of these two different conditions, it is by no means uncommon to find stone in the bladder. Patients who are younger than those who are the subjects of retained urine from hypertrophied prostate, already referred to, find it necessary, from the causes above named, to pass all their urine by catheter; and when they form stone, it is mostly phosphatic in character. Here the complication is less formidable than that which has just been described. The organs are habituated to the contact of instruments; no deformity exists; there is only a flaccid bladder and a want of tone in its coats. All that is necessary, beyond the crushing of the stone, is its removal by the lithotrite and the aspirator.

4. *Sacculation of the bladder.*—This is one of the most serious and unpromising conditions which can complicate any proceedings to remove a stone. It is unquestionably unfavourable in Lithotomy, and in Lithotrity it is the source of failure and of danger. Unhappily, the diagnosis of sacculation is not by any means always possible. I have diagnosed a sac during life, and verified the statement by autopsy; but in the majority of cases in which sacs exist, I know no means of accurately determining the fact during life. For example, after some years of obstruction to the outflow of urine, partially relieved by the catheter, or not, an elderly patient may exhibit the following phenomena:—He habitually uses the catheter, say, two or three times daily, and after the contents of the bladder have been apparently withdrawn, some dribbling of turbid urine through the instrument continues. This occurring only to a slight extent, denotes merely inequalities in the cavity, produced most commonly by irregular masses of prostatic outgrowth. But if it continues to a considerable extent, and, *à fortiori*, if, having made the patient lie on each side alternately for two or three minutes, he rises to the standing position, and then some ounces more are withdrawn, there can be no doubt as to the existence of some sac or sacculi in the bladder. This experi-

ment I have tried repeatedly, and upon it have founded a diagnosis of sacculation which has been ultimately confirmed by examination after death. In one of the cases in which these circumstances occurred, I found two small calculi within the sac, where they never could have been detected during life.

In cases of death in aged patients, occurring after Lithotomy and Lithotrity, and especially when it follows slowly and insidiously the commencement of habitual use of the catheter, for elderly men who had been the subjects of long neglected chronic retention of urine from enlarged prostate, it is by no means uncommon to find sacs in the bladder. Often these are small and numerous, less frequently they are large, but in any case they seem to conduce in some manner to the unfavourable issue. They become the depositories of decomposed urine, which rarely altogether issues from them; thus chronic but severe inflammation is set up, and not only cystitis, but even peritonitis, may be produced, for many lie in close contact with that membrane. As a result of performing Lithotrity, fragments may be caught in these recesses, where the foreign matters doubtless increase irritation, while their removal becomes impossible. When, in the course of the operation, the surgeon has reason to believe that sacculation exists, an additional argument is furnished for removing all the débris, if possible, at a single sitting.

Should, however, the diagnosis be clear before commencing any proceeding, it is possible, other conditions being equal, that Lithotomy might be somewhat less hazardous for such a case than Lithotrity.

5. *Tumours of the bladder.*—These—simple prostatic growths being of course not included in this category—are so rare, that the question of applying Lithotrity for a patient with a tumour in the bladder can very seldom arise. I have operated in two instances only, and in these the growth was cancerous. The only indication presented was to operate with extreme gentleness and care, so as to avoid occasioning hæmorrhage. In these cases, the space for operating was limited; but this, if the stone is not large, is scarcely a serious objection. Each patient lived a short time after the removal of the calculus, and his sufferings were mitigated in consequence.

6. *Renal disease.*—I have had to perform Lithotrity several times for patients suffering with manifest and advanced disease of the kidneys. Such individuals exhibit tendency to severe constitutional disturbance, such as fever, irregularities in the excretion of urine, &c., more readily than those who are not so affected. It is often with no little anxiety that the symptoms must be watched in these cases. The main object of the surgeon in performing the necessary manipulations, is to produce as little irritation as possible. Probably this will be in the long run accomplished as well, or better, by a single complete sitting than by repeated small ones. The condition and strength of the patient must be considered. The retention of fragments in the bladder in the circumstances described will probably be more likely to propagate irritation to the kidney than their removal at one operation, provided the surgeon is capable of accomplishing this skilfully and without inflicting injury. All possible care should be taken of the patient's external conditions: he should be confined to his bed, or at all events to his room, and on the appearance of any fever, or of pain in his loins, hot cataplasms of linseed, sprinkled with mustard, should be applied to the back. All rapid changes of temperature should be provided against, the sufficient action of the bowels ensured, and the powers of life supported by unirritating nutritious diet.

7. *Multiple calculi.*—It is by no means uncommon among elderly patients to find several small calculi in the same bladder. Weight for weight, the advantage is on the side of the numerous calculi, as compared with the single one. No large fragments are made in granulating small stones: no sharp, rough, and irritating masses follow the crushing process. When two or three calculi of considerable size are found in the bladder, in the place of one, the amount of manipulation which will be involved by the necessary crushing, although considerable, is notably less than if the total amount of calculous matter existed in a single compact mass. In dealing with a case in which the presence of two or three stones, say, each the size of a filbert, has been demonstrated, one only need be attacked at first. The unbroken stone, with its surface more or less smooth, is a much less irritating object than the angular pieces

which are produced by a single crush of the instrument, and may be left for a subsequent sitting, if desired.

It is by no means necessary to interfere with a second or a third entire stone, after crushing and removing the first; although there is no reason why the whole should not be removed at one sitting, if all the circumstances of the case are favourable to the adoption of this method.

CHAPTER XIII.

THE RESULTS OF LITHOTRITY.

Difficulty of estimating the Results of Lithotrity.—Small Phosphatic Concretions not to be regarded as 'Stone.'—Weight of Débris should always be recorded.—Brodie's Experience.—Reports by Civiale.—The Author's Experience, embracing 422 Cases.—Its Results analysed:—1. The Recovery Rate; Causes of Death; Tabular View of all the Fatal Cases in the Series.—2. General Condition of Patients afterwards.—3. The Return of the Malady.—Nature and Composition of the Calculi.

During the forty or fifty years which have elapsed since Lithotrity first claimed to be recognised as a surgical operation, more or less applicable to a large number of cases of extreme importance, occasional attempts have been made to determine with precision the results derived from its employment. At first sight this object might be thought easily attainable, since it would seem necessary only to compare a sufficiently large number of cases, so treated, with a similar number of cases by the single pre-existing operation, that of Lithotomy. The capabilities of that method were well known, or might be obtained without difficulty. The cutting operation had been applied under all circumstances, and to all cases, the young and old; to stones of all sizes, small and large; and the effect of it, in any case, could never be doubtful.

With Lithotrity, however, it was soon found to be a much less easy matter to arrive at an accurate appreciation of the result. After a few years of trial, it was quite obvious that the crushing method was even more hazardous than cutting for large stones; and for a few stones of particularly hard structure it was impracticable. For a great majority of the cases of infants and children, it was certainly less successful than Lithotomy. It was applicable, then, only to a certain proportion

of adult cases; and did not include among them the most formidable. On this ground alone, the comparison between its capabilities and those of the old method could not be easy. One thing was clear, namely, that as it was only applicable to what might be called, to some extent, selected cases, its results for these ought to be very successful, or Lithotomy ought not to be set aside for it. At the same time, it was not to be forgotten, that although Lithotrity necessarily demands, as a condition of successful performance, a stone of not too large a size, it does not necessarily demand youth or strength of constitution, that it makes no insuperable difficulty of any age, nor a serious objection to whatever feebleness of body great age involves, provided only the first condition exists, viz. that the stone be small.

An absolute comparison of results, therefore, is difficult. The value of Lithotrity cannot be estimated, unless the ages of the patients and the size of the stones dealt with are accurately known. For it is obvious that if the Lithotrity of one surgeon embraces only stones of three drachms in weight, while that of another surgeon deals with all that occur up to five or six drachms or more, the operation of the latter will in the aggregate be a more hazardous proceeding, and will be attended with more numerous and graver casualties, than the operation of the former. After much consideration of the question, I confess it appeared to me that, owing to these and other circumstances, an accurate and careful appreciation of the results of Lithotrity has not hitherto been made. One, perhaps, in the early history of the operation possessed the characters named, so far as it went, viz. a paper contributed by the late Sir B. Brodie to the Transactions of the Medical and Chirurgical Society, fifteen years ago: at which time it excited much interest.

The distinguished author made no endeavour to establish a case either for or against Lithotrity. He recorded all the casualties, and made no attempt to lessen their importance, or in any manner to explain away their relation to the operation. And in regarding this record of Sir. B. Brodie's experience as, perhaps, one of the best existing contributions to a real knowledge of the value of Lithotrity, I do not overlook the fact that during the last few years the late M. Civiale has published

annual reports of his practice, giving the number of patients, and in part the results of his operations. These reports, however, never at any time contained the particulars which are essential in order to enable others to form a judgment, and which I have felt it a duty to furnish in the table of cases now given at the end of this work. It was impossible to know that clever operator without feeling that his natural bias for an operation he had mainly designed, was the first to perform, and with which he was so intimately identified during life, and even after death, led him, as is universally confessed, to estimate his results more favourably than an unbiassed looker-on could venture to do. In short, he barely admitted that Lithotrity could occasion death. It is useless to deny this fact, nor that it influences all his writings on this subject. He invariably attributed death, when it occurred in the course or after a case of Lithotrity, to some other cause; never to the operation. Such was, without doubt, his conscientious belief; and practically for him, although he did not formally affirm it, Lithotrity was never fatal.[1] But the mode of reasoning he employed would render almost every operation in surgery innocent of fatal results. To Civiale I desire, on every ground, public and private, to render due homage. It is no small boon that his skill and indomitable perseverance have conferred on suffering humanity. But the mode of estimating the results of an operation which he adopted in relation to Lithotrity, is not one which is, or can be, accepted here. As long as it is an accepted formulary that death may be produced by a surgical operation, and that the liability to cause death is a quality which can be approximately estimated by observation, and the knowledge of which enables us to speak of an operation as more or less grave, according to the amount of such liability proved to exist, we cannot make an exception of Lithotrity. Lithotrity does not less surely destroy life in certain cases, although no palpable lesion may be produced, than Lithotomy does, when the necessary wound proves fatal. The catastrophe is only much more obvious in the one case than in the other.

With this conviction, I have therefore made it my object to

[1] *La Lithotritie et la Taille.* Par Civiale. Paris, 1870. Chap. X.: 'La Lithotritie, peut-elle occasionner la mort?'

test, as carefully and impartially as it is in my power, the operation of crushing the stone as applied to all cases up to a certain weight, with regard to its after results, both immediate and remote. The main objects of inquiry being the number per cent. of recoveries after the operation, the proportion of cases in which the stone recurs, and the condition of the recovered patient in after life; the last being, from the nature of things, the least easy of inquiry.

With this end in view I presented to the Royal Medical and Chirurgical Society, as already referred to (page 118), an analysis of 500 consecutive cases of operation on adult males performed by myself for calculus in the bladder, accompanied by the calculi removed: the Lithotomy cases being 78 in number; and those of Lithotrity being 442.

Of every case I possess full written notes, made at the time, as well as the stone itself (with very few exceptions indeed), carefully preserved and labelled for reference. I adhere to the system of verifying each one by naming some gentleman who has seen it with me,—a system unnecessary, I am quite ready to believe, for my contemporaries, but which will form a guarantee of accuracy to unknown or future observers and commentators. The cases themselves will be found in the Appendix at the end of the volume, each briefly reported; further details being afforded of all those which terminated fatally.

In offering an analysis of these 422 consecutive cases of Lithotrity, I must first recall the fact that all occurred in adults, and for the most part of an advanced age. And here let me remind the reader, that in comparing statistics relative to the operations of Lithotomy and Lithotrity, all numerical tables are worthless which do not separate the cases of children from those of adults, so different are the results of operations, especially by the knife, which occur above and below puberty respectively. Next, let it be observed that several of these patients have been operated on twice; some as many as three times; and there are two very remarkable instances of four operations on the same individual. (Table, Nos. 62 and 74.) 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 forma-

tion has been present, or the case would not have been so registered.

The removal of some phosphatic concretions, from the bladders of elderly men who do not empty the organ naturally, has never been admitted by me 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. Now, in the paper by Sir B. Brodie, already referred to, 115 cases were recorded. But Sir B. Brodie frankly states that *eight* of them occurred in the person of one individual in the course of as many years (!), and that other cases of a similar kind were included (vol. xxxviii. p. 185). So that the 115 cases probably represented considerably less than a hundred individuals. Such numerous repetitions of the proceeding however cannot now be regarded as distinct 'operations for the stone.' Each doubtless, in the case referred to, was a small phosphatic formation. In this manner I might have greatly augmented the number of my cases had I reckoned as such the removal by the lithotrite of a small phosphatic concretion, such as frequently occurs in the bladder of an elderly man with old-standing hypertrophy of the prostate, necessitating, as it often does, withdrawal of all the urine by catheter. In this condition many

persons live, in tolerable comfort, for twenty years or more. But it is by no means rare, in some of these cases, to find the symptoms aggravated by the presence of a small phosphatic concretion, weighing perhaps from ten to twenty grains, too large to wash out, but which a single introduction of the lithotrite suffices to remove. This proceeding may be repeated sometimes once or twice in a year; and thus, for a single individual, the surgeon may have to repeat the process six, eight, or even ten times. These concretions I have never allowed to rank as 'stones,' and have not admitted them into my series, otherwise I might have reckoned at least a hundred more 'cases.' I hope, in future, to give the precise weight, in grains, of all the débris obtained in each case, a plan which the increased use of the aspirator renders more easy of accomplishment. Illustrations of such conditions may be seen at Nos. 111, 207, 211, 276, 359, 381, 409, 410, and others in the list at the end of the volume.

Lastly, it must be remembered that the expectation of life, and the general quality, as regards health, of these patients is a little below the average; since it includes so many of those old and confirmed cases which seek the aid of a well-known operator, as a forlorn hope, and are attracted for this purpose from every part of the world. Most of these patients are from different parts of Great Britain; but the table includes also patients from France, Germany, Portugal, Turkey, Russia, Sweden, Norway, Canada, Belgium, the United States, California, the East Indies, and New Zealand.

In commencing this analysis it is necessary to bear in mind certain important facts relative to age. They may be briefly stated as follows:—The mean age of the 422 cases is rather more than 61 years.

The youngest patient was 21 years old; the eldest was 84 years. There were about 100 cases of 70 years of age and upwards; and more than 250 cases of 60 years and upwards. Next, with regard to that important point, the size and weight of the stone, I may say that I have, as a rule, to which but few exceptions have occurred, applied Lithotrity to every case of ston under my care which has been obviously beneath an ounce in weight. At one ounce and upwards I have preferred Lithotomy.

I may add, for the sake of giving a criterion as to size, that a uric acid stone which weighs an ounce equals in size a large date. I know no better comparison.

In examining the results of the operation in these cases, I shall inquire, first—What is the rate per cent. of recovery after the operation? Secondly, What is the general condition of the patient after it? And, thirdly, In how many instances is there a return of the malady?

In considering the first subject, viz. the number of recoveries per cent. which took place, I must request attention to the following statements, which are extremely important in relation to the question:—

1stly. That I have only twice in my life found it necessary or desirable to complete by the knife a case of stone in which I have commenced the operation by crushing. This was not unfrequently done by Civiale when the patient's life has been in danger; and in such circumstances, if death has occurred, it has not been placed to the account of Lithotrity.

2ndly. That I have not left incomplete or unfinished a single case of stone on which the operation of crushing has once been commenced: a plan which has been pursued elsewhere, when great difficulty or danger has arisen. The result of sending a patient into the country[1] in these circumstances can very rarely be otherwise than hazardous, or fatal. But when death has so taken place, it appears likewise not to have been placed to the account of Lithotrity. It appears to us in this country unusual to send away uncompleted cases; and it is very rare indeed here to refuse any operative aid to any calculous patients who apply for relief.

3rdly. I have not refused, or at most in three or four instances, to operate in any case of stone by one means or the other; and I have sometimes consented, rather than refuse the patient all chance of life, to perform Lithotrity, when he has absolutely refused my advice, that Lithotomy would be for him the better operation. I am certain that two or three of the fatal cases in my table occurred in individuals for whom, had I not been fettered by circumstances, Lithotomy would have been the preferable proceeding. Certainly, as a rule, the surgeon must

[1] See Civiale, *Reports on Lithotrity*. Paris.

decline to perform any operation but that which appears to him the better of two courses open; but in rare exceptions he cannot refuse to be influenced by circumstances, and adopt the less promising, when by its means some hope of saving life exists.

I may now say that the deaths which occurred from all causes, during or after the conclusion of treatment, among the 422 cases of patients averaging 61 years of age, were 32 in number, although one or two of them ought, I think, not to be so reckoned; but I wish to err on the wrong side, and am content to accept 32. This constitutes a rate of recovery of 92½ per cent., or a mortality of 7½ per cent. My first 84 cases included 4 deaths, or a rate of 95 per cent. of recovery. The subsequent cases were a little less promising, on the grounds named above, and I consider the result therefore to be even better than the preceding. For only two or three bad cases tell heavily against a small percentage rate of mortality in the total.

I have taken great pains to ascertain, and to record as accurately as possible, the cause of death in each case. The following table presents the result, as well as the age, of each one of the 32 fatal cases; together with remarks relating thereto.

It will be seen that acute nephritis, pyelitis, and cystitis are frequent causes of death: the most common being the first-named. Now, a certain amount of cystitis is common enough, in some degree, but usually slight and evanescent in character: it is usually met with at some time or another in most cases of Lithotrity, where several sittings are necessary. In some individuals, however, invasion of the kidney follows it, and is announced by a severe rigor, succeeded by other rigors at intervals of a few hours. Several severe rigors occurring consecutively, as, say, one or two daily during three or four days, should arouse anxiety on this head. It is rare indeed, with these signs, that some affection of the kidney is absent. Fever continues, and slowly increasing exhaustion, and if recovery does not take place, the patient sinks in from seven to twenty-one days; suppression of urine occasionally, but not generally, taking place. The autopsy reveals marked traces of inflammatory action in one or both kidneys and ureters, and, mostly, deposits of pus are formed in the renal structure, and

TABLE OF DEATHS FOLLOWING LITHOTRITY.

No. in Series	Age	Remarks	Cause
3	68	Unfit for operation . . .	Calculous disease of kidneys and dilated ureters.
11	69	... ...	Diseased kidneys and dilated ureters.
13	81	Unfit for operation; if any, he should have been cut	Hæmorrhage.
16	69	... ...	Fever, mania, delirium tremens (?).
23	77	Unfit for operation; treated at a distance in the country	Acute cystitis and fever.
72	64	Disease of heart	Exhaustion.
85	69	Unfit for operation, but demanding relief	Ditto.
95	73	Ought to have been cut, but he refused	Acute cystitis and fever.
109	80	... ...	Fever and exhaustion.
118	59	... ...	Pyæmia and local abscesses.
142	68	Ought to have been cut, but he refused	Acute cystitis and fever.
162	70	... ...	Nephritis and suppression of urine.
164	72	Stone large; might have been cut	Chronic Bright's disease.
167	65	Ditto	Acute nephritis.
187	62	... ...	Acute cystitis and fever.
199	55	... ...	Chronic Bright's disease and pyelitis.
202	62	... ...	Pyæmia, joint affections.
234	74	The pyæmia occurred after he left town, six weeks after operation	Phlebitis of leg after operation, and subsequent pyæmia
245	32	Unfit for operation, which was done to relieve suffering	Chronic Bright's disease.
256	64	... ...	Pyelitis and exhaustion
269	52	... ...	Pyelitis and fever.
272	66	Probably might have been cut .	Diseased kidneys and dilated ureters.
277	77	... ...	Pyæmia.
294	75	Very feeble and unfit for any operation	Fever and exhaustion.
306	57	Large stone, very feeble . .	Exhaustion.
311	65	... ...	Diseased kidneys and dilated ureters.
327	66	... ...	Ditto.
371	81	... ...	Fever and exhaustion.
374	61	... ...	Diseased kidneys and dilated ureters
388	70	... ...	Pyæmia.
424	58	... ...	Nephritis and exhaustion.
434	75	.. ..	Fever and exhaustion.

N.B. Particulars of each case will be found in the Appendix.

in the course of the ureter. I am satisfied that in some or all of these cases, chronic pyelitis, if not chronic nephritis, also, has pre-existed, occasioned by the calculous affection before any operative interference took place. It must be admitted that, at present, we have not an unfailing means of ascertaining the existence of these conditions. There may be no albumen in the urine, and not necessarily are there any deposits in the urine, significant of the renal affection. The urine of a calculous patient frequently contains mucus, pus, and blood; but whether the origin of these is in the bladder (naturally its most common source from the irritation of the calculus), or in the organs above, it is impossible always to determine, and usually there are no casts or other pathognomonic signs of disorganising renal structure. In fact, neither physical signs, nor subjective symptoms, are by any means frequently present, yet advanced pyelitis, and even sometimes chronic nephritis, may exist. This subject, and its bearing on the question of the choice of operation for stone in the bladder, I have discussed at considerable length in another work.[1]

Another cause of death is acute cystitis, apart from any serious renal affection. In such cases the bladder may or may not be sacculated to some extent—most frequently the latter state exists. When these pouches, not by any means necessarily large, have been formed in the bladder, any instrumental interference, which is continued or repeated (such as daily catheterism for the purpose of relieving an atonied bladder), is liable not unfrequently to induce slowly cystitis or pyelitis, which ultimately proves fatal. Two or three examples of death by this way occur in the table just given.

Lastly, it is worthy of remark that no less than five cases of pyæmia occurred: while in the twenty-nine deaths among my Lithotomy cases (see page 71) only one occurred. The connection between pyæmia and the operation of crushing is, I believe, to be accounted for thus. Cystitis is mostly produced by the presence of sharp fragments in the bladder, which, if permitted to remain, may give rise to inflamed vesical veins;

[1] *Clinical Lectures on Diseases of the Urinary Organs*, 5th edit. London: Churchill, 1879. Lecture XVI.

the products of inflammation are readily carried into the circulation, and thus may give rise to purulent deposits.

In the paper of Brodie, before alluded to, the causes of death were placed under the two following heads; and I quote his words as most suitable to the purpose here:—

'First. Cases in which there was a fatal result, arising solely from the operation itself.

'Secondly. Cases in which a similar result was to be attributed to the co-existence of some other disease, brought into an active state by the shock of the operation, but which disease would in itself have been sooner or later the cause of death, even if the operation had not been performed.'[1]

Now, although it is not possible to draw a hard and fast line by the indications here given, still they furnish a useful and fair classification, by which it will not be difficult to arrange the cases of death before us. I take it for granted, that the existence of advanced organic disease of the bladder and of the kidney must be held to place any case exhibiting it in the second category, or that in which death must have occurred sooner or later, even if the operation had not been performed. Having made numerous anatomical examinations after deaths occurring through disease of the urinary organs, after surgical operations upon them of various kinds, I may say that the organic changes alluded to are distinctly definable, and they are as follows:—

1. Marked sacculation of the bladder.
2. Chronic pyelitis with distended ureter.
3. Marked organic changes of a chronic character in the kidney structure.

Could the existence of these conditions be accurately diagnosed beforehand, it might become a question whether the crushing operation, or any operation at all, should be performed. For there is little doubt that the existence of such organic changes is almost as surely a source of fatal issue in Lithotomy as in Lithotrity. Now, in the thirty-two cases before us, one or other of these conditions certainly existed in nine or ten cases; and had it been possible to be aware of them, the operation would not have been performed, and the patient might

[1] *Medico-Chirurgical Transactions*, vol. xxxviii. p. 186.

have lived a little longer, with much suffering, it is true; and he ultimately must have died at no distant period.

Eliminating these, we have but twenty-three cases in 422, in which the death might be attributed to the surgical operation, or little more than 5 per cent.

The general and local condition of patients after Lithotrity is a subject which has not been studied, perhaps, so much as it deserves. Very little space can be accorded to it here, but there are nevertheless matters of much interest attaching to the after-history of an individual who has formed a stone, and has submitted to an operation issuing in its successful removal. A very large number of patients recorded in my list are living still, free from any sign of the old complaint, and enjoying fair health, age considered. On frequently seeing instances of the excellent health and condition of a large proportion of these elderly men on whom I have some years ago performed Lithotrity, I am forcibly reminded of the well-known axiom which Deschamps chose as the motto of his classical work on Stone ('causâ sublatâ effectus tollitur'); happily true of so many. With a few it is otherwise, and more so in middle life, I think, even than in advanced age. In exceptional instances chronic inflammation still affects the bladder, or it may be the organs above, and impaired health and local troubles of some kind still persist. The operation can but remove the stone, and those troubles which were due solely to its existence. Symptoms due to other causes, associated or not, as the case may be, with calculous formation, will not disappear with the removal of the foreign body. It would be interesting to know to what extent a kidney, in which a calculus has once been formed, is damaged in the process. Necessarily, not much perhaps, or at all; but sometimes, no doubt, it is irretrievably deteriorated, and is a cause of future ill-health. Then the irritation produced by the operation itself is doubtless answerable in a few cases for the production of after troubles: but I am bound to say such irritation ought to be inconsiderable. It was formerly not so, with the clumsy apparatus, the enormous lithotrites, and rough handling, once employed in Lithotrity, and now for the most part swept away from practice. Neither was it so when large and angular fragments were dragged through the neck of the

bladder, and along the urethra—a practice which has often proved damaging to patients, and consequently to the credit of the operation, of which in reality it forms no part. In order to ensure, first, recovery, and subsequently a complete and lasting cure, it is impossible to avoid too sedulously such mechanical interference. I believe, if the principle of crushing and removing all the calculus at one operation, when practicable without excess of manipulation, and always performed with delicacy and care, be adopted, the best guarantee is obtained against the existence of chronic cystitis afterwards.

Thirdly. Recurrence of calculus.

Among the 500 cases, there are fifty-six in which the calculus has reappeared, and in which the operation has been again performed. Let it be repeated here, that the mere removal of a few phosphatic débris, subsequently occurring, has not been reckoned as an operation, but only the reformation of a fresh calculus after a year or more of absence on the part of the patient.

Now, there are two ways by which calculous matter reappears after an operation of Lithotrity. First, there may be a fresh descent from the kidney into the bladder; either of a uric-acid or an oxalate-of-lime calculus, and but very rarely of a phosphatic formation: any one of these having found its way into the bladder, if not expelled naturally, or removed by artificial means, will form in time a larger stone. This occurrence may follow equally either the cutting or the crushing operation, and does take place in a certain proportion of all cases. The descent of a freshly formed uric acid calculus was noted in exactly twenty of the 500 cases; the intervals between the first and second stone varying from one year to eight.

Secondly. Another, and a wholly different mode of calculous formation has to be described. And this is more common than the other. To a certain extent, but not altogether, it is to be accepted as an opprobrium to Lithotrity. Happily, the frequency of its recurrence is to be diminished by perfecting the crushing operation in all its details. At the same time, it is by no means unknown after Lithotomy, although it is rare after that operation. It occurred in from thirty to forty cases of the 500. In those conditions of the bladder wholly uncon-

nected with the presence of stone, in which the organ is not emptied by the natural efforts, so common among elderly men, chronic cystitis may arise and become the point of departure for the production of phosphatic deposits. If prolonged chronic inflammation of the bladder is produced or perpetuated by mechanical disturbance, due in part to the pre-existence of the stone itself in the organ, in part to the employment of instruments, and in part to the presence of sharp irritating fragments produced in the operation, a large quantity of triple phosphate is often rapidly formed within the bladder, and becomes a more or less persisting deposit. If neglected, fresh calculus is very likely to result. No doubt, in most cases, by much care, by emptying the bladder daily, injecting it, &c., this reproduction may be prevented. In some constitutions, the tendency to produce phosphatic deposit thus is much more marked than in others, and the formation in question by no means corresponds precisely with the degree of inflammation which has been present. A small degree will give rise to it in some individuals; a very large degree will fail to do so in others. Still it is quite clear that the more perfect is the operation of Lithotrity—that is, the smaller the amount of irritation produced by the mechanical means employed—the smaller is the risk of its occurrence. Hence it is unquestionably a sequence of Lithotrity which is diminishing, and will diminish, in the same ratio that the operation itself becomes more perfect. It is an additional reason, if one were wanting, for avoiding, by every means possible, all sources of injury to the bladder and urethra, on the principles already enunciated.

In some cases the tendency to form these phosphatic deposits is subdued by treatment, or wears itself out in time: I have had several patients in whom it has disappeared. In all cases the morbid product can be always easily removed, and the patient relieved, by the lithotrite and the aspirator. One cause of persisting phosphatic formation, although a rare one, is beyond doubt encysted calculus. This I have been able to verify. A sac of the bladder, perhaps usually a small one, contains a calculus, the narrow neck of the sac not permitting the possibility of escape to the foreign body. A small surface of the calculus is thus exposed in the bladder; on this surface

phosphatic salts are encrusted, and as the deposit goes on, a more or less spheroidal body is produced, the attachment of which to the encysted calculus is by a narrow and brittle neck. Ultimately this snaps, and a phosphatic calculus is set free in the bladder. This is removed, the symptoms disappear or are much relieved, and the process again commences as before, and is reproduced again and again. I may repeat that I have several times observed this condition—in the dead body not infrequently, in the living three or four times. One of these latter cases was identified by examination with my friend, Mr. Cadge, of Norwich, when in consultation on a long and troublesome case of this kind. I have exhibited and recorded several post-mortem examples of this condition at the Pathological Society, and elsewhere.

I now come to the important practical conclusion which, I beg to submit, is logically derivable from the data before us. It is not offered here as my opinion, or as the opinion of any other person experienced on this subject. It is a conclusion which the facts recorded inevitably indicate. I have long ago had to contend that Lithotrity, properly performed, is an eminently successful operation; the proof that it is so is now patent to all. For a certain and by no means limited number of cases, its success may be regarded as a certainty; absolutely without fear of any contingency, except such as attends the minor operations of surgery; for example, the opening of a small abscess or the passing of a catheter. *For I have lost but one patient in the whole course of my experience after crushing a stone which was no larger than a small nut*: a case which has occurred since the series of 500 reported in the Appendix, and therefore not appearing there. And this is a size at which, with very, very few exceptions indeed, every stone ought to be discovered. But this very fact leads me to remark, that the success of Lithotrity cannot therefore be considered, apart from a knowledge of the extent, in regard of the magnitude of the stone and the constitution of the patient, to which the capabilities of the operation have been pushed. When it is employed for stones as large as a date or a small chestnut—and it is impossible to deny the excellent chance of success which this method offers to the subjects of such stones

—a certain, but still only small, proportion of deaths must be expected. And the rate of mortality will correspond with augmentation in the size of the stone, and with the amount of existing disease, and age, on the part of the patient. Given a small stone, in a fairly healthy person, and success is certain; the possibility of contingency in such a case depending only on the presence of those remote and excessively rare conditions which will make, for an individual here and there, the mere passing of a catheter a cause of death.

As to the extent to which I have pushed the capabilities of the operation here, the preservation of the débris, all of which have been exhibited at the Medical and Chirurgical Society, enabled the observer to judge. Many of them were as large as a chestnut, and some were much larger. Further, it has been already stated in the seventh chapter, 'On the Results of Lithotomy,' that while the proportion of patients submitted to Lithotomy and to Lithotrity respectively has been among some operators about equal—although the proportion crushed now, I believe, by most surgeons, is mostly larger than that submitted to the knife—I have ventured to regard Lithotrity as the rule, applying it to five out of every six adult cases, and to employ Lithotomy only as the exception.

It may be as well to put on record here the composition of the calculi. 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.

CHAPTER XIV.

ON THE CHOICE OF PROCEEDINGS BEST ADAPTED TO DIFFERENT CASES.

Importance of accurate Diagnosis.—Without it Choice of Operation impossible. —Sounding.—Classification of Stones.—Questions to be determined respecting the Stone.—1. The Age of the Patient—Results of Investigation; Ratios of Death at Different Ages in 1,827 Cases of the Lateral Operation, Metropolitan and Provincial; how affected by Age; Prevalence at Different Ages.—2. Absence or Presence of Local Disease, their bearing on the question of Operation.—3. Susceptibility to Constitutional Disturbance.—Final Deductions as to Choice of Operation for Different Patients.—When not to Operate.—Immense Importance of detecting the Stone at an early period.

In approaching that final appreciation of the various methods which have been described, we cannot but be struck with the single broad feature which marks our subject at the present day, and distinguishes it from the subject as it has been dealt with in times which are past.

An appreciation of methods was impossible when only one method existed; or at most, but one other for very exceptional cases. Given the simple fact of stone in the bladder, it was but a very few years ago removed, as a matter of course, by incision after the lateral method; only here and there the high operation was resorted to. Nevertheless, the body to be removed might be so small as to be almost inappreciable; it was sometimes carried out by the first gush of urine when the bladder was opened, and was never discovered. It might be smaller in size than an apple-pip, or as large as a turkey's egg, still one and the same set of incisions was practised; these being lengthened, perhaps, in some cases, if the existence of a very large stone was suspected. But as new methods of operating were designed, and especially when the possibility of removing a calculus by crushing had been demonstrated, a new ground

of inquiry became necessary to success, one which had been almost overlooked because barely required before. It followed instantly from the new phase into which practice had entered, that a *diagnosis of the size, form, and chemical characters of the stone was absolutely necessary.* With various modes of Lithotomy to select from, adapted to various conditions of the patient and of the stone itself; with Lithotrity and its varied resources besides, it becomes at once a matter of the highest importance, if any advantage is to accrue from the discovery of the latter, that the case and the method should be judiciously adapted to each other. Otherwise it might happen—and I do not hesitate to say that it did happen, in the earlier experiences of Lithotrity, especially when it was first attempted by others than the originators of the art—that the new method, although a great advance in surgery, at this time actually increased the fatality from stone operations, and was a positive calamity for many stone patients at that era. I have abundant evidence of the increased mortality which was occasioned by it during the period in which its application was mainly experimental. This apparent paradox is easily explained; the cause was, partly, that experience was at first necessarily wanting, by which to form rules for the operator's guidance; and partly, that the importance of diagnosing the characters of the stone had not been perceived. Hence patients who were well adapted for Lithotomy, and who would have been saved by it had Lithotrity not come into vogue, were submitted to the crushing operation, which was unfitted to their cases and terminated them fatally. Hence, also, much undeserved obloquy fell on Lithotrity. Such obvious illustrations of want of adaptation in the method to the case were then numerous, a sad but necessary result of the failure to form a correct diagnosis as to the nature of the body to be removed from the bladder, and of the varied capabilities and adaptation of each of the principal means for effecting its removal. And I will venture to say with deliberate conviction, that the importance of such a diagnosis is not sufficiently perceived at the present day, and consequently only a portion of the advantages placed within our reach by modern methods have yet been attained. The increased resources of surgery render this a most important branch of inquiry; one,

indeed, to which it is absolutely necessary for the practical surgeon to devote himself. Otherwise these resources will become the occasion of misfortune rather than of benefit, and will diminish rather than augment the success of his practice.

It must therefore appear that an appreciation of the absolute and comparative values of the varied operations which are offered for our selection is not possible, unless it first be granted that we are able to diagnose the physical and chemical characters of the stone, before any attempt is made to remove it from the bladder. Unless, then, this can be done—unless, indeed, it is done with tolerable accuracy—it will be better to return to the use of a single method, say the lateral operation, than to risk the application by guess of a method inapplicable to the case. Thus, to take an extreme, but quite possible, case for illustration, let us suppose two adults, one of whom has a small, friable stone, the other a large compact one; that, being deceived as to the relative proportions of the stone from want of care in diagnosis, I decide to cut the patient with small stone and to crush the large stone; I run a certain risk of losing both, and do so; whereas, had the terms of my decision been reversed, the chances are that both were saved. But had the lateral operation been employed in both, the chances are equally great that I should at all events have saved one.

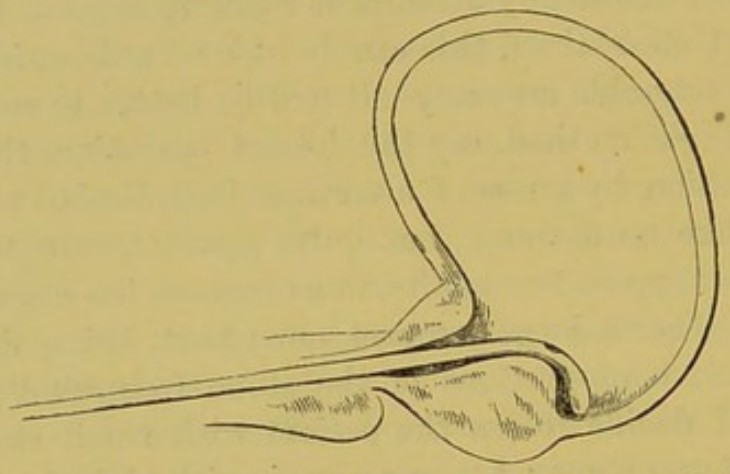
I repeat, then, that it is probably safer, uniformly to practise Lithotomy in every instance, if the surgeon does not arrive at an accurate diagnosis of the nature of the stone, and select an operation in accordance with it.

There are two principal facts which it is necessary to ascertain respecting any stone which it is proposed to remove from the bladder: its size and its texture. In a degree subordinate to the latter character, it is desirable to know its chemical characters. It is in a less degree important, also, to ascertain the patient's susceptibility in relation to instrumental interference, a matter which has already been alluded to.

In sounding a patient for the purposes of diagnosis, we should place him usually in the ordinary position for Lithotrity, as already described (p. 140); if we do not succeed in that position, or if his prostate is enlarged, he should be placed with the pelvis higher still. Furthermore, it is absolutely neces-

sary that the sound should have a form altogether different from that of a common catheter. Its curved part, or beak, should be little more than an inch long, and have more of a tendency to form an angle with the shaft than exists in the catheter. It can then be easily inclined to right or left, or rotated completely if need be. Various forms are employed for the purpose; that shown at Fig. 86, and represented in the

FIG. 86.



Sound, with small curve, for exploring the bladder. An opening is seen in the convexity of the curve for increasing or diminishing the fluid in the cavity. The beak is solid.

reversed position within the bladder, is an excellent model, and, being less angular than some, passes with ease: it is hollow also, enabling the operator to inject water into the bladder, or to withdraw some, without change of instruments for the purpose. Thirdly, we may use a sound which enables us to measure the stone with precision. It may have a blade which opens so as to seize it, and an index in the handle, like that in a lithotrite, which indicates the diameter when seized. But a light lithotrite, with the cylindrical handle (see fig. 60, p. 137), is the best instrument to measure with; the sound with a sliding blade is superseded by it. But it is a material advantage to employ the cylindrical handle also for the ordinary sound, since the instrument may be turned on its axis, right or left, or be reversed, with greater ease and delicacy than the sound with a flat handle as usually made; only it is necessary that a mark should be placed on the handle to indicate the direction of the beak (fig. 87).

The act of sounding should be performed precisely in the

manner in which the search for the stone or for fragments by the lithotrite is conducted, and which has been already fully described. A large stone, it may be recollected, is generally encountered immediately on entering the bladder, near to its neck. A small one is often found in the same situation—not always, being sometimes at the back of the trigone; and all often lie either right or left of the median line. If not at once encountered, it is necessary to explore consecutively and carefully the upper and lower parts, and the sides of the bladder; also occasionally with much, but always with a small quantity of fluid in it; and finally in the upright, as well as in the horizontal position, although this latter position is very rarely necessary. When, notwithstanding all, the stone still remains undetected, as when it lies behind an enlarged prostate, for example, and in some other circumstances, something may be gained by placing the forefinger in the rectum, where the stone may be felt distinctly, or lifted up so as to place it between the finger and the sound, or between the jaws of the lithotrite.

FIG. 87.

Hollow Sound, with cylindrical handle, for exploring the bladder.

The stone being found, the characters are next to be determined. These may be classified as follows for facility of reference :—

I. *Size.*—With regard to size, stones may be classified as *Small*,
Medium, and
Large.

II. *Texture.* — With regard to texture, stones may be classified as *Soft*, and
Hard.

And hard stones may be either { *Friable*, or / *Compact.*

Every possible variety in size necessarily exists between the two extremes of small and large, and some latitude in the use of these terms,

as well as in that of medium, must be afforded. Hence, they convey only an approximative estimate in any case: a stone, however, measuring an inch in diameter, which may be held to include the mean of two diameters, the longest and the shortest, may be regarded as a type of the medium size.

With regard to texture, the variations are more marked: each chemical constitution indicating distinctly certain physical characters.

Soft Stones are phosphatic, with chiefly earthy bases. The urine is alkaline, and is charged with earthy phosphates. Pus and mucus are also commonly present.

Hard Stones are oxalate of lime, uric acid, urate of soda, and mixed, *i.e.* alternating layers of uric acid, or urate with phosphatic deposit. The urine is mostly acid, contains crystals of uric acid, the amorphous deposit, of urate of soda, or the octohedra of oxalate of lime; and if any of these are found as a persistent deposit in any given case, it helps to establish the nature of the calculus.

But while all of these are 'hard,' some are friable, while others are not so, but exceedingly compact in their structure. This is a distinction of great practical import in Lithotrity. Hard, but friable, stones break without the exercise of great power; and they crumble into small granular masses instead of fracturing into sharp angular portions, as stones of compact structure are prone to do.

Each kind of calculus has its own mode of breaking. Thus oxalate of lime, which is very compact, requires great power to fracture it, and it mostly forms irregular jagged masses.

A uric calculus, when nearly pure, has an exceedingly compact texture; it requires considerable power, and fractures into wedge-like splinters, which are very hard and sharp.

Urate of soda is looser in texture, friable, and granulates easily under smaller degrees of power than are required for either of the preceding calculi. The mixed calculus also breaks easily, because its several layers have unequal powers of resistance; the phosphatic constituent granulates, and the thin alternating layers of uric acid, or the urates, fracture into flat and shell-like pieces. These general indications are practically

sufficient without descending to minor distinctions or rare varieties of calculus.

Cystine—but this is of very rare occurrence—is hard, and rather friable; it breaks up into small granular masses and passes easily. I crushed a large one twelve years ago in the person of a gentleman, aged eighty years; and he is still living and well. (See case in Appendix, No. 127).

Still more rare is pure phosphate of lime. It is very hard, and breaks into angular or rhomboidal masses.

We can and ought, then, in every case, before selecting the operation for its removal, to determine—

1. Whether a calculus is large, medium, or small, which can be done by measuring it by means of the lithotrite. Attention to the previous duration of symptoms will, of itself, afford some clue to the size, and especially if we are acquainted, from observation of the urine, with the chemical character, of the stone. A pure uric acid calculus is slowly formed; so is oxalate of lime. Urate of soda concretes in a shorter space of time, the mixed form more quickly still; and the phosphatic are produced with greater rapidity than any.

2. Whether the calculus be hard or soft is determined by the click, or ring, obtained on striking it with the instrument in the bladder: clear and sonorous in the case of hard stones, and dull in that of soft ones.

3. Whether it is friable or compact in texture may be generally determined by ascertaining what is the persistent deposit in the urine during some days or weeks, if not previously known; from which one may almost certainly judge of the chemical nature, and hence of the physical structure, of the existing calculus, remembering, however, that phosphates are frequently present from irritation produced by acid calculi. But in very many cases small calculi have been passed before, and their composition is known; and that which is in the bladder now will mostly be identical in kind.

4. It is necessary to ascertain whether there is one calculus only, or more than one, in the bladder—sometimes a matter of importance. It is exceedingly difficult, if not impossible, to determine this accurately with the simple sound, the signs afforded to it by multiple calculi being very deceptive. With

the Lithotrite it is easily determined. One calculus being seized, it is held between the blades, and the search is continued for a few moments with the stone in that position. If another is present, it is almost instantly struck either by the instrument or by the stone already secured within its grasp. In this manner I have often verified the presence of a calculus on each side of the instrument as it lies in the bladder, showing the existence of at least three stones. It is necessary that the calculus between the jaws of the lithotrite be firmly grasped and does not rattle between them, or this will produce a sound exactly like that of striking another calculus. I have known the presence of multiple stone asserted by error arising from this circumstance.

Having thus determined these particulars respecting the stone or stones, we are in possession of the first series of data which enable us to decide on the operation to be recommended.

The remaining series of data necessary, consists in the condition of the patient, local and general, and may be obtained under the following heads:—

1. Age.
2. Absence or presence of local disease.
3 His susceptibility to constitutional disturbance as a result of local irritation.

1. The age of the patient:—

This is an important element in dealing with this subject. So much so that the early age of the patient, a few cases only excepted, may be held generally to decide the nature of the operation at once. By an early age I mean infancy and boyhood; or, to speak more exactly, from birth up to twelve or fourteen years.

At this period of life there is little temptation to employ Lithotrity, Lithotomy being very successful, and occasioning a mortality of only one in about sixteen cases under twelve years of age. Lithotrity has never approached these results for young subjects. But the propriety of employing it becomes a matter for consideration between fourteen and twenty, if the stone is not large, and is easily dealt with. It becomes almost the rule subsequently, as far as to forty years of age, under the same condition. But, in general terms, the period which

embraces all ages above twenty years, is essentially the period for crushing the stone; that during which we may derive the greatest aid from it; provided always, that some other considerations, which shall be discussed hereafter, are fully taken into account in dealing with individual cases.

These considerations arise from the analysis of the 1827 carefully reported Hospital cases, which are studied minutely, and at length, in Chapter VII., on the 'Results of Lithotomy.' But in order to show the prevalence of calculus at different periods of life, *among the classes who form Hospital patients*, the annexed table of that series is appended here, extending from the first to the eighty-first year of life.

Age of Patient. Years.	Number of Patients.
1	7
2	74
3	116
4	153
5	123
6	90
7	86
8	49
9	57
10	60
11	35
12	58
13	32
14	35
15	26
16	27
17	18
18	26
19	19
20	13
21	12
22	10
23	9
24	12
25	11
26	10
27	5
28	6
29	11
30	11
31	3
Carried forward	1204

Age of Patient. Years.	Number of Patients.
Brought forward	1204
32	14
33	7
34	9
35	9
36	5
37	3
38	14
39	4
40	21
41	4
42	7
43	11
44	4
45	17
46	11
47	15
48	6
49	10
50	23
51	15
52	11
53	17
54	25
55	23
56	26
57	25
58	16
59	22
60	33
61	17
Carried forward	1628

Age of Patient. Years.	Number of Patients.
Brought forward	1628
62	22
63	22
64	16
65	26
66	20
67	14
68	17
69	8
70	16
71	8
Carried forward	1797

Age of Patient. Years.	Number of Patients.
Brought forward	1797
72	5
73	4
74	2
75	9
76	4
77	0
78	1
79	0
80	4
81	1
Total	1827

The following facts appear from its analysis:—

First. That one third of the entire number of cases occur during the first six and a half or seven years of life.

Second. That one-half of the entire number occur before the thirteenth year is completed.

Granting that Lithotomy should be employed in childhood and boyhood, as a rule to which there are few exceptions, it follows that this method must be applicable to fully one-half the entire number of hospital calculous cases.

What is, then, the period of life when the individual is most liable to be affected with calculus? It has been common to answer, in childhood. A very superficial glance at these figures might confirm some reader in this opinion. I believe, however, that it is the period between fifty and seventy years, and of this the latter half of the term especially. Certainly, the proportion of elderly calculous patients to the existing population at their own age is much larger than the proportion of children afflicted is to the number of existing children. This is the only accurate method of viewing the question. Calculus is most common between fifty and seventy; appears in the next degree of frequency between two and six years; and least frequently of all, perhaps, between twenty-six and thirty-six years —when, indeed, it is rare.

2. It is necessary to ascertain the absence or presence of local disease. Malignant disease of the bladder, for example, would generally be held to contra-indicate any operative interference: not necessarily so, however. Two of my cases at

University College are examples in which intense suffering was greatly relieved by Lithotrity, and it also lengthened life. Such instances are exceptional.

But by local disease here is mainly intended organic changes in the kidney; severe or persisting cystitis; enlargement of the prostate; and stricture of the urethra.

With regard to the first named, it is not very common to find calculus associated with those systemic changes which manifest themselves in the production of either fatty deposit, or those degenerations of structure commonly known as Bright's disease, and the existence of which is evidenced by persistent albuminuria, renal casts in the urine, and, in advanced stages, by dropsical effusions in the cellular tissue, and in derangements of the cerebral functions. If such evidence is present, the stage of the disorder must guide us as to the propriety of entertaining the question of affording operative relief of any kind. For one case, No. 53 in the series in the Appendix, life was made much more comfortable, and beyond doubt prolonged several months, by removal of a large phosphatic stone. The patient was in an advanced stage of Bright's disease; he died within a year from the conclusion of the operation. Encouraged by this result, I operated in another, but probably more advanced case (No. 177) in University College Hospital, but death rapidly followed. The post-mortem showed both kidneys to be largely changed in structure. When the disease is in an advanced stage, no condition is more unpromising for the success of any operative procedure.

But there is another class of renal affections not to be confounded with these blood disorders, in which the organic change in the kidney results from pre-existing irritation of the bladder, or urethra. We commonly meet with patients, the subjects of chronic nephritis and pyelitis, who owe the existence of these complaints to an obstinate stricture, to chronic disease of the prostate, or to a calculus which has long remained in the bladder. We find in the most advanced cases of this kind, after death, the kidney diminished in size, the cortical substance especially so; interstitial deposits, and often small collections of pus in the renal substance, while the pelvis may be dilated, and, in some cases, is enormously so. Such are the

results of obstructive disease of the urethra and neck of the bladder, accompanied, as it always must be, more or less, by chronic inflammation extending up the urinary track. And it is with this type of disease that we have ordinarily to deal in discussing the question of operative procedure. Now the signs of this pathological state are not so clear as those which belong to the blood disorders above referred to. Furthermore, they cannot be distinctly isolated from the symptoms which belong to the urethral or vesical disease from which they derived their existence. They are not, by any means, to be discovered by urine analysis; and their existence can only be imperfectly inferred from symptoms which after all are by no means to be regarded as pathognomonic in their character. The patient complains of pains in the back and loins, and often in the groins and testicles; is probably tender on one or both sides on deep palpation through the abdominal muscles in the region of the kidney; is rather emaciated, and has gradually lost flesh; is weak and depressed, subject to chills and feverishness, amounting to rigors sometimes, after slight irritations, after the use of a catheter and the like. The urine is variable in its quantity and characters, and always contains pus, sometimes in great abundance. Still, we can by no means be certain from any signs or symptoms, that the changes described exist in any given case, and it is certain that they prejudice exceedingly the result of an operation. Examples are afforded by Nos. 3, 11, 199, 272, 311, 327, 374, and 425 in the series referred to.[1]

3. This group of symptoms leads us insensibly to the next class of phenomena, viz. those which indicate considerable susceptibility to general disturbance from sources of local irritation, no organic disease whatever existing. There are many cases indicated in this division, in which extreme tendency to rigor exists, not on account of any existing renal implication, for, as before said, none may be present, but from some other and less obvious cause.

There are some constitutions in which the nervous system appears to be so susceptible, as we express it, that almost any mechanical interference with the urethra, or bladder, is followed

[1] See a full discussion of this subject in my *Clinical Lectures*, 5th ed. 1879. Lecture XVI.

by startling symptoms obviously depending on some kind of shock propagated to the nervous centres, and consisting in syncope, rigor, vomiting, depression, with intense pains in the back, loins, and elsewhere. These, although alarming, are, generally, not dangerous, unlike those symptoms which, closely resembling them, depend on organic renal disease. Now, in none of these cases is it usually desirable to attempt the removal of a stone by any method which requires repeated manipulation in the bladder or urethra. It is better, perhaps, to deal with it by one operation, and this is usually within our power, now, by Lithotrity.

Nevertheless, much more may be done with the last-named class than with the first. The cases belonging to it are improvable by general management, whereas those of the first steadily grow worse with time. And here we see, incidentally, the value of the preliminary treatment already referred to, and which may thus be briefly summed up :—

Some preparatory treatment may be useful in view of either Lithotomy or Lithotrity ; and it is desirable in certain exceptional cases to pass a few times sounds of gradually increasing calibre, to accustom the urethra to the contact of instruments, and to increase its calibre, before the commencement of Lithotrity. But where the urethra is capacious, and its sensibility not great, such preliminary treatment is wholly unnecessary.

With these brief preliminary remarks, the way is now cleared for some final deductions relative to the operations to be employed in the various cases met with in practice.

1. For all cases of calculus during the periods of infancy, childhood, and boyhood, which may be regarded as from one to twelve or fourteen years, the following course appears to be the most judicious :—

To practise Lateral Lithotomy as the rule ; the mortality from which varies during this period from one in eleven to one in twenty-eight cases ; the mean of the whole being about one in fifteen cases.

The exceptional cases are those in which the stone is only a little too large to pass by the urethra, and therefore small. For these, there is no occasion to perform Lithotomy. Opposed as I am to Lithotrity in children, as a rule, for reasons already

named, I nevertheless believe, when the stone is so small as to be easily pulverised at a single crushing by a slender lithotrite, it is the simplest and best method of proceeding, and that when the stone can be well and easily crushed in two sittings, it may be admissible.

With regard to Median Lithotomy in children, there appears to be no objection to it, provided a director or gorget conducts the finger into the bladder. At the same time, I do not know that it offers any advantage over the lateral operation.

2. In adult cases we have to decide between Lithotomy and Lithotrity; and if the former is indicated, to point out the particular form to be employed.

First, Lithotomy or Lithotrity?

The special indications for these operations must be considered as they relate to two separate classes of patients.

a. In tolerably strong and healthy adult patients.

b. In feeble and diseased adult patients.

This division is of more practical value than a division founded on age, because the influence of age is less strongly marked after manhood has been attained than before. If age be regarded alone, the period between twenty-five and forty years gives the best results, viz. one death in eleven and a half cases, from Lateral Lithotomy. But the data are comparatively few, since it is the period of all others when stone is most rare. The question of age and its effects in adults is therefore included in the major one of constitutional conditions.

1. In the class of healthy adults.

If the calculus is of full medium size, and of course when smaller, whether soft, friable, or compact, it should be crushed.

But the term 'medium' admits of some extension in relation to size, for uric acid calculi, with the more powerful instruments, and the aspirator now used; although for oxalate of lime calculi, the size denoted should not be much exceeded, the spheroidal form of these stones making a medium-sized calculus (one inch in diameter) mostly large enough for Lithotrity.

If there is any special or exceptional ground for rejecting Lithotrity in such cases, the ordinary median operation may be employed. Indeed, these are the sole conditions, I believe, in

which it is now advisable, since Lithotrity has rendered it for the most part an unnecessary proceeding. But when, as owing to the presence of a very narrow or unmanageable stricture, the crushing process is inapplicable, and the stone is small or of 'small medium' size, this is perhaps the best mode of removing it, as we shall see further on. But, on the other hand, if the stone is large, and especially if it be also one of compact structure, the Lateral operation would generally be the best to select. For a large and friable stone Lithotrity may be successful, but such an one offering between twenty-five and forty years of age would probably be as well dealt with also by Lateral Lithotomy.

2. The question is to be considered for feeble and diseased patients.

a. Where there is no marked disease of the urinary organs, but feeble and failing strength :—

If the calculus is of medium size and friable, there is no question that Lithotrity should be the operation selected. If it should be even hard and compact in structure, I doubt whether in these cases any form of Lithotomy would afford better results.

b. Where well-marked disease of some portion of the urinary organs exists.

In stricture of the urethra, especially if it has existed long, and is well marked, Lithotomy is preferable to Lithotrity if the calculus is large. But I have been able to accomplish so much recently by Lithotrity, for cases of stricture, by tying in a catheter (see page 194), that for small, and even medium-sized stones, the crushing process will often be found applicable. If, however, the stricture proves very unmanageable, the Median operation may be selected, while its line of incision, being central, may be easily made to divide also the rigid tissues of the stricture.

In hypertrophied prostate, with a quiet condition of the bladder, Lithotrity is successful with small and medium-sized stones. But with an irritable condition of bladder, and with compact and *large* stones, Lateral Lithotomy seems preferable, and, in such, seems to be more successful than Median operations.

In cases where the bladder cannot expel its contents on

account of loss of power in its coats, i.e. atony, and not on account of enlarged prostate, no objection lies, on that ground merely, against Lithotrity; indeed, such a condition is more favourable to success than that of undue irritability of the organ. This is now known to most practical lithotritists, although it is a condition which, not long ago, was held to contra-indicate Lithotrity.

In marked disease of the bladder, cystitis with constitutional disturbance, tumours, simple or malignant, or if the existence of sacculi may be suspected, Lithotrity is very hazardous, so also is Lithotomy. But it cannot now be said that Lithotrity is inadmissible.

Finally, for cases of either class where the stone is of extremely large size, such as are now rarely met with, say from four ounces upwards, I doubt whether experience can indicate, on the whole, a safer method than the Lateral operation, aided or not by a double incision of the prostate. It is in these circumstances that the apparatus of Civiale, for crushing a large stone before extracting, through the perineal wound, becomes applicable. For this purpose he preferred a central opening into the bladder, the Medio-bilateral operation; and I think, in order to work the instrument efficiently, that such incisions may perhaps give a better chance to it than the Lateral.

The high operation offers, perhaps, as good a chance, if the bladder be distensible, and the patient is not corpulent. Data, however, are wanting to determine the value of this as well as that of the recto-vesical operation in relation to extremely large stones. Probably the latter might be regarded as the safer procedure were it not for its liability to be followed by permanent fistula.

There is a question inevitably presenting itself sometimes, which is rarely dealt with by surgical writers, viz. Should we ever refuse to perform an operation for the relief of the calculous patient, and if so, under what circumstances? In practice, this question must be answered; and the manner of answering it influences very much the rate of mortality resulting from operative proceedings. I think in England and in Scotland very few cases are rejected as unfit for operation, certainly in hospital practice; in private there are, from various

causes, more examples of unremoved stone. So much may be done to mitigate suffering for those whose means enable them to command every resource available for the purpose, that the alternative of an operation, rendered hazardous by the magnitude of the calculus, or other unfavourable circumstance, is not necessarily adopted. It is widely otherwise with the poor, and it is sometimes a difficult point to determine whether continuous suffering or a severe operation involves the graver consequences to life. Mostly, the patient himself desires to turn the scale in favour of the latter alternative rather than be abandoned to the hopeless prospect of unrelieved suffering. In France a larger proportion of cases is, I think, rejected. Lithotomy is not so successful there, on comparing the results, in large numbers, of practice in the two countries; and the operation appears to me to be more dreaded by both surgeon and patient. It is more rarely performed, and thus it is, perhaps, that there seems to exist a want of that confident familiarity with Lithotomy which distinguishes the practised English operator, and which doubtless conduces to success. On the other hand, those who practise Lithotrity in France appear unwilling to hazard its application to very unpromising cases, and no doubt they act justly and prudently in so doing. Take, for example, the practice of M. Civiale, during the year 1862, which is a fair specimen of his experience, both before and after that period. He reported that he had treated during that year sixty-nine calculous patients: sixty-six men, two women, and a child; forty-five in private practice; twenty-four at Hôpital Neckar. Fifty-eight of these were operated on: forty-five were submitted to Lithotrity; of these eight were partially cured; and it was successful in all the remainder but one.

Ten were treated by Lithotomy; three were cured, two relieved, and five died. Three were treated by a combination of Lithotomy and Lithotrity; two were cured, the other has incontinence of urine.

In *eleven cases* operative means have been adjourned or considered impossible.

Now, although the Lithotrity, as here recorded, is extremely successful, every English surgeon will feel surprised to find an operation declined in one of every six adult cases, and that one-

half of the Lithotomy cases were fatal. It must be obvious to all who are familiar with the practice of this country, that nothing like this proportion of cases is adjudged unfit for operation.

Are they, or are we, right in thus acting? Without entering upon a discussion of the numerous topics which the answer to this question might give rise to, I shall simply appeal to the results of English Lithotomy in the very worst cases, viz. those of large stone and broken-down constitution. If such an appeal shows that two out of three, or three and a half, recover, and it does so, I think we are justified in offering that chance to a patient whose only other prospect is a lingering death, greatly aggravated in its misery if his circumstances are narrow. There is one condition, perhaps, which must be held as sufficient ground in a bad case, such as described above, for refusing to operate, and that is the presence of advanced renal disease; and when this can be affirmed to exist, I think it may be said that such a patient will certainly die, and that the surgeon is not justified in accelerating his fate. There are, however, a good many examples among us, in private practice particularly, although certainly less now (1880) than twenty years ago, of patients who resolve not to risk any interference. I have had under my own care four patients, all at an advanced age, so greatly relieved by the daily use of the decoction of *Triticum repens*, that they have (in two of the cases I think unwisely) declined to submit to any operation. Certainly I have seen no circumstances in which that useful agent is more valuable than in those of calculus, sometimes when it is in the kidney, but especially when it is in the bladder, and I have received similar testimony from several of my professional brethren.

The foregoing observations, then, will be sufficient to enunciate the general principles which extended observation and experience indicate, in my opinion, to be our guides in selecting the proper procedure for given cases. Nevertheless, it is not presumed that every example can be brought to rule and measure, so to speak, and be mathematically fitted to the process requisite for it. Let it be well understood that they are held forth as principles to indicate the way, not as rigid

laws knowing no exception. Since the last edition, I have in practice, as I have now by precept, extended somewhat the application of Lithotrity; adopting with success the method of removing as much as possible at a single sitting, or by means of at most two sittings, with aspirator and large evacuating catheters.

I must now call attention to the advantage of discovering calculus in the early stage, of which several of the cases in the Appendix are examples. Many years ago I brought this subject forward at the Medical Society of London, reading five cases, with the view of illustrating what appears to me the great importance of this practice. For I do not hesitate to affirm that Lithotrity for a small, compact, or friable stone occurring in a tolerably healthy subject, devoid of unusual local susceptibility, at any age above puberty, is, if properly performed, an operation almost absolutely devoid of danger. Such a statement cannot be made of any other mode of operating for stone. In proof of this I am in a position to assert that, having now performed the operation some hundreds of times (1880), I have lost but one patient in whom the calculus was no larger than a small nut, and he was the subject of renal disease.

It follows then,— since every calculus is during a portion of its history small, and passes, generally, not very rapidly, through the early stages of formation; and since deteriorated health much more frequently succeeds to than accompanies its formation,—it follows, I repeat, that calculus of the bladder is removable, if its presence be early diagnosed, in almost every case, with little or no danger.

No proposition can be more logically incontrovertible than this: yet the practice of the past, so far as it depends on diagnosis, though steadily improving, has done so by very slow and gradual degrees. Its truth, however, pregnant as it is with the happiest results for humanity, only requires to be known and acted on, in order to achieve at once a great advance, and one which I am sure is within our reach. In this department, as in every other of the wide domains of medicine and surgery, diagnosis is the one thing needful. That diagnosis is slowly reducing the size of the stone year by year, and has been doing so during some past time, is demonstrable from our museums.

Take that of Norwich, for example, which is, thanks to the surgical genius of East Anglia, the most perfect and complete record, literally 'graven in stone,' that the world possesses of calculous experience. When the art of surgical diagnosis was young, the stone was often overlooked, until its large size and long existence precluded the possibility of the oversight continuing. Hence, among the stones removed there in the end of the last century, are seen masses which now most rarely come to light. I calculated the sizes presented during each consecutive ten years down to the present time, and noted the significant fact that they are gradually decreasing in size. In other words, it has been successively true at different periods, that the stone now is detected in an earlier stage of its existence than formerly.

	dr.
Thus the first, or earliest, 100 stones in the Norwich Museum have an average weight to each of	8·64
The second 100	7·07
The succeeding 400	5·95

But how much too late is still the stone detected. Ought any man, who complains of his symptoms, within reach of competent skill, to carry a stone in his bladder for more than twelve months, nay, more than eight, or six? And if detected thus early, if discovered when it assumes the size of a bean, or at most that of an almond, how often would it be necessary to lithotomise an adult? There can be no doubt that skill in diagnosis is greatly on the increase, and, from this fact, I may venture to foretell, without any pretension to the gift of prophecy, that year by year the stone will be detected sooner and sooner still, and that, therefore, *pari passu*, Lithotomy will become less necessary, and Lithotrity more often applicable. Add to this the fact that the unchangeable conditions of anatomy leave little more to be effected, probably, in the mode of removing stone by the knife, while the improved application of mechanics to Lithotrity is, year by year, perfecting the process.

I say little here of chemical solvents in the treatment of already-formed calculus. In exceptional cases, they possibly may have been of some service. But their special application

is to the earlier stage of the calculous diathesis, antecedent to true stone formation; for the solution of those particles which, aggregated, form the stone. For the action of solvents we require minute mechanical division of the material to be acted upon. And here we have it. It is but one step further still in the application of diagnostic science, which recognises in the persistent undue deposit of crystalline material in the urine, and certain associated symptoms, that calculus-formation is imminent or impending; and internal solvents arrest the formation of precipitated deposit, while, which is much more important, the erring tendency of the economy is gradually corrected by medical treatment, diet, and hygiene.* But of this, enough; for the terms of my subject are purely surgical, and there is no further need that I overstep that imaginary line which is supposed to trace the confines of medicine and surgery. A subject which, nevertheless, illustrates well the important truth that no man can be a good practical surgeon who is not also an intelligent physician.

[1] See this subject discussed in the *Clinical Lectures*, 5th ed. London, 1879. Lecture XVII.

APPENDIX.

TABLE OF 500 OPERATIONS FOR STONE IN THE CASES OF MALE ADULTS ONLY.

The following Table contains a brief account of every Male Adult case, without exception, of Stone in the Bladder, which has been operated on by myself up to January 1877.

The name of each patient, his age, the nature of the operation, the year in which it was performed, the species and number of the calculi present, and the after-history so far as I have been able to ascertain it, are recorded; each particular in a separate column.

In addition to these facts, the distinction between patients treated by me in University College Hospital, and those who were in private, is indicated; the letter 'H' in the second column indicating a hospital patient: these ceased in 1874 when I resigned my appointment there. When the column is blank, the patients consulted me in private: in connection with these the name of the medical man who sent the patient, or who saw him with me, is appended. There are a very few cases of patients who had no other medical attendant than myself.

The first column contains a series of numerals only, from one upwards; each of these numbers indicates a single patient, and not merely an operation. The highest figure of the series, therefore, represents the precise number of individuals operated on, and not the number of the operations performed, which is considerably greater: inasmuch as some patients have been operated on twice or three times; and there are, in the entire series, three persons on each of whom four operations have been performed. (See pages 71 and 118).

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
1		1857	32	H. C.		Phosphatic.	Successful: a second operation in 1859; and was well in 1861: died at Barcelona in 1862, and at autopsy a stone was found in the kidney only. Seen with Mr. Tweed, of Brook Street. I record two operations.
2	H.	1859	36	H. A.		Oxalate.	Successful: I saw him six years after: and no return.
3	H.	„	68	O. G.		Uric; three.	Too large for crushing, which ought not to have been attempted. I was then not sufficiently aware of the importance of making an accurate diagnosis before operating. Death.
4		1860	74		H. W.	Phosphatic.	Lateral: Sir William Fergusson held the staff: patient died, apparently of exhaustion, on tenth day. Death.
5		„	76	J. W.		Uric; two.	Successful: a patient of Mr. Gatis, Wolverhampton: lived until 86, enjoying excellent health, and no return.
6	H.	„	57	P. B.		Phosphatic.	Successful: a second stone in 1863; and made a good recovery. I record two operations.
7	H.	1861	22		D. S.	Phosphatic, on sealing-wax.	Successful: he said he had passed a piece of sealing-wax into the urethra as a bougie, and let it slip in six months ago. I cut him by the median; on the ninth day had severe hæmorrhage; made a good recovery. I saw him well two years after.
8		„	69		Jas. E.	Phosphatic.	Successful: lateral; Mr. Erichsen holding staff. Two years after I relieved him by removing phosphatic matter with the lithotrite, which I do not record as an operation.
9		„	43		J. Q.	Uric	Successful: median; Mr. Erichsen held the staff. He made an excellent recovery.
10		„	64	G. L.		Uric	Successful: I saw this case at Brighton, with Mr. Tatham. Is living now (1876).

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
11		1861	69	W. T.		Uric.	A large uric acid stone successfully removed in seven sittings. After this he was able to take exercise, but gradually sank with renal disease six weeks after. Sent by Mr. Gatis, of Wolverhampton. I accept it as a death, although the fatal result can scarcely be attributed to the operation. Death.
12	H.	1862	23	J. L.		Oxalate.	Successful: no return during eight years after operation (1870), the last time I saw him.
13		„	81	R. D.		Uric; several.	Much hæmorrhage after a short and easy sitting, but the calculi were too large for lithotrity. I had not then learned the importance of diagnosing precisely the contents of the bladder. Death.
14		„	75	C. W. H.		Uric; several.	Successful: I crushed others in 1863, and again in 1869. He lived, with no return, in good health six years longer, and died of old age at 83. I record two operations.
15		„	71		A. P.	Uric; two.	Successful: the median, Mr. Erichsen holding the staff. I saw the patient in good health, and very active for his years (88), in March 1880.
16		„	69	L. T.		Uric.	After an easy crushing, he appeared to be doing well. Fever came on in a few days, delirium tremens, and he died maniacal on the twelfth day. Death.
17		„	68		H. H.	Uric.	Median: he sank about three weeks after the operation which promised, until a few days before death, to be successful; the cause apparently exhaustion; probably he had some renal disease. Death.
18		1863	61	D.		Phosphatic.	Successful: lived several years after with his son, Dr Dieudonné, of Essex Street Strand.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
19		1863	56	H. R. H.		Uric.	Successful: was well eight years, after which I crushed a second uric acid stone in 1872, and he again made an excellent recovery. I record two operations.
20		„	72	L.		Phosphatic.	Successful: he lived two and a half years afterwards in comfort, and without return of stone symptoms.
21		„	73		J. B. S.	Uric; numerous.	Median: Mr. Erichsen holding the staff. He died on the fifth day apparently exhausted. The stones were very numerous and some spontaneously broken, perhaps fifty altogether. Death.
22		„	73	W. J.		Phosphatic.	Successful: lived several years after with his son, Dr. E. Jackson, of Sheffield.
23		„	77	F.		Uric.	I operated at a distance, at Hendon, which was an error. The patient had retention of urine, and his medical attendant used the catheter frequently and with great difficulty; and death soon occurred. Since this, I rarely consent to operate unless the patient comes to reside near me for a time. Death.
24		„	65	T. C.		Uric; two.	Successful: I operated at Boulogne, going six times for the purpose: he was in charge of Dr. Perrochaud there, whose skill and attention made him a valuable ally. The patient lived several years afterwards without return, and died of a cerebral affection.
25	H.	„	59	T. P.		Uric.	Successful.
26	H.	„	42		D. D.	Uric.	Successful; median; calculus upwards of an ounce in weight.
27	H.	„	61		W. H.	Uric; two.	Successful: median; weighed together one ounce and a half.
28	H.	„	44		W. L.	Uric.	Successful: median; calculus upwards of an ounce in weight.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
29		1863	45	M.		Phosphatic.	Successful: a very large stone; the patient had lost nearly all power of the lower limbs from spinal disease. He lived some time after, free from trouble. I saw him with Mr. T. W. Cowell, of Piccadilly.
30		,,	74	R. T.		Uric.	Successful: quite well for a year or two after, and died from some accident. I saw him with Dr. Cupiss, of Great Grimsby.
31		1864	69	J. W.		Uric; two.	Successful: had a second stone a year and a half after which I crushed, and he lived some time after that without any return. Seen with Mr. Gayleard, of Devonshire Street. I record two operations.
32		,,	45	J. S. W.		Uric.	Successful: was well three years; then had symptoms of stone during a year, and I operated again in 1868. No return after. He wrote me in 1871 he was quite well. Dr. Koepl was present on the first occasion, and Dr. Keith, of Aberdeen, at the second. I record two operations.
33		,,	69	J. M.		Uric.	Considerably relieved, and left for the country. A fortnight after he complained of return of pain. Six weeks after he had severe rigors, no instruments having been used; he gradually sank in about a month. At the autopsy several calculi were found in the right kidney; in the left a large abscess. The patient was sent to me by Dr. Drury, of Harley Street.
34		,,	46	P. T.		Oxalate.	Successful: Dr. Pancoast, of Philadelphia, was present at two of the sittings. Heard he was well eight or nine years after.
35		,,	74		W. H.	Uric.	Median, for which the stone was, I think, too large. Mr. Berkeley Hill held the staff. The stone was flat, resembling an oyster-shell, and was removed with difficulty. He died of peritonitis. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
36		1864	69	R. B.		Large, uric and phosphates.	Successful: was seen by Mr. B. Hill several times in my absence. Lived six or seven years after, free from any trouble, and died of old age, after a very active life.
37		„	48	N. H. C.		Uric.	Successful: he was a military surgeon in India, and had himself cut 200 patients. He made a good recovery, and lived several years more in India: he returned, however, with diseased liver, and died, but had no return of the calculous disorder.
38		„	70	D. H.		Urate and phosphate.	Successful: had blood-poisoning with deposits in the lung, but recovered after a long struggle; attended by Mr. B. Hill with myself. He became quite strong and well for several years, and then formed a second stone, which was crushed successfully eight years after. Two years later he died at nearly eighty years of age. I record two operations.
39		„	68	E. J. P.		Urates and phosphates.	Successful: saw him with Mr. Harris, of Gower Street. Two years after he called on me quite well.
40	H.	„	63		P. P.	Uric.	Successful: lateral; removing a stone fully 2 oz. in weight.
41		„	48	C. P.		Uric.	Successful: no return; health excellent, and living now (1880). This case was confided to me by Mr. Hilton, of Guy's, who was leaving London for his holiday; he was present at the first sitting.
42		„	62	T. T.		Uric.	Successful: saw him with Mr. Hammerton, of Piccadilly, who was present at every sitting. I saw him well in 1869; there had been no return.
43		„	62	Col. B.		Large uric.	Successful: no return; recovery excellent. I saw him well in 1867.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
44		1864	59	R. P.		Uric.	It was small, and I enjoined no restrictions as to movement after operation. He had severe fever and cystitis, but ultimately made a good recovery.
45	H.	„	59	J. H.		Uric.	Successful: a good recovery; remaining well three years; then symptoms reappeared, and he came to the Hospital at the end of 1868. I performed lithotrity again, and he left quite well. I record two operations.
46		„	75	J. A.		Phosphatic.	Successful: saw him with Mr. Tatham, of Brighton. The patient never emptied his bladder but by catheter. In 1866 he had another stone, which I crushed with much relief. He lived a year or so longer, with much trouble and frequent catheterism. I record two operations.
47		„	58	T. M.		Uric.	Successful: saw him with Mr. P. Jackson, of Wimpole Street; was perfectly free from troubles for some years. In 1870 he came with another uric acid stone which was also crushed with excellent result. He is living and well now, 1876. I record two operations.
48		„	57	J. K.		Oxalate.	Successful: saw him with Mr. Ray, of Dulwich. Some years after the patient was troubled with retention, and had a phosphatic calculus, which I crushed five years after the first. He was living and in fair health, 1876. I record two operations.
49		1865	84	S. R. S.		Uric.	Successful: the oldest case I have operated on; an uncle of the late Mr. Solly, the surgeon, who saw him with me. The patient had no return, and lived two and a half years after.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
50		1865	60	E. T.		Phosphatic.	Successful: passes urine by catheter; a year after he had again symptoms, and I removed a second stone in 1866. No return after; he continued an active life until his death in 1875. I record two operations.
51		,,	75	Capt. M.		Phosphatic.	Successful: a year and half later I removed another rather large stone; after this I occasionally removed a phosphatic concretion, but he had excellent health, and died at eighty of apoplexy. I saw him throughout with Mr. C. A. Aikin. I record two operations.
52		,,	61	T. O.		Large, uric.	Successful: it was a large stone for lithotrity, and required ten sittings; saw him with Dr. A. Simpson, of Glasgow.
53		,,	59	H. C.		Phosphatic.	Successful: the subject of advanced albuminuria; and I operated to relieve his sufferings. He died a little less than a year after; seen with Dr. Sharpe, of Norwood.
54		,,	65	J. G.		Uric.	Successful: from Naval Hospital, Plymouth. I heard from him six months after that he was well, but not subsequently.
55		,,	53	A. M.		Uric.	Successful: sent by Mr. Veal, Grimsby. Had excellent health, and no return for six years; then slight symptoms during two years; came with a fresh uric acid calculus in 1873, and was again successfully treated by lithotrity. Living and well now, 1879. I record two operations.
56	H.	,,	62	G. B.		Phosphatic.	The bladder much thickened and diseased; but relieved after two crushings. Returned to Framlingham, Suffolk, whence his attendant, Mr. Jeaffreson, wrote me that he shortly afterwards died of peritonitis. Autopsy: Bladder involved in a mass of cancer on one side and sacculated; no calculus. The death here was clearly due to cancer.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
57		1865	71	R. F.		Uric ; three.	Not very successful at first ; but much relieved ; six months after I removed a small phosphatic calculus. Subsequently he was free from trouble, and I heard from him as being well in 1869. Seen with Dr. A. Simpson, of Glasgow.
58	H.	,,	28	E. B.		Phosphatic.	Successful.
59	H.	,,	71		J. P.	Uric and phosphate.	Medio-bilateral : successful. Stone large, and crushed it before removing. Fragments weighed 3¼ oz.
60		,,	62	R. B.		Uric.	Successful ; and had no return. Lived in good health and activity several years, and died in 1875. A patient of Dr. Boyd, Durham.
61		,,	74	W. M.		Uric.	Successful : had a large prostate, which occasioned some little difficulty. He lived two and a half years after ; saw him with Mr. C. King, of Highbury.
62		,,	70	G. M.		Large uric.	Successful : this patient produced more calculi than any man I ever knew, except one (No. 74). I removed a large calculus of uric acid in 1865, with freedom from symptoms up to 1867. In 1868 a moderate-sized uric acid calculus. In 1870, a large collection of calculi, some as big as a pea, about one hundred. In 1871, a mixed calculus, phosphatic and uric, large. He lived to 1873, passing all his urine by catheter, and suffering much from vesical troubles, but without further calculus formation, dying at the age of 78. I record four operations.
63		,,	62	J. R.		Uric.	Relieved : no return of calculus : but chronic cystitis some time. Seven years after he was greatly relieved by learning to pass a catheter, being then unable to empty the bladder ; since which I have heard nothing more. Seen with Mr. M. B. Hill.
64		,,	61	Baron de T.		Uric.	Successful : was seen with Dr. Greenhow.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
65		1865	73		J. K.	Oxalate.	Medio-bilateral: Mr. Erichsen held the staff. Stone weighed 2¾ ounces, a specimen of rough 'mulberry,' and difficult to extract. He died, slowly exhausted, on the 23rd day after operation. Death.
66	H.	„	39	F. B.		Phosphatic, bony nucleus.	Successful: I found and extracted a piece of bone, the nucleus of the stone, on first crushing it. Then I learned that several years before he had chronic disease of hip-joint. Bone had been exfoliated externally, and no doubt a portion had also made its way into the bladder. Sent by Dr. N. West, Alford, Lincolnshire.
67		„	69	P. B.		Uric and phosphatic; two.	Successful: seen with Dr. Buchanan, of Glasgow. He had been cut three years before and two uric acid stones removed. He lived several years after.
68		„	47	J. D.		Phosphatic.	Successful: no return two years after when I saw him. Sent by Mr. Rhind, of Shipley, Yorkshire.
69		„	65	C. F.		Uric.	Successful: saw him well one year after. Three years after saw him again, with chronic cystitis; there was no calculus but he did not empty the bladder, from enlarged prostate, and learned to pass the catheter. Sent by Mr. Warwick, Southwell, Notts.
70		„	64	R. S.		Uric.	Successful: had no symptoms a year after when I saw him. Was attended by Mr. M. B. Hill with me, and seen by Dr. Seegen, of Carlsbad.
71		„	65	W. H. G. L.		Uric.	Successful: saw him next year quite well. Seen by Mr. Clover only, who gave chloroform.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
72		1865	64	C. F.		Phosphatic.	At first consultation with Mr. E. Wright, of Clapham, I stated that the case was unpromising, either for lithotomy or lithotrity; but his symptoms being severe, would not refuse a chance by the latter operation. The prostate was very large and the bladder small: he had also organic disease of the heart. After five sittings fever set in; he gradually became weaker, and died suddenly while taking food, about a month after the last sitting. I am satisfied to accept this as a death following lithotrity, although the actual cause of death at last was diseased heart. Death.
73		„	66	H. L.		Uric; large.	After removal of the stone in eight sittings, there was some chronic cystitis. I saw him a year afterwards; he passed a catheter daily, and washed out the bladder to remove phosphatic matter which occasionally formed. Sent by Dr. M. Foster, Huntingdon.
74		„	60	G. A. N.		Phosphatic.	Successful: made a good recovery after eight sittings, and continued well for two or three years. Five years after he was unable to pass any urine except by catheter, and had a large phosphatic calculus. More than a year later he came with a third, requiring four sittings. After two years more he came with a fourth as large as the preceding, and requiring four sittings. He died about three months after with advanced renal and bladder disease. This case, with 62 and 220, are the only cases in which I have removed on four distinct occasions a large calculus, and recorded four operations on one individual.
75		„	56	J. T.		Uric; two.	Successful: sent by Dr. W. Morris, of Petworth: was well for several (8 or 9) years. Ten years after (1875) came with symptoms of a year's duration, with Mr. W. Hope, of Petworth, having another uric acid stone which I crushed with same result as before. I record two operations.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
76		1866	65	W. H.		Phosphatic and urates; several.	Successful: passes most urine by catheter, having enlarged prostate. Dr. M. Foster, of Huntingdon, saw this case with me. Seven years after, in 1873, he had no return of calculus, and was in good health. In 1878 he had a large uric acid stone, and I cut him successfully.
77		,,	53	G. M.		Phosphatic and uric.	Stone removed after much trouble. He had chronic cystitis and passed phosphates for some months after, sometimes with much suffering. Another portion was subsequently removed. After this, he wrote me that he was better than he had been for years. Sent by the late Dr. Brinton, and Dr. Phillips, of Coventry.
78		,,	67	G. S.		Uric.	Successful: sent by Dr. C. S. Webber, of Connaught Square. Had no return and is enjoying excellent health (1877), eleven years after operation.
79		,,	67	A. W.		Uric; large.	Successful: nine sittings. Seen only by my assistant, Mr. J. Foster: lived several years after.
80		,,	68		J. E.	Uric; large.	Medio-bilateral: successful: Mr. Erichsen held the staff. A rounded mass, a prostatic tumour, about an inch in diameter, came away, and almost no bleeding occurred. Patient enjoyed good health for several years, and died in 1877.
81		,,	66	W. P.		Uric.	Successful: the stone small, and removed in two sittings. But fever following the second was severe and prolonged. He ultimately became strong, had no return of the calculus, and was living in 1878. Seen throughout by Dr. S. Monckton, of Maidstone.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
82		1866	72	J. B.		Phosphatic.	Successful: passes all urine by catheter, prostate very large: perfectly relieved for several months. More than a year after he formed another stone, which I also successfully removed. I saw him a year and a half after, but there was no return. Seen with Mr. C. Butler, of Ingatestone. I record two operations.
83		„	80		J. M.	Uric with oxalate.	Medio-bilateral: not so much his age, which was eighty, as his bad condition produced by several soundings by different surgeons made it an almost hopeless case from the first. Sir Jas. Paget agreed with me in this, and that the operation was his only chance. Sir James held the staff, and all went well at first, but the patient sank exhausted on the 24th day after operation. Death.
84		„	63	R. H.		Uric.	Successful: saw him two years after without any return of stone symptoms. Seen by Dr. Chas. Mayo and by Dr. Taylor, of Guildford.
85		„	69	T. M.		Phosphatic; several.	He had advanced disease of the bladder, and an enormous prostate; but was suffering so much from his calculi that I made an attempt to remove them, notwithstanding his unpromising condition. He gradually sank from debility. Seen with Mr. W. S. Foster, of Newport. Death.
86		„	74	W. R.		Uric acid; large.	Successful: had no return, and hunted regularly as master of hounds at Faversham after. I saw him quite well five years later. Next year he was killed, being eighty years old, by a fall from his horse when hunting.
87		„	56	H. M.		Uric; many.	Successful: no return. I saw him well in 1876 when operating upon a brother: case No. 423.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
88		1866	70	W. A. U.		Uric.	Successful: seen with Dr Radcliffe, of Cavendish Square. Lived several years after in comfort, and without return of symptoms.
89		„	48	R. S. C.		Phosphatic.	Successful: seen with Dr. Hudson, of Cork Street.
90		„	67	T. C.		Uric.	Successful: no return; and is living now and in good health, in 1880. Seen by Dr. G. O. Rees.
91	H.	„	69		J. T.	Uric and oxalate.	Medio-bilateral: Mr. Erichsen held the staff. Stone weighed 2½ oz. He sank in fourteen days after operation. Death.
92	H.	„	59		J. S.	Uric.	Medio-bilateral: had peritonitis six hours after operation, and died in three days. At the autopsy, a small opening was found at the upper part of the bladder, which was soft and friable, no doubt made by the long staff with a large curve, commonly used when the prostate is large. Death.
93	H.	„	49	T. H.		Uric; two large.	Successful; returned home after eight sittings, without any symptoms.
94	H.	„	39	D. E.		Uric; large.	Successful; left after seven sittings, quite free from symptoms.
95		„	73	A. F. L.		Uric; large.	The stone proved larger than I had anticipated. He was averse to lithotomy, which might have been better for him; and I consented to crush, and entirely removed it in several sittings, but he died exhausted with fever and cystitis. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
96		1866	67	Rev. W. H. C.		Phosphatic.	A most unpromising case. Signs of renal disease existed, œdema of the legs, and advanced disease of the bladder; also complete phymosis. The urethra was blocked with phosphatic débris, and the urine flowed involuntarily. I operated first on the urethra and cleared it, then crushed the stone in five sittings, with perfect success. The other symptoms were greatly relieved. In 1873 he called on me in fair health. Seen with Mr. P. C. Chadwick, of Wrington.
97		,,	70	Rev. H. T. T.		Uric; several.	Successful: had no return for two years, and continued his duty at Bury St. Edmunds as before. In 1869 he came with another calculus, which had recently come down from the kidney. It was crushed once; he had no vesical irritation, and was doing as well as possible, when he died suddenly from valvular disease of the heart, as his sister had done before him.
98		,,	55		T. C.	Uric.	Medio-bilateral: made an excellent recovery, and went back to Leighton Buzzard before the end of a month. The stone weighed 1¼ oz.
99	H.	,,	55	M. O.		Phosphatic.	Successful: I saw him a year after; no return of the calculus. He used his catheter daily, as before the operation, having long had atony of the bladder, and inability to empty its contents.
100		,,	78		J. C.	Uric.	Medio-bilateral: J. Foster held the staff. Seen with Dr. Robt. J. Black, of De Beauvoir Town. No bleeding at the time, but much came on after, and the wound was plugged. Two days after he again had severe hæmorrhage, and died on the eleventh day after the operation. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
101	H.	1866	40	W. M.		Phosphatic; two or three.	He was known to have organic renal disease, and I consented to remove these small calculi to relieve his symptoms. This was done in two sittings, and he left the Hospital, dying of renal disease a month or two after.
102	H.	„	52	R. T. W.		Phosphatic; very large.	Successful: had been cut by Syme some time ago, and still had fistulous opening. He was anxious not to be cut again, and begged to be crushed. I found a bladder full of calculus, not very hard, and consented to try lithotrity. In fifteen sittings, during two months, I removed all; he left cured, and lived several years in fair health.
103		„	76	J. A.		Uric; two.	Successful: he lived several years without return: seen with Mr. Blaker, of Brighton.
104		„	67		T. H. P.	Phosphatic.	Had a narrow stricture, for which I did internal urethrotomy. His symptoms not being much improved, I examined his bladder, found a calculus, and did median lithotomy. He died on the 21st day after the operation. Death.
105	H.	„	60	R. E.		Phosphatic and uric.	Successful.
106		„	54	T. H.		Uric.	Successful: no return of calculus up to 1877, when I last saw him; was also under the care of Dr. Lionel Beale.
107		„	75	J. R. P.		Uric; large.	Successful: had no return when I saw him next year. Seen with Dr. F. Davies, of Gower Street.
108		1867	50		R. L.	Oxalate and phosphatic.	Large and apparently phosphatic. The result of four sittings was the removal of a thick layer leaving a hard large oxalate of lime, which could not be crushed. I did lateral lithotomy, Sir W. Fergusson holding the staff, and removed a stone weighing 1¾ oz. Death on the third day with peritonitis. Dr. Owen Rees saw him with me.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
109		1867	80	W. N.		Uric.	Severe cystitis after second sitting; stone was removed in four, but he sank soon after. Death.
110	H.	„	70	T. G.		Mixed; uric and phosphatic.	Successful: much trouble with enlarged prostate and cystitis, ultimately left the Hospital without symptoms.
111		„	69	W. J.		Phosphatic; large.	Enlarged prostate, and habitually used catheter. Saw him with Dr. Owen Rees, and removed calculus in six sittings. One year and three-quarters after this I crushed another in four sittings. Two years more elapsed and then I removed a concretion or two, after which he lived without any return of stone for a year and a half, and died at seventy-five. I record two operations.
112		„	61	L. L.		Uric; three or four small.	Successful: sent by Dr. Seegen, of Carlsbad.
113		„	63	A. M.		Uric; three or four small.	Successful: had been seen and examined by Mr. Ayerst some time previously.
114		„	35		J. D.	Uric; three.	Successful: medio-bilateral, done at his request, although on account of extreme exhaustion after a voyage of great suffering from the Cape, both Sir Jas. Paget, who held the staff, and I thought him almost absolutely without a chance of recovery. He got well, however, slowly, and lived several years.
115		„	59	J. H.		Uric; very large.	Successful: ten sittings were required; seen with Mr. R. Lamb, of Barnsbury.
116		„	71	Dr. C.		Phosphatic.	Successful: had considerable prostatic enlargement, and passed no urine except by catheter. Three years after, I removed a second stone. One year later he found his catheter so difficult to manage, that I gave him temporary relief by opening the bladder above the pubes. He died a few weeks after. I record two operations.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
117	H.	1867	63		E. C.	Uric; large.	Successful: medio-bilateral.
118		„	59	S. G.		Uric.	A week from first sitting symptoms of blood-poisoning appeared, with large abscess in the neck. No cystitis, and urine clear to the last: seen with Mr. Marshall, of Bedford Square. Death.
119		„	77	C. T.		Uric; several, small.	Successful: seen with Mr. E. Newton, of Upper Wimpole Street. Remained well three or four years. More than five years after, being eighty-two, he formed more calculi, which I crushed. He lived two years longer, with no return. I record two operations.
120		„	64	W. B.		Uric.	Successful: seen by Dr. Gibson, of Dundee, under whose care he was.
121		„	40	J. W. B.		Phosphatic.	Successful: sent by Dr. Boyd, of Durham. He continued well above two years, and then had fresh symptoms. Three years after I found a stone of moderate size, and crushed it; he has continued well ever since, and is enjoying good health (1880). I record two operations.
122		„	79		T. C.	Uric; three.	Medio-bilateral: Sir Jas. Paget held the staff. We agreed it was necessary to relieve his sufferings, but were not sanguine, from his age and condition, as to the result. He sank from exhaustion in a few days. Death.
123		„	66	W. B		Uric.	Successful: seen with Dr. Allen, of Albion Place, Hyde Park.
124		„	35	S. S.		Phosphatic.	Successful: seen with Mr. Price, of Stamford Hill.
125		„	61	E. M.		Uric; large.	Successful: seen with Dr. Heslop, of Birmingham. I saw him a year after, perfectly well.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
126		1867	71	C. J. S.		Uric; numerous.	Successful: seen with Dr. Painter, of Brompton. Some were crushed, others washed out, not less than fifty or sixty in number altogether; he lived a year or two after, and passed others of a similar kind.
127		„	81	H. L.		Cystic oxide; large.	Successful: it required nine sittings, was easily crushed in granular débris which came away easily; he made an excellent recovery and is still living (1880). Seen by several of my friends, from the rarity of the case.
128		„	67	S. E. D.		Uric.	Successful: the patient had no return and is living now (1880).
129		„	66	Lord K.		Uric; two.	Successful: sent by Dr. Thomas Keith, of Edinburgh.
130		„	71	E. P.		Uric.	Successful: a year and a half after had a mixed uric and phosphatic stone crushed in four sittings. After this he lived two years and a half without return, and died at seventy-five, of some other malady. I record two operations.
131		„	59	A. M.		Uric; three or four.	Successful; seen with his son, the late Dr. Murray; also by Dr. Kelburne King, of Hull. Living and in good health, without return of symptoms (1879).
132		„	71	B. A.		Uric.	Successful: his health was good, and no symptoms of fever, cystitis, or other disease existed. He fell down dead as he was walking to the water-closet one morning, the cause being mitral disease. His father and brother had died in the same sudden manner.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
133		1867	57	A. C.		Uric and phosphate.	He passed all his urine by catheter, which it was necessary to use very often, and he suffered severely. The removal of the stone relieved this condition partially. He continued to pass his catheter a year or so after, and died of disease of the bladder.
134		„	60	P. N.		Uric; numerous.	Successful: requiring ten sittings for removal. Seen with Dr. Nash, of Notting Hill. A year after he had a phosphatic stone, removed in three sittings. After this, no return. I saw him well in 1870. He passed all his urine by catheter. I record two operations.
135		„	41	C. M.		Uric.	Successful: Mr. C. Heath present at the first sitting. I saw the patient in June, 1874; no return of symptoms.
136		1868	47	F. L.		Uric; large.	Successful: a patient of Mr. Pritchard, of Retford. Nine sittings required. He was long free from symptoms. About three years after he came with another large uric acid calculus, which required seven sittings. Two years later (1873) he was quite well. In June, 1878, I removed a third large uric acid stone, and he made an excellent recovery. He writes me quite well, July, 1879. I record three operations.
137		„	67		G. P.	Uric; large.	Summoned by Messrs. Ceely, of Aylesbury, to Wendover, to perform the operation (mediobilateral): it was simple, easy; no sign of danger appeared during the first three days. After this he had a sudden seizure of paralysis, and died in a few hours. Is this a death 'due to the operation'?
138	H.	„	55	J. S.		Uric and phosphatic.	Successful: a labourer, from Essex. Sent by Mr. Baker Brown.
139	H.	„	50	S. R.		Uric.	Successful: sent by Dr. Price Jones, of Surbiton.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
140	H.	1868	51	G. S.		Uric; large.	Successful: required nine sittings. Sent by Dr. Lightfoot, of Kirkby Moorside, Yorkshire.
141	H.	„	55	E. B.		Uric acid; two.	Successful: a large amount of calculus requiring eight sittings.
142		„	68	E. R. C.		Large uric and phosphatic.	The calculus was chiefly uric acid, very compact, and only coated with phosphates. He ought to have been treated by lithotomy, but strongly objected to it. He died after the fourth sitting, of severe cystitis produced by sharp fragments. Death.
143		„	58	Lord de B.		Uric; several.	Successful: had stricture, and a small lithotrite was constructed expressly; had had diabetes several years. He made a good recovery, without return, living a year or two after, and dying of diabetes. Seen with Dr. Ringer.
144		„	76	Sir R. K.		Uric; two.	Successful: eight sittings; seen with Sir Thos. Watson. He had no return, living several years afterwards.
145		„	66	Lord S. L.		Uric.	Successful: passed almost all urine by catheter. Three and a half years afterwards he had severe symptoms, and I crushed some small calculi in five sittings. In nearly two years more I crushed another, mixed urates and phosphates. He lived a year or two longer, suffering severely from inability to pass any water except by catheter, from phosphatic deposits, and from cystitis. Seen with Mr. Furner, of Brighton, and others. I record three operations.
146		„	66		J. R.	Uric.	Successful: very stout, with large prostate; stone weighed 1¼ ounce. He lost much blood on the first and on the fourth day, but ultimately made a good recovery.
147	H.	„	36	J. K.		Uric.	Successful: sent from Saxmundham, Suffolk.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
148	H.	1868	65		J. T.	Uric.	Large uric acid weighing 2¼ ounces; removed by Dupuytren's bilateral. He died of peritonitis on the fifth day. Much dilatation of ureters and pelves of kidneys found at autopsy.
149		„	68		W. L.	Uric and phosphatic.	Lateral: the stone was not very large; but the prostate was enormous in size. After thirty-six hours a rigor followed by suppression of urine, and soon after by death. At the autopsy, the prostate was found as large as a full-sized orange; there was no peritonitis.
150	H.	„	70		M. D.	Uric.	Successful: lateral. Went home well in three weeks.
151	H.	„	58	S. C.		Uric.	Five sittings. After the operation was finished, he went out, caught cold, and had sore throat, followed by œdema glottidis, for which laryngotomy was performed. He apparently recovered in a week's time, and the tube was removed. Ten days after this the œdema reappeared. The wound was reopened and the tube introduced; but he gradually sank in four days. The autopsy showed the bladder to be perfectly healthy. This death cannot therefore be reckoned to lithotrity.
152		„	72	O. J.		Uric.	Successful: was very feeble, the bladder was atonied; he learned to pass a catheter and did so three times a day. He returned to Carnarvon, and died there a few months after.
153		„	65	P. P.		Uric; two large.	Successful: a large quantity removed in thirteen sittings. Seen with Dr. Ringer. A year after I crushed a phosphatic calculus. He remained well some years, but lost power to empty his bladder and used the catheter. Three years and a half later I removed a large phosphatic calculus, and he lived two years longer without return, dying of a cerebral affection. Saw him with Mr. Sequeira, of Aldgate. I record three operations.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
154		1868	62	W. C.		Uric; several small.	Successful: remained free from symptoms one year and a half: then had symptoms for ten months, and came in November, 1870. I crushed another, uric acid; he made a capital recovery, and lived three years after in good health. In 1873 I crushed another, uric acid; and he left me well, as before. Seen with Dr. Packman, of Ware. I record three operations.
155		„	58	L. M. R.		Uric.	Successful: seen with Mr. R. Phillips, of Leinster Square. No return for six or seven years. In July, 1876, he came, having several, uric acid, in his bladder: removed in four sittings; Dr. Bissett Smith and Mr. John Morgan present. In June, 1878, I operated a third time, removing several calculi, in two sittings, and he made a good recovery. I record three operations.
156		„	60	— D.		Oxalate.	Successful: seen with Dr. G. O. Rees and Mr. Aikin. Living in good health, without return (1879).
157		„	59	Mr. Justice M.		Uric and phosphatic.	Successful: seen also with Mr. Aikin. No return. Living and in good health (1880).
158		„	53		Rev. F. B.	Uric.	Successful: lateral. Dr. Keith, of Aberdeen, held the staff, being in London. A rapid recovery. I saw him well in 1874.
159	H.	„	29		J. N.	Uric.	Lateral: stone weighed 2¾ oz. He did well for the first three weeks, but got bed-sores a week after the operation. I left town for my holiday at the end of three weeks, expecting him to recover, but learned that he gradually sank about a fortnight after from exhaustion. Death.
160		„	70	T. H.		Uric; three.	Successful: left soon after for New Zealand, quite well; seen with Dr. Gavin Milroy.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
161		1868	65	Dr. P.		Uric.	Successful: four years after he had no return, but could not empty his bladder from large prostate, and he learned to pass a catheter. Two years after (1854), he came with a large phosphatic calculus, which I crushed successfully. He lived more than a year, dying with disease of bladder and prostate at seventy-three years of age. I record two operations.
162	H.	"	70	G. B.		Uric.	Two days after first crushing he had a rigor, and complete suppression of urine for thirty hours. Urine then reappeared, but rigors came on again, and two days after he died; the urine having been clear to the last. At the autopsy the bladder was found free from inflammation; half the calculus was there, the rest having passed. One kidney was healthy, the other showed marks of recent inflammation. No disease elsewhere. It is remarkable that this state of kidney should occur after operation on the bladder, without inflammation of it, the urine being clear throughout. Death.
163		"	68		E. H.	Uric; large.	Lateral: seen with Mr. Parsons, at Godalming, Surrey. He died three days after of peritonitis. Death.
164		"	72	D. P.		Uric; large.	Lithotomy might have been better, the calculus being large for crushing. After seven sittings, the patient had suppression lasting thirty-six hours, then the urine became clear, and subsequently he greatly improved, so that I crushed again, nearly finishing the stone. He gradually sank, and died a few days after. At the autopsy the right kidney showed fatty degeneration, the left marks of recent inflammation, and an abscess. Two or three small fragments were in the bladder. Had been under the care of Dr. Bayntun, of Bath. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
165		1868	58	G. L. T.		Uric.	Successful: seen with Dr. Price, of Dublin. I saw this gentleman in excellent health in May, 1879.
166		„	52	S. T. S.		Uric.	Successful: seen with Mr. Newnham, of Wolverhampton. I met the patient a year after quite well.
167	H.	„	65	W. W.		Uric; large.	After ten sittings, when the greater part was removed, he had much fever and cystitis. During the next fortnight he gradually sank. The autopsy showed marks of chronic inflammation of bladder. One kidney was tolerably healthy, the other contained deposits of pus. Death.
168	H.	„	63	J. L.		Uric.	Much cystitis, but he left the Hospital greatly relieved.
169		„	49	Capt. A.		Urates and phosphates; large.	Successful after nine sittings: seen with Dr. Macaldin, of Islington. I saw him in 1876; no return of the calculus, but learned to use his catheter, for loss of power to pass urine by his own efforts.
170		„	64	J. S.	J. S.	Uric.	In October, 1868, I crushed at six sittings several small calculi, after which he had fever and orchitis. Then he went out of town, and in March had abscesses in the perineum and parts adjacent. In April, 1869, I found a small stone, and performed lateral lithotomy, Sir W. Fergusson holding the staff. I opened a very large abscess at the first incision, and removed two small stones. He made a slow but good recovery, and, being a surgeon, attended to his own practice all the next autumn and winter.
171		„	51	W. H. W.		Uric; large.	Successful after ten sittings: seen with Dr. Langmore. I saw him well a year afterwards.
172		„	73	— H.		Uric; several.	Successful: seen with Mr. Garlick, of Bloomsbury.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
173		1868	55		A. J. M.	Uric; large.	Lateral: went on well until the ninth day, when severe hæmorrhage took place, and continued in spite of all efforts to stop it; he died from its effects on the twelfth day after. Death.
174		„	66		Capt. D	Uric.	Lateral, successful: with Mr. E. Newton, of Upper Wimpole Street. I saw him in the following year quite well.
175		„	68	Gen. G.		Uric and oxalates.	Successful: the patient was very feeble, requiring constant catheterism; but made a good recovery, and returned to the country, having learned to pass the catheter for himself. Subsequently he had fever and died. Seen with Mr. Barratt, of Welshpool.
176		„	59	J. B. W.		Uric.	Successful: a patient of Mr. Dansey, of Devonport. In the following year I saw him perfectly free from symptoms.
177	H.	„	29	J. R.		Phosphatic.	Had advanced disease of kidneys, and bad health. I dared not cut him, and resolved to offer a chance of temporary relief, by lithotrity. His case resembled No. 35. I made two small crushings, and he passed some débris, but I did not repeat the attempt. He had much albumen in the urine, and gradually sank in three weeks. The autopsy showed marked signs of chronic disease of one kidney, with abscess, chronic cystitis, and two portions of phosphatic calculus in the bladder. The death was due to long-standing renal affection.
178		1869	61		T. S. B.	Uric.	Successful: went back to his home at Hammersmith, within a month after operation, quite well.
179		„	48	A. P.		Uric: two or three.	Successful: a Turkish admiral, who since held an important command in the Black Sea Fleet in 1877. Seen with Mr. J. G. Forbes, of Hyde Park.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
180	H.	1869	36		W. R.	Uric.	The lateral: sank gradually, fourteen days after. The autopsy revealed advanced disease of kidneys. Death.
181		„	67	T. A.		Uric.	Successful: seen once with Dr McLeod, of Glasgow. Four years after he was obliged to use a catheter, from advanced prostatic disease, of which he died, but had no return of the stone.
182		„	32	F. H.		Uric and oxalates.	Successful: Mr. Newnham, of Wolverhampton, saw this patient with me.
183		„	79	H. W.		Phosphates; several.	Successful: nine sittings; seen with Mr. E. Tayloe, of Clapham. He lived nearly four years after, without return of stone, although he required the catheter for hypertrophy of the prostate.
184		„	67	T. C.		Uric; three.	Successful: seen with Mr. Bostock, of Horsham. I heard from him a year after that he had no return.
185		„	74	P. L.		Uric.	Successful: conjointly under the care of Mr. Clover and myself, and lived several years after without return.
186	H.	„	75		T. A.	Uric.	Lateral; successful: much gout during recovery, which retarded it, but returned to business within three months after.
187		„	62	Mr. Justice D.		Uric.	Seen with Dr. R. McDonnell, of Dublin. I crushed the stone at one sitting, March 31st. No fever during first three days, and in all respects well. Then rigors; urine retained, bloody, required catheter, and he gradually sank and died April 17. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
188		1869	73	R. P.		Uric and oxalates: two large.	Successful: fourteen sittings; seen with Dr. O. C. Maurice, of Reading. A year after had a renal attack, and passed a small calculus into his bladder; it was removed in two sittings. After this enjoyed good health, and freedom from his complaint, living four years longer. I record two operations.
189		"	72	C. K.		Uric.	Five sittings: seen with Mr. Macilwain. Afterwards some cerebral symptoms occurred, and Dr. Owen Rees saw him. In June effusion on the brain suddenly appeared, and he died in a few hours. The cause of death was due to cerebral changes of long standing, and in so far as the operation weakened the patient, its effect may have been prejudicial, but it cannot be regarded as the cause of death.
190		"	56	C. L.		Uric.	Successful: seen with Dr. Connor, of Battersea. I saw him a year afterwards quite well.
191		"	66	— Y.		Uric; many.	Successful: many calculi, of different sizes, were removed in seven sittings. Seen with Mr. Cribb, of Highbury.
192		"	65		— W.	Oxalate with phosphates; large.	Lateral. He was very weak, and passed all his water by catheter (twelve times in the twenty-four hours) from enlarged prostate: died exhausted seven days after operation. Death.
193		"	74		W. C.	Uric and phosphatic; one encysted.	Lateral; from which he recovered. I removed a large stone, leaving another impossible to remove, enveloped in a sac, near the neck of the bladder. He died about a month after; the autopsy showed that this stone could not have been removed during life. He certainly did not die from the operation: the wound nearly healed, but much irritation remained, produced by the remaining stone, which caused the fatal result.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
194		1869	61		H. S.	Uric.	Lateral; after which he made a sound but slow recovery. The patient is living now, 1879.
195		„	76	W. P.		Uric.	Successful: seen with Sir Wm. Fergusson.
196		„	66		W. F.	Phosphatic.	Lateral; successful: sent by Dr. Francis, of Northampton. A man weighing nearly 300 pounds. Sir Wm. Fergusson held the staff. The stone weighed above three ounces: he made a slow but sound recovery, and lived some years after.
197	H.	„	50	J. W.		Uric and phosphatic.	Successful: went home well, but failing to empty bladder by his own efforts, formed in a year and a quarter a phosphatic stone, for which he came again to the Hospital for crushing. He was taught to use the catheter, and wash out bladder, and did so for two years, after which his instruments were worn out and were not replaced. Three years after he came with another stone, which was again crushed at the Hospital, and he was supplied with instruments as before. He wrote in 1875 that he continued well; and he came in 1879 for advice, but without fresh calculus. I report three operations.
198	H.	„	26	R. H. W.		Oxalates and uric.	A man in the third stage of phthisis, was transferred from a medical ward to mine with severe symptoms of stone. I found a small calculus, which I crushed in two sittings. He was sent back, free from urinary troubles, to the physician's ward, where he ultimately died of phthisis.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
199		1869	55	Lord S.		Uric; large.	Seen with Sir Thomas Watson and others. The patient had slight feverish attacks, and several sittings, calculous matter, chiefly removed by Clover's bottle. The bladder was atonied, and he required the catheter several times a day. He left town for the country, taking daily drives, but he gradually lost strength, was confined to the house, and sank in a few weeks. There was no autopsy, but the case was evidently one of suppurative renal disease and pyelitis. Death.
200		„	47	Dr. G.		Uric.	Successful: a Russian medical man who travelled in great suffering from Siberia for the operation, and left well in four weeks: was seen by several medical men here.
201		„	60	E. N.		Uric; large.	Successful: seven sittings: sent by Dr. Stilling, of Hesse-Cassel. Rather slow recovery, but quite well ultimately. I saw him in good health in 1872. Not emptying his bladder then, I taught him to pass the catheter.
202		„	62	L. F.		Uric.	After the second crushing, had pyæmia with affection of the joints, and died in ten days. Seen with Dr. Bäumler, of Finsbury Place. Death.
203		„	52	E. D.		Uric.	Successful: seen with Mr. Ryot, of Newbury.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
204		1869	61	J. B.		Uric.	Successful: sent by Dr. Savile, of East Retford: no symptoms for a year or two, after which they reappeared; but he did not come again until March, 1874, when I found a large uric acid calculus, requiring ten sittings. On one occasion the lithotrite became impacted with calculous débris, requiring slight operation, and this was followed by good recovery. A year and four months after (in 1875) he came with a smallish uric acid calculus, requiring two sittings. Again, August, 1877: numerous calculi removed in four sittings. This case is not surpassed for rapidity of uric acid production by any I have seen: No. 62 approaches it. He is quite well, 1879. I record four operations.
205		,,	71	J. D.		Uric.	Successful: seen with Mr. Ryot, of Newbury.
206	H.	,,	65	W. B.		Uric.	Successful: nine sittings. Sent by Mr. Druitt, of Wimborne.
207	H.	,,	57	W. L.		Uric; large.	Ultimately successful: nine sittings. Discharged in December, with some irritation of the bladder. Returned in March, 1870, with a small phosphatic formation, which was rapidly removed. He recovered by daily use of injections. Sent by Mr. Jalland, of Horncastle.
208	H.	,,	69	J. M.		Uric: large.	Successful: seven sittings. Sent by Dr. Canham, of Ramsgate. Two years after, having been quite well during nine months succeeding first operation, he came with another, which I removed in five sittings. I record two operations.
209	H.	,,	65	W. W		Uric; large.	Eight sittings: much fever and debility; relieved only.
210		,,	48	W. R.		Uric.	Successful: a surgeon at Wolverton. His practice called him away after four sittings within a fortnight. The stone was perfectly removed, and his symptoms were rapidly improving when he left, and I heard no more of him.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
211		1869	73	Sir R. S		Phosphatic.	Successful: had enlarged prostate, and I taught him to use catheter, which he did four times daily. During next three years I often removed a small piece of phosphatic matter which he failed to wash out. In 1874 he had a second stone, requiring four sittings; I saw him with Mr. W. Lawrance, of Chiswick. In the autumn he died, during my absence, under the care of Mr. Foster, at nearly eighty years of age. I record two operations.
212		„	75	Admiral R.		Uric.	Successful: seen with Dr. Pavy. Pursued an active life, and enjoyed excellent health for several years after.
213		„	59	Dr. S.		Uric.	Successful: a medical man; six sittings; but he left me too soon, to attend to practice. A year and a half after he came, having neglected to empty the bladder, as I had directed, with a phosphatic calculus, which I crushed. I record two operations.
214		„	40	Dr. M.		Uric.	Successful: from Sandown, Isle of Wight; an excellent recovery. Saw him four years after quite well.
215		„	64	J. S. J.		Urates and phosphates.	He submitted to one sitting only, by which much was removed; he appeared greatly relieved, but absolutely declined further examination, and I believe there was no reappearance of symptoms.
216		„	35	R. J.		Almost pure phosphate of lime.	Successful: had been confined during four years to recumbent position for curvature of spine, under care of Mr. Brodhurst, and had made a good recovery. This calculus is one of extremely rare form; I saw him two and a half years after, passing occasionally a little phosphatic matter, but without any symptoms of stone.
217		„	69	J. B. K.		Uric.	Successful: seen with Dr. Price Jones, of Surbiton.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
218		1870	33	L. A. T.		Phosphatic; with fatty matter.	Successful: a small mixed calculus of peculiar kind, the basis being triple phosphate with organic matter, mostly fat: two sittings. There was a tendency for this material to reappear; but was quite controlled by daily washing the bladder. Has been perfectly free from symptoms for several years; and is enjoying perfect health (1880).
219		„	55	Prof. G. W. E.		Uric.	Successful: no return, and in perfect health now (1880).
220		„	73	N. P.		Uric.	Successful: seen with Dr. Smith, of Little Hadham, Herts. He was quite well, and hunted regularly for some years after. At Christmas, 1874, he came up with another, which I crushed in six sittings; excellent recovery. In January, 1877, I crushed a third, and he recovered rapidly. In January, 1879, I crushed a fourth, of considerable size; recovery as before; never empties his bladder now, and passes catheter four times a day. Is remarkably active, although eighty-two years; but is subject to phosphatic deposits, which are mostly removed by washing the bladder. I record four operations.
221	H.	„	64	S. G.		Uric; two.	Successful: much calculus; requiring eight sittings; treatment delayed by gout. No return of symptoms, and now quite well (1879).
222	H.	„	22	A. R.		Uric and oxalate.	Successful.
223		„	49	F. S.		Uric.	Successful: seen with Mr. J. Story, of London.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
224		1870	64		T. B.	Uric.	Successful: Mr. Clover gave chloroform; Mr. Foster held the staff. In this case the end of the male blade had snapped off in attempting to crush, and I did lithotomy in consequence, removing a large stone and the portion of blade. The only instance in my experience in which fracture of a lithotrite has occurred. He recovered well, returned to East Kirkby, Lincolnshire, about five weeks after. See p. 133–4.
225	H	„	57	W. H.		Uric.	Successful: had no symptoms for two years after: half a year later he came with a small calculus, which I crushed in two sittings, leaving well. I record two operations.
226		„	63	F. J. S.		Uric.	Successful: seen with Dr. Dobell; had enlarged prostate, and I taught him to use the catheter. He lived about a year and a half after, dying of renal disease.
227		„	70	A. S. Le M.		Uric and phosphatic; numerous.	Successful: for five years had passed all urine by catheter; much calculus removed in six sittings. Seen with Mr. Hill, of Stanhope Terrace, Bayswater. I saw him five years after with Dr. Saunders; for advanced disease of bladder, but no return of calculus, and he died soon after at seventy-six years.
228		„	61	J. H.		Uric.	Successful: sent by Dr. Kilbers, of Brighton.
229		„	73	R. G.		Uric.	Successful: sent by Mr. Coles, of Yeovil. Remained well nearly three years. Soon after I crushed a small calculus for him at Southsea with Dr. Jackson of that place. I saw him well here three years after that. I record two operations.
230		„	72	D.		Uric.	Successful: seen with Dr. Brace, of London.
231	H.	„	65		J. W.	Uric; large.	Successful: lateral; with a little trouble from anchylosed hip. A rapid recovery.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
232		1870	60		W. F.	Uric.	Lateral: stone not large, but he had very severe cystitis after sounding; and I thought it better to cut him at once. He died of peritonitis three days after operation. John Foster held the staff; Mr. Clover gave chloroform. Both father and uncle 'died of stone.' Death.
233		„	59	R. T.	R. T.	Phosphatic.	Successful: lateral; Mr. Clover gave chloroform; J. Foster held staff. An excellent recovery. Not more than half a year after he came with a phosphatic calculus, which required several sittings to remove. After this was free from all symptoms, and remains so still (1876).
234		„	74	W. V.		Uric; large.	Eight sittings: seen with Mr. Dickenson, of Chelsea. The stone was entirely removed, the case appeared to be successful, and he left town for the sea-side. But he had phlebitis of one leg: symptoms of pyæmia appeared very insidiously, and proved fatal. Death.
235		„	81	G. C.		Phosphatic.	Stricture of urethra: seen with Mr. Hilliard, of Shefford, Beds: a good illustration of the successful application of lithotrity to calculus with stricture of old standing. See p. 194.
236		„	28	J. C. F. M.		Phosphatic.	Successful: seen with Dr. Sibson. No return of calculus when I saw him last in 1874.
237	H.	„	60	J. R.		Uric, phosphatic.	Successful.
238		„	60	J. S.		Uric.	Successful: seen with Dr. Roberts, of Portmadoc, Wales.
239		„	46	W. A.		Uric.	Successful: from Guernsey. I saw him well in 1875.
240		„	51	C.G.		Phosphatic.	Successful, after nine sittings: sent by Dr. Blaikie, of Oswestry.

No	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
241	H.	1870	72	R. C.		Uric; large and small.	Successful, after seventeen sittings, of which two were by Mr. B. Hill, and two by Mr. C. Heath, in my absence; success perfect: the quantity removed was very large.
242	H.	„	54	E. L.		Uric; large.	Successful after twelve sittings; sent by Dr. Roberts, of Portmadoc.
243	H.	„	48	J. P.		Phosphatic.	Successful: he was cut for stone eight years ago; lithotrity recently attempted without success. Health bad; and has stricture which barely admits No. 7; tied in catheter a few days, then operated, removing as much débris as possible. This process was repeated several times, and much calculus removed. He does not empty the bladder, and passes catheter three times daily; much relieved.
244	H.	„	23	J. P.		Phosphatic.	Successful: great debility, with albuminuria. But his sufferings made it necessary to operate, with great care, during ten weeks. Left greatly improved, and called six weeks after to report better health than for two years past.
245		„	52	S. S.		Phosphatic.	Had advanced renal disease, under care of Mr. Craven, of Hull. I kept him three weeks under observation, before operating, and did so because his suffering was severe; after the fourth sitting he had severe fever, was much reduced, and slowly sank. Death.
246	H.	„	65		J. M.	Uric; four.	Lateral; successful.
247		„	66	W. C.		Uric and phosphatic.	Successful: seen with Mr. Hart, of Chesterfield. Operation followed by some pyelitis: moreover, he cannot empty his bladder, and uses the catheter daily.
248		„	73	J. H.		Uric; three or four.	Successful: much calculus removed in five sittings. Seen with Dr. Carlill. He has no return of his complaint (1877), and in good health for eighty-one years. He died in 1878.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
249		1870	71	W. L.		Phosphatic.	Successful: has passed all urine by catheter many years, and has a very large and irregular prostatic growth in the bladder. Seen with Dr. Easton, of Connaught Square. I heard of him two years afterwards, as relieved, but not since that time.
250		„	45	W. G.		Phosphatic.	Successful: I saw him with Dr. Legouest, a Surgeon in Chief in French army. Was perfectly well some years after, and I have never heard of any return.
251		1871	70	P. W. W.		Uric.	Successful: seen by Mr. Clover, who gave chloroform at each sitting.
252		„	57	W. R.		Oxalate.	Successful: also seen by Mr. Clover. I saw this gentleman in 1878; he had no return of calculus, and was quite well.
253		„	82		J. K.	Uric; large.	Lateral: a very large uric acid calculus; a few weeks before I saw him, spontaneous fracture had taken place, and severe cystitis produced. I operated, great as his age was, to relieve him of his sufferings. He sank during the third week. I saw him with Dr. C. Ray, of Bishop's Road. Death.
254		„	71	P. I.		Uric.	Successful: was followed by some irritation of bladder, but he eventually became quite well. Seen with Dr. Southey, of Colebrook, Slough.
255		„	67	J. H.		Uric; several small.	A very stout man, who died suddenly of heart disease a few days after first sitting, at which most were removed. Dr. R. Reynolds saw him with me, and stated that he had advanced mitral disease.
256		„	64	A. B.		Uric.	Calculus removed in three sittings; symptoms not relieved: these chiefly depended on pyelitis, and he lived only a month after the operation. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
257		1871	47		J. B.	Urates and phosphates; two.	I began by crushing, and did so four times, removing much. But the neck of the bladder was peculiarly rigid, without prostatic enlargement, and he could pass neither fragments nor urine. I therefore did lateral lithotomy, removing the second stone and portions of the first. I saw him with Mr. Quain, of Cavendish Square. He made a good recovery, and is quite well (1880).
258		,,	50	W. J. T.		Uric; large.	Successful: in eight sittings; seen with Dr. R. S. Mair, of Bayswater. He returned to India, was without symptoms for two years, but came over in 1874 with fresh symptoms; I found another, and crushed it in three sittings, and he again left perfectly well. In July, 1878, he returned, and I removed another large uric acid calculus, in two sittings, by crushing and aspirator; and he made a rapid recovery. I record three operations.
259		,,	36	J. N. G.		Phosphatic.	Successful: seen with Dr. Harling, and remains well now (1880).
260		,,	59	S. S.		Uric.	Successful: seen with Dr. Hamilton, of Dublin.
261	H.	,,	49		B. P.	Uric; very large.	Lateral: made an excellent recovery.
262	H.	,,	60		J. H.	Uric.	Lateral: leaving nothing to be desired in its ease and rapidity, yet he died of peritonitis on the seventh day. The autopsy showed sacculi of bladder, one inflamed and suppurating under surface of the peritoneum evidently occasioning a fatal result. Death.
263		,,	61	J. B.		Uric and phosphatic; large.	Successful: in eight sittings, with difficulty, from inability to pass water without a catheter. Three years after he formed a phosphatic stone, requiring four sittings, also successfully removed. He lived not quite two years after. I record two operations.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
264		1871	31	A. L.		Phosphates and oxalates.	Successful: seen with Dr. Owen Rees. He was for some time the subject of chronic pyelitis; but leads an active life, with good general health (1880).
265		„	61	A. T. H.		Phosphatic; large.	Successful: six sittings: he is compelled by prostatic disease to pass all his urine by catheter. A year and a quarter after he came with another, which I removed in four sittings. A year later he came with another, removed in five sittings. Seen with Sir James Paget, and under the care of Dr. Bunny, of Newbury, Berks. He lived a few months after, and died worn out with disease of the prostate, &c. I record three operations.
266		„	77	T. B. P.		Uric; numerous.	Successful: much débris in six sittings. Seen with Dr. Wright, of Clapham. I saw him a year after, with Dr. Wright; free from calculus.
267		„	63	J. S.		Uric; several.	Successful: from Orkneys; seen here with Dr. Murray. I heard from him a year after that he was quite well.
268		„	55	C. W.		Uric.	Successful: seen with Dr. Palfrey. A year and a quarter after had a renal attack, and another descended from his kidney producing symptoms, which had before disappeared. I found a stone and proposed to crush. He declined, and commenced to drink 'constitution water' to dissolve it. During winter and spring he drank 'fifteen pounds' worth,' after which a large phosphatic calculus was produced. I removed an enormous quantity in five sittings by the lithotrite and Clover's aspirator. He is now living and in good health (1879). I record two operations.
269	H.	„	52	J. B.		Uric, large; two.	Death from pyelitis after first sitting.
270		„	66	J. T.		Uric.	Successful: seen by Dr. Chepmell.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
271		1871	56	F. H.		Phosphatic; large.	Successful: a case of unusual difficulty; seen with Dr. Chepmell. He had been often sounded without discovery of the stone; was unable to empty the bladder except by catheter: made a perfect recovery, and lived three or four years with no return: he died of pleurisy (1876).
272	H.	,,	66	T. H.		Uric.	The urethra was narrow and he passed no fragments by his own efforts; much instrumenation necessary. After six sittings he died exhausted; the bladder having been throughout unusually irritable. Autopsy revealed sacculated bladder, chronic pyelitis both sides, with deposits of pus in one kidney. Death.
273	H.	,,	57	J. B.		Uric.	Successful.
274	H.	,,	20		J. S.	Uric; large.	Lateral: successful.
275		1872	60	Col. St. C.		Phosphatic.	Successful: seen with Dr. G. O. Rees. Living and in good health for several years, dying suddenly in 1879.
276		,,	64	W. B.		Phosphatic.	Successful: seen with Mr. Jos. Bartlett, of Notting Hill; much relieved. He passes all urine by catheter; is subject to phosphatic deposits, often washing them out. A year after I removed a little débris he had been unable to get rid of.
277		,,	77	D. C.		Phosphatic.	Very infirm, and had used catheter habitually for years. Suffering so much from a phosphatic stone that I ventured to remove it, and did so in three sittings: soon after pyæmia appeared and he died in a few days. I saw this case with Dr. Travers, of Kensington. Death.
278		,,	65	Col. M.		Uric.	Successful: sent by Dr. Druitt, of Wimborne; passes most of his urine by catheter, and is living now and in good health (1878).

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
279		1872	64	W. C.		Uric.	Successful: seen with Mr. Gardner, of Gloucester Terrace. There has been no return, and he is enjoying good health (in 1880).
280	H.	,,	42	D. M.		Uric.	Successful: sent by Dr. Squire.
281		,,	71	W. P.		Phosphatic.	Successful: sent by Mr. Gaskell, of St. Helen's, Lancashire.
282		,,	74	J. M.		Phosphatic, oxalate; large.	Successful: has long passed his urine by catheter. Seen with Mr. Gardner, of Gloucester Terrace. Two and a half years after I saw him again, and found he had long been suffering much. He had now a very large phosphatic stone, removed in ten sittings, leaving him in comfort. I heard that he lived a year after, very feeble, being then seventy-seven years of age. I record two operations.
283		,,	67	J. J.		Uric.	Successful: sent by Mr. Snow, of Lincoln.
284		,,	74	A. B.		Uric.	Successful: sent by Mr. Sweeting, of Basingstoke; no symptoms for nearly two years. Two and a half years after, I crushed a second uric acid stone, since which he has had no return. I record two operations.
285	H.	,,	47		W. J. M.	Uric; large.	Lateral: had albuminuria; and sank after operation, which I did to mitigate his sufferings. Death.
286		,,	59	J. S.		Uric and phosphates; large.	Successful: seen with Mr. J. B. Curtis, of Boston, U.S. He required constant catheterism to empty his bladder, and somewhat neglected this. Next year he had another large phosphatic stone, which I crushed; he then took greater care, and has been free ever since, being in good health until 1878, when he died of erysipelas. I record two operations.
287		,,	66	J. B.		Uric and phosphates.	Relieved: but all his urine had long been removed by catheter, and he had constant cystitis; no return of stone, but died of his urinary maladies next year.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
288	H.	1872	54	J. M.		Uric and phosphates.	Successful.
289		"	74	R. B.		Uric.	Relieved: seen with Dr. Osborne, of Bitterne, near Southampton. He had no return of the stone. I saw him a year and a half after with cystitis, but free from calculus.
290		"	63	D. G.		Uric.	Successful: seen with Mr. T. B. Curtis, now of Boston, U.S. He had no return of the stone. A year after I taught him to empty the bladder by catheter, since which I have heard no more.
291		"	69	C. T.		Uric.	Successful: seen with Mr. Devereux, of Tewkesbury.
292		"	58	S. L.		Uric.	Successful: sent by Mr. Parsons, of Godalming.
293		"	70	R. R.		Uric.	Successful: Dr. Townshend, of Cork, saw this case with me.
294		"	75	J. W.		Uric.	Feeble, and suffered greatly: after the second sitting had severe fever, and died exhausted a week after. Sent by Dr. Magrath, of Teignmouth. Death.
295	H.	"	66	T. R.		Uric.	Successful.
296		"	63	W. W. R.		Uric.	Successful: sent by Dr. Gibson, of Dundee.
297		"	69	W. D		Phosphatic.	Successful: sent by Mr. Morgan, of Stamford.
298		"	79	G. B.		Uric.	Successful: Mr. Clover gave chloroform for each of five sittings; had no return, and I saw him in fair health in 1874.
299		"	70		E. H. O.	Uric.	Lateral: bled freely after operation, notwithstanding a tube well plugged in the wound, which was insufficient to command the hæmorrhage sufficiently. He did not recover the loss, and died in three days. Death.
300	H.	"	70	R. B.		Uric.	Successful: sent by Mr. G. C. Tayler, of Trowbridge. Living and in good health now (1880).

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
301	H.	1872	32	T. M.		Oxalate.	Successful: a perfect result. It was the largest oxalate of lime calculus I had then crushed, being not less than an inch in diameter.
302	H.	„	60	C. C.		Phosphatic; large.	Successful: had been cut by Keith, of Aberdeen, some years before; not emptying his bladder, I taught him to pass a catheter. Above a year after, he came with another rather large stone, which I crushed in seven sittings. Now quite well (1876). I record two operations.
303		„	78		H. P.	Phosphatic.	Lateral: I cut him at Brighton, with Mr. Turner. He did well for a few days, but died exhausted a week or two after. Death.
304		„	62	H. H.		Uric and phosphatic.	Successful: seen with Mr. Harrison, of Braintree.
305		„	55	K. W. A.		Uric; several.	Successful: but slow recovery; seen with Mr. Gay Shute, of Greenwich.
306		„	57	S. F.		Uric; large.	From Boston, U. S. I found a large stone, not before suspected; his health being very feeble, he went to the seaside for two months, advised also by Dr. Wilson Fox, who saw him with me. On his return two sittings were well borne and efficient; after a third he had abscess, a long illness, and died of exhaustion. Death.
307	H.	„	68	W. B.		Uric.	Successful.
308		„	75	D. T.		Phosphatic.	Successful: seen with Mr. Moullin, of Porchester Terrace; passes all urine by catheter. I had formerly dilated a stricture, and had now to repeat this before passing a lithotrite. Two years later I divided his stricture, with great relief, to enable him to use a catheter. He was then seventy-eight, and had no return of stone.
309		„	69	G. R. J.		Uric.	Successful: sent by Dr. Duigan, of Gainsborough.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
310		1872	36	J. K.		Uric.	Successful: sent by Dr. Hepworth, of Manchester.
311		1873	65	N.		Phosphatic; rather large; on small uric acid nuclei.	Had suffered symptoms severely some years, and when urged to submit to examination had declined. I had advised sounding six months before, with same result. His health having become very feeble, and being now confined to the house, examination of the bladder was for the first time permitted. I sounded in presence of Dr. Conneau, Dr. Corvisart, and Sir Wm. Gull, finding a phosphatic stone of the form and size of a large date. It was agreed to operate by lithotrity. Two sittings under chloroform, given by Mr. Clover, were successful in removing half the stone. The day after he became drowsy, evidently from impaired renal function, which condition gradually became more marked, and he died very suddenly the third day after the second sitting. The autopsy showed very unusual dilatation of the ureters and pelves of the kidneys, with recent purulent deposits in the latter. Death.
312		„	69	S. D. M.		Uric; numerous.	Successful: much removed in five sittings; seen with Dr. Newton, of Wimpole Street. He wrote two and a half years after that he was quite well.
313		„	60	T. C.		Uric.	Successful: sent by Dr. D. Manson, of Chesterfield.
314		„	71	Dr. B.		Uric.	Successful: seen with Dr. Beatty, of Dublin.
315		„	67	W. M.		Uric.	Successful: seen with Dr. C. Lovegrove, Belgravia. He was free from all symptoms four years. He came again in Dec. 1878, passing his urine by catheter, from retention by enlarged prostate, and had a phosphatic calculus, which I removed in one sitting. I record two operations.
316		„	59	Sir W. M.		Oxalate.	Successful: sent by Dr. Oldham, of Brighton.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
317		1873	79	Sir W. H.		Uric.	Successful: seen with Sir Wm. Fergusson. He died a year after of some other affection.
318		,,	64	G. M.		Phosphatic.	Successful: seen with Dr. Murchison. He was lunatic; all his urine was passed by catheter. About two years after I saw him with extravasation of urine, of which he died. There was no return of stone.
319		,,	60	R. W.		Uric.	Relieved, but evidently has symptoms of renal disease, of which he died six months after. Sent by Dr. Evan Jones, of Aberdare.
320		,,	41	W. S.		Oxalate.	Successful: sent by Dr. Smith, of Belfast. I have seen him (1876) perfectly well.
321	H.	,,	36	T. W.		Uric.	Successful.
322	H.	,,	63	W. B. H.		Uric.	Successful.
323		,,	67	Capt. E.		Phosphate and carbonate of lime.	Has very severe symptoms; seen with Mr. Savory and others. Found a calculus imbedded between the rectum and the neck of the bladder, easily detected by finger introduced into the bowel. Lithotomy was proposed, but he wished it removed by lithotrity if possible. I extracted it piecemeal from the sac in which it was lodged, in six sittings. It proved to be carbonate and phosphate of lime. He lived some time after, but the relief was only slight.
324	H.	,,	61		J. M.	Uric; large.	Lateral: a little difficulty in removing the stone. He died next day, and at the autopsy I found a small opening in the top of the bladder, and some blood in the abdominal cavity. I had used a staff, with a long curve, which I think must have gone through a very fragile bladder. It was certainly not done with the knife. See page 70. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
325		1873	56	Viscomte de L.		Phosphatic.	Successful: passes no urine but by catheter, and this at least twenty times a day; very feeble. I found a large stone, and removed it in six sittings. Chloroform given by Mr. Clover. He returned to the Brazils greatly relieved, passing his catheter six times only in twenty-four hours. He remained thus for a year, and then came again with phosphatic deposits which I removed, relieving him greatly. Two and a half years after he came again in a pitiable condition, passing his catheter every hour, having a quantity of phosphate in the bladder. Being now in the last stage of chronic cystitis and pyelitis, I endeavoured to relieve him by removing and washing away some of the mortar-like material which choked the neck of the bladder, so as to enable him to use his catheter, but could not attempt more. He died exhausted in a few weeks.
326		,,	36	K. D. S.		Uric.	Successful: chloroform given by Mr. Clover; has had no other return than a small oxalate of lime calculus, impacted in the urethra at Nice in 1876, which sent him in great haste, suffering from retention, to London, when I removed it with the long urethral forceps. Is quite well (1878).
327	H.	,,	66	W. W.		Phosphatic.	He had no albumen in his urine, and no signs besides those of calculus. After a short and easy sitting, had severe rigors, and died in five days. The autopsy revealed large dilatation of both ureters. Right kidney and ureter much inflamed, as well as tissues surrounding. Death.
328		,,	65	E. L.		Uric.	Successful: chloroform given by Mr. Clover. Mr. Lund, of Manchester, present at one sitting.
329		,,	67	Prof. C.		Phosphatic.	Successful: chloroform by Clover. From Philadelphia.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
330		1873	60	W. N.		Uric.	Successful: sent by Mr. Dixon, of Watlington.
331		,,	77	Capt. A.		Uric.	Successful: from Chambéry, in France; chloroform given by Mr. Clover and by Mr. Bailey. I saw him quite well in 1875.
332		,,	67	Rev. C. B.		Uric.	Relieved: still symptoms which were evidently due to some cerebral condition, which continued two years after the operation. I saw him with Mr. Lund, of Manchester.
333		,,	56	R. S.		Phosphatic.	Relieved: symptoms returned and grew worse, but no more calculus ever found: had now signs of tumour of the bladder, and died a year and quarter after operation from malignant disease of the bladder. I saw him with Dr. Pearson, of Manchester.
334		,,	78	F. C.		Uric.	Successful: he persisted in leaving too soon, as he felt quite well, although I desired him to stay and learn to pass a catheter, as I believed he did not empty his bladder. This proved to be the case, for he came to me six months after with a phosphatic calculus, crushed in four sittings, since which he has been quite well, passing his catheter daily. Sent by Dr. Paley, of York, and Dr. Hick, of Easingwold. I record two operations.
335		,,	76	A. E.		Uric.	Successful: but requires to use his catheter twice a day. There was no return in the summer of 1875, when I last saw him: with Dr. Griffiths, of Camberwell.
336		,,	72	Lord B.		Oxalate.	Successful: seen with Dr. Beddard, of Nottingham. Perfectly well (1880).
337		,,	63	J. P.		Uric.	Successful: sent by Mr. Parker, of Newton-Malpas, Cheshire. I heard from Mr. Parker, in summer of 1875, that he was perfectly well.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
338		1873	70	Capt. F.		Uric.	Successful: sent by Dr. Watson, of Dundee.
339	H.	„	59		J. C.	Uric.	Lateral; successful.
340		„	75		T. G.	Uric.	Lateral; successful. Clover gave chloroform. He died next year of diseased liver.
341		1874	60	Col. H.		Uric.	After removing one, I found a second stone, the existence of which I had not suspected, and so had rather too much to dispose of by lithotrity. However, I emptied the bladder completely in ten sittings. Much irritation remained for some time, slowly diminishing. He now withdraws all his urine by catheter. Seen with Mr. Blaker, of Brighton. See also No. 431.
342		„	61	Rev. J. P.		Uric.	Successful: sent by Dr. Roberts, of Carnarvon.
343		„	70	W. A. A.		Uric.	A small calculus successfully removed, but much irritation continued, from inability to empty the bladder, &c. He died in little less than a year, when much sacculation was found, but no remains of the calculus existed. Seen with Mr. Ellis, of Sloane Street.
344		„	62	J. N.		Uric.	Successful: seen with Dr. Macdonald, of Inverary.
345	H.	„	36		J. L.	Phosphatic.	Lateral: recovering rapidly, eating his chop daily and sitting up, when he was attacked with erysipelas, which prevailed in the Hospital. He was recovering from this and regaining appetite, when he had a second attack, from which he never rallied, and he died six weeks after operation. I cannot regard this as a death due in any way to the operation.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
346		1874	67	H. B.		Uric; oxalate.	Mr. Clover gave chloroform, but with especial care, since he was subject to 'angina pectoris,' and it was a question whether he should have chloroform on this account. A few days after the second sitting, being as well as usual and seated in bed, he was seized with one of his attacks and died in a few minutes.
347		,,	72	Sir R. C.		Uric.	Successful: seen with Dr. Sibley. No return, and is perfectly well now (1880).
348		,,	64	Sir F. S.		Phosphatic; large.	Successful: seen with Dr. Holman, of Reigate. No return, and is quite well now (1880). He passes all urine by catheter.
349		,,	51	F. C.		Uric.	Successful: seen with Dr. Allan, of Islington. Was perfectly well when last heard of, 1875.
350		,,	50	C. C.		Uric.	Successful: Mr. Lawrence, of Hammersmith, was present at the operation: no return in 1875.
351		,,	65	T. M.		Phosphatic.	Successful: he continues to pass all urine by catheter, as for several years past. A year and quarter after I removed phosphatic matter from the bladder, and he continued well long afterwards. Sent by Mr. Meadows, of Ipswich.
352		,,	60	Rev. W. P. M.		Uric.	Successful: seen by Dr. Lambert, of Sunderland. No return when I saw him last, 1877.
353		,,	68	J. L.		Uric; large.	Successful: seen with Dr. Lambert, of Sunderland, who wrote a year and a quarter after that his condition was 'perfectly satisfactory.'
354		,,	61	G. W. S.		Uric.	Successful: seen with Dr. Helksham, of Brixton, who wrote me next year he was quite well.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
355		1874	69	J. A. L.		Uric and phosphates; large.	Successful: sent by Mr. Freeman, of Stowmarket, Suffolk. He continued in excellent health and without return, using the catheter daily, as the bladder could not empty itself. A year after he had a paralytic seizure, and died.
356		,,	59	G. S.		Uric.	Successful: known to Mr. Hick, surgeon, of Easingwold, Yorkshire.
357		,,	57	J. C.		Uric.	Successful: sent by Mr. G. Grewcock, of Folkingham, Lincolnshire. I saw him in summer of 1875, perfectly well.
358		,,	73	Dr. V.		Phosphatic; large.	Relieved: he has long been the subject of enlarged prostate and chronic cystitis, and frequent catheterism is necessary. Seen with Dr. Evershead, of Arundel.
359		,,	63	J. R.		Uric and phosphatic.	Successful: seen with Dr. Jamison, of St. Helen's. He passes all urine by catheter from hypertrophied prostate. A year and half after (Nov. 1875) he came with a rather large phosphatic calculus; removed in four sittings: the pain disappeared, but necessity for catheterism exists as before (1876). Subsequently his bladder was more irritable, the use of the catheter more frequent, and I removed twice a small concretion, which he had failed to wash out. He died, in 1878, with chronic disease of the ureters and kidney, but without any further stone formation or operations. I record two operations.
360		,,	55	Rev. G. B. M.		Uric.	Successful: sent by Dr. Griffiths.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
361		1874	59	R. S.		Uric.	But little relief followed: severe cystitis continued; he returned to the country, and improved for a time. A few months after I went there to see him, meeting Mr. George, of North Thoresby, Lincolnshire; he was suffering from advanced renal disease, and he died not long after. The stone had been removed, but he died of disease of the kidneys.
362		,,	43	E. W. R.		Uric.	Successful: but he made a rather slow recovery. Seen with Mr. Bainbridge, of St. Martin's Lane.
363	H.	,,	67	T. W.		Uric.	Successful.
364		,,	71	— T.		Uric.	Successful: seen with Mr. Roberts, of St. John's Wood.
365		,,	72	Sir A. A.		Uric.	Successful: seen with Mr. Tyler, of Devonshire Street.
366	H.	,,	59		Wm. A.	Uric; large.	Lateral; a good recovery: he was a very stout man, weighing 19 stone.
367		,,	69	P. G.		Uric and phosphates.	Successful: Mr. Clover gave chloroform on each of his three sittings, and he made a rather slow but sound recovery.
368		,,	50	R. P.		Uric.	Successful: slow recovery, but ultimately became free from symptoms: seen by Mr. Cadge, of Norwich.
369		,,	54	Capt. T.		Uric.	Successful: seen with Mr. Roughton, of Kettering. Is living now and in fair health (1876).
370		,,	61		A. G. H.	Phosphatic; large.	Lateral: died the fourth day after, with symptoms of uræmic poisoning. Death.
371		,,	81	Gen. S.		Uric: two or three.	Prostate very large; notwithstanding which and his age, I consented to operate, his pain being very considerable: had retention after first sitting; severe fever, and died of exhaustion a few days after second sitting. Death.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
372		1874	65	J. T. L.		Uric and phosphates.	Successful: seen with Mr. Butt, of Mayfair: passes his catheter daily from enlarged prostate and continues to do so. Next year had symptoms due to some phosphatic matter, which I removed. All urine is now passed by catheter, using it eight times in twenty-four hours. Subsequently, he had a paralytic attack, but he still enjoys fair health. I saw him last with Dr. Jackson, of Notting Hill (1879), with irritability of bladder, but there is no return of calculus.
373		„	57	Dr. R. H. P.		Uric.	Successful: from Danville, Illinois, U.S. Mr. Clover gave chloroform for each of five sittings: heard subsequently that he is perfectly well.
374	H.	„	61	C. M.		Uric.	Health bad; suffering severe: urine clear, but always albumen: lithotrity has been twice lately attempted without success. I crushed twice; débris freely passed. After second sitting he gradually failed, and died in a few days. Autopsy showed both ureters much dilated and left kidney large. Death.
375		„	62	A. R.		Uric and phosphates.	Successful: Dr. Levis, of Philadelphia, saw this patient with me.
376		1875	70		E. C.	Phosphatic; large	Lateral; successful: Mr. Clover gave chloroform. Heard from him a year after that he was quite well.
377		„	69		T. B.	Uric; large.	Lateral: recovery slow, but went home well: lived a year after, and died of some affection not connected with the bladder. Mr. Clover gave ether.
378		„	62	M. H.		Oxalate.	Successful: Dr. Colegate, of Eastbourne, was present.
379		„	83	J. T.		Phosphatic.	Successful: seen with Dr. Acland, of Oxford: requires catheterism daily: has been greatly relieved. Died in the summer of 1877 from old age, without return of stone.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
380		1875	61	C. M.		Uric ; two.	Successfully and easily removed, but he did not empty the bladder by his own efforts, and deliberately neglected my instructions to pass a catheter regularly. Hence he had phosphatic deposits frequently, which I removed with the lithotrite, and he had chronic cystitis during the year. But he persisted in his neglect, and I lost sight of him.
381		,,	22	A. B.		Oxalates and urates.	Improved : the subject of chronic pyelitis, and often forms phosphatic deposits, which I removed. Sent by Mr. Diver, of Warlingham. I last saw him in 1879 ; he has recovered from the tendency to produce deposit, and is almost well.
382		,,	80		Capt. D.	Uric.	Lateral : saw him with Sir James Paget, who agreed with me that lithotomy would be better than lithotrity. Made a rapid recovery, left London (for Exeter) three weeks after operation, and is living and active in 1880.
383		,,	73	Rev. J. E.		Uric.	Successful : seen with Dr. Evans, of Gloucester.
384		,,	71	E. W.		Uric ; two.	Successful : has been recently under the care of Mr. Van Buren, of New York, who sent him to me.
385		,,	63	R. G.		Uric; large.	Successful : sent by Dr. Boyd, of Durham ; heard that he died of malignant disease of bladder, 1879.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
386		1875	66	J. D.		Uric; two; one large.	After six sittings much fever; and it was obvious that he is the subject also of disease of the kidneys. He left town for Tottenham. He took daily exercise, and next month was able to call on me. Soon after had symptoms of uræmia and died. The autopsy showed that the bladder had been completely emptied; it was sacculated, and in one of the sacs two small calculi were found: the ureters much dilated, both kidneys diseased, one almost disorganised. It is impossible to consider this death due to operation.
387		"	70	W. S.		Uric; large.	Successful: sent by Mr. G. Evans, of Seaton, Axminster, Devon.
388		"	70	General M.		Uric; large.	Four days after the last sitting, a swelling appeared over right hip; another in the neck; others afterwards, during nearly a month; he died of pyæmia, twenty-eight days after last sitting. Seen with Dr. Maclean, of Netley. Death.
389		"	70	M. D.		Uric and phosphates	He was obliged to use the catheter daily, and much irritation always present. He left my care the 1st of June for his house in the suburbs, where he was doing well. On the 13th he worked in his garden, came in chilled, had severe bleeding, which greatly weakened him, and died on the 17th. I saw him with Dr. Vintras, who made an autopsy and wrote as follows:—'The left kidney much atrophied, not weighing more than 1½ oz.: the right weighing over a pound, and extensively diseased, with traces of recent hæmorrhage. The bladder bore no signs of recent inflammation, the prostate much enlarged, and prostatic portion of the urethra quite free from any trace of recent irritation.' The death was in no degree due to the operation, from which he had completely recovered.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
390		1875	22		J. M.	Uric; large.	Lateral: much bleeding, and I used a tube tightly plugged. He made a good recovery.
391		„	68	Rev. H. W.		Uric; two.	Successful: sent by Dr. Gramshaw, of Walton, Suffolk.
392		„	71	J. D.		Uric; large.	Successful; seen with Dr. Jackson, of Islington.
393		„	65	G. T. K.		Uric.	Greatly improved: seen with Dr. Slack, of Leamington.
394		„	63	J. G. G.		Uric.	Successful: sent by Dr. Anderson, of Coventry.
395		„	66		S. S.	Large mass, of three uric calculi, bound together, phosphatic.	Lateral: excellent recovery; seen with Dr. Tuke, of Chiswick. In perfect health (1880).
396		„	65	J. F. B.		Uric; three.	Successful, after a severe and prolonged attack of pyæmic deposits in various parts, ending in recovery; seen with Dr. Sibson. Lithotomy in July 1878, with Mr. P. Hewett; and now well (1880).
397		„	69	T. H.		Uric.	Successful: seen by Mr. Clover. Saw him, summer of 1876, perfectly well.
398		„	62	C. T.		Uric.	Successful: Dr. Joseph Luke, of Newington, present; a rapid recovery. Quite well (1878).
399		„	70	T P.		Uric.	Left too soon, and returned with chronic cystitis; improved by removal of phosphatic matter and by learning to wash out his bladder. He is now much better and fairly active. Sent by Dr. Gibb, of Newcastle.
400		„	26		F. C.	Uric.	Median: he made an excellent recovery; was sent by Dr. Watts, of Frampton-on-Severn.
401		„	67	J. T. R.		Uric and phosphates.	Successful: passes his water by catheter: seen with Dr. Luke, of Newington. No return (1876).

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
402		1875	66	H. O. N.		Uric; numerous.	For years has passed all urine by catheter, and small calculi have accumulated in bladder; amount of débris very large. Five long sittings, under ether by Clover. Much irritation after; chronic cystitis severe, and catheterism frequent. Next year he got worse, and during my absence from town was cut by Mr. C. Heath, who removed a phosphatic calculus.
403		„	64	H. H.		Uric.	Successful: uses catheter to empty bladder, and has chronic cystitis. Seen with Dr. E. Marten, of Paris.
404		„	61	A. F.		Uric.	Relieved: uses catheter to empty bladder. Clover gave ether, and has done so since to remove phosphatic matter, which formed for some time. But he is in excellent health now (1878).
405		1876	71	R. Q.		Uric; several.	Successful: seen with Sir William Jenner; quite well 1880.
406		„	62	E. B. W.		Uric.	Successful: seen with Mr. Walford, of Ramsgate; saw him quite well in summer 1877.
407		„	68		B. W.	Uric; very large.	Lateral: a rapid recovery: seen with Dr. Mitchell, of New Cross; was in good health in 1878.
408		„	53	J. A.		Oxalate.	Successful: seen with Surgeon-Major Harris, Indian Army.
409		„	73	T. B.		Phosphatic.	Successful: seen with Dr. Buzzard, of Grosvenor Street: passes all urine by catheter; occasionally forms phosphatic matter which requires to be removed. In excellent health, and no return during last two years (1880).
410		„	64	Rev. D. M.		Uric.	Successful: seen by Surgeon-Major Harris; much irritation for some time after. Then had excellent health, and little trouble. I washed out a small concretion, 1879. Heard of his death 1880.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
411		1876	64	W. J. D.		Phosphatic; very large.	He passes all urine by catheter, twelve times in twenty-four hours; health very bad. I removed a large quantity in eight sittings, under ether by Mr. Clover; and at length verified existence of an encysted portion at the side of the bladder, which I can seize but not move. Much relieved; but unfit for further operation. Seen by Dr. Harris and others.
412		„	68	G. J.		Uric.	Successful: Dr. J. A. Pepper saw him with me.
413		„	40		R. F.	Oxalate.	Lateral: seen with Dr. F. N. Hall, of Bermondsey; recovery rapid.
414		„	68	J. C. F.		Oxalate.	Successful: seen with Mr. A. R. Martin, of Chatham.
415		„	69		— E.	Uric; one very large and one small.	Lateral: seen with Mr. T. L. Read, of Kensington; capital recovery. Living and in good health (1879).
416		„	60	J. J. G.		Uric.	Successful: a year and half ago Mr. B. Holt crushed a stone for him. Another has formed, requiring four sittings.
417		„	53		T. W.	Uric.	Lateral: very stout; weighs 20 stone; seen by Mr. Knox, of Bakewell; an excellent recovery.
418		„	47	J. S.		Oxalate and phosphate.	Successful: sent by Dr. Mather, of Glasgow.
419		„	55		E. R.	Uric.	Lateral: Mr. Henry Smith, of King's College, saw the case with me; healing almost by first intention; no urine by wound after second day. Excellent recovery.
420		„	65		F. O. H.	Oxalate.	Lateral: Mr. Henry Spencer Smith saw the case with me; little or no water after operation, except by catheter. On seventh day after a little urine passed by rectum, and urethro-rectal fistula since (1877), now greatly improved (1880); he is in excellent health, and takes horse exercise.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
421		1876	55	Dr. C.		Oxalate.	Successful: sent by Mr. Bowman, of Clifford Street; belongs to the Indian service, and has done many operations for stone there. Saw him summer 1880, in perfect health.
422		„	55	Gen. S.		Uric.	Successful.
423		„	72	Lord H.		Phosphatic.	Successful: passes no urine except by catheter; seen with me by Sir William Jenner.
424		„	58	G. B.		Uric.	Repeated rigors; organic disease of the kidneys present. He died in a week; autopsy showed dilated ureters and pus in the pelves of the kidneys. Sent by Mr. Maling, of Sunderland.
425		„	60	H. J. P.		Phosphatic.	Successful: seen by Mr. Worthington, of Lowestoft; has passed all urine by catheter.
426		„	79		The Marquess of C.	Uric; large.	Lateral: performed as a last resource, in consequence of great suffering; had declined it when advised at an earlier period. He sank on the fifth day from exhaustion: seen with Sir W. Jenner, Mr. P. Hewett, and Mr. Tagart. Death.
427		„	59	W. S.		Uric.	Successful: sent by Mr. H. G. Moore, of Ipswich.
428		„	66	W. F. B.		Uric.	Successful: seen with Dr. Bisset Smith, of Birmingham, and Mr. J. Morgan; passes urine by catheter. In September, 1877, a second stone (phosphatic) removed in three sittings: passes all urine by catheter. Had no return, and died suddenly of some other malady in 1879. I record two operations.
429		„	64	E. B. P.		Uric.	Successful: sent by Dr. Palfrey.

No.	Hosp. or Private	Date	Age	Lithotrity	Lithotomy	Calc.	Results
430		1876	74	— F.		Foreign body, coated with phosphates.	The last inch of a vulcanized catheter broke off in his bladder; severe symptoms since. I removed a quantity of phosphatic matter; then seized a yielding mass, and after a few trials withdrew the fragment by the urethra; success complete.
431		„	63		Col. H.	Phosphatic.	Lateral: successful; seen with Mr. Blaker, of Brighton. Same as No. 341, for whom I performed lithotrity two and a quarter years before. He is quite well (1877), passing urine by catheter as before.
432		„	66	R. E. M.		Uric.	Successful: Dr. Miller, of Chicago, present on each of two sittings; excellent health, and no return (1879).
433		„	70		T. A.	Uric.	Lateral: excellent recovery. Seen with Mr. Wakefield, of Nottingham Place; passes all urine by catheter. In good health (1880).
434		„	75	N. G.		Urates and oxalates.	Very feeble, and died soon after an attack of fever. Death.
435		„	71	Dr. J. F. M.		Phosphatic.	Successful: seen with Dr. A. S. Heaton, of Detroit; requires frequent use of the catheter from enlarged prostate.
436		„	64	W. L.		Uric.	Successful: seen with Dr. E. Lynes, of Coventry.
437		„	72		G. I. W. F.	Uric.	Lateral: from pyæmia in a few days. Death.

The above is the number (437) of individuals, on whom the 500 operations were performed; viz., 422 of Lithotrity, and 78 of Lithotomy. See pages 206–8.

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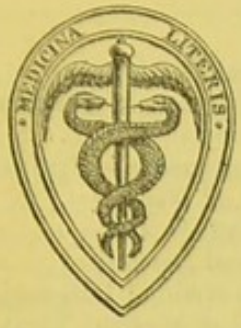

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