

## CHAPTER XV.

## LITHOTRITY.

Preparatory Treatment.—Instruments required for the Operation, with the Manœuvres employed in using them.—Impaction of Fragments in the Urethra, with Methods of removing the same.

LITHOTRITY (*λίθος*, a stone; and *τερω*, to break) is the name by which custom seems to have decided that the crushing operation shall be known. While it was yet a new enterprise, without an established position among the operations of surgery, many other designations were applied to it which have since passed out of use. Modern surgery has fully recognized the process by which it is proposed to reduce a stone in the bladder to powder, or, at least, to fragments so minute as to allow their free escape with the urine, and thus to remove it as thoroughly as by the knife—as the operation of lithotrity. It is only now, since its wide and successful employment by educated surgeons in all parts of the world, that lithotrity has been fully recognized as the mode by which a stone can be removed from the bladder, in proper cases, with the least risk to life. It has taken position, not as a rival of lithotomy, but as a new and additional resource by which the modern surgeon can cure stone in the bladder in a large proportion of cases, without incurring the well-recognized risks of the cutting operation.

This process of curing stone was first successfully accomplished by Civiale, of Paris, who operated before a committee of the French Academy appointed to report on the merits of the newly-invented operation, and cured his patient, in 1824. Before this it had been theoretically proposed to reduce a stone to fragments in the bladder, by Gruithausen, a Bavarian surgeon, by straight instruments, in 1813, with the purpose of subsequently acting upon them by solvents; and by Elderton, of Scotland, by a contrivance curved like a catheter and containing files, by which it could be ground to powder, in 1814; but to Civiale belongs the credit of first practically accomplishing this desirable result, and of effecting an undisputed cure of stone by a new operation. His earlier instruments and operative manœuvres have undergone great changes. These have been effected mainly by himself, by Amussat, Leroy d'Etiolles, and Heurteleup, on the Continent; and by Brodie, Crampton, Fergusson, and Thompson, in England. Charrière, of Paris, and Weiss, of London, the well-known surgical-instrument makers, have contributed greatly by their skill to the mechanical perfection of the instruments employed in the operation.

At first the instruments by which lithotrity was effected were inefficient, cumbersome, and in many respects defective; the operative manœuvres complicated, and unnecessarily severe and prolonged; the cases ill-chosen, and the success of the treatment frequently disputed. Ingenious men were attempting and testing new means and methods against an old enemy; the rivalry among them was not always free from petty and personal jealousies; nor was the conventional opposition to innovations against established usage devoid of bitterness and bigotry. But, considering the magnitude of the enterprise, the difficulties which attended its inception and early progress have been overcome with a steadiness and success worthy of the efforts of science in behalf of suffering humanity, and the result has added lustre to modern surgery. The efforts of the earlier lithotritists slowly but surely established certain great results, such as the necessity of patient study and diagnosis, with judicious selection of cases, careful preparatory treatment, deliberate and gentle manipulation, and short operations; and experience, growing steadily wider in its scope, has gradually settled most of the details of the operation, and created rules for the practice of the art which—at the end of half a century—are about as well established as those of any other department of surgery.

PREPARATORY TREATMENT, in its bearing upon the successful result of the crushing operation, can hardly be over-estimated as to its importance. Sir Benjamin Brodie's experience of 115 cases led him "to the conclusion that lithotrity, *if prudently and carefully performed, with a due attention to minute circumstances*, is liable to a smaller objection than almost any other of the capital operations of surgery."<sup>1</sup> The "attention to minute circumstances," emphasized by this honest and able surgeon, is especially applicable to the preliminary management and preparation of the patient for the operation.

At least ten days of rest—of freedom from all labor and anxiety attending ordinary pursuits—in the apartments to be occupied by the patient, is to be regarded as a necessary preliminary to lithotrity in the least unpromising case. This is essentially important for those who come to a large city from the country, a position in which, for obvious reasons, most patients will find themselves; and, for those seeking relief in the wards of a hospital, a period of acclimation is even more indispensable. The impatience of restraint, and the driving habits which characterize our countrymen, render it necessary to emphasize this point. A false estimate of time and the value of money will often prompt the patient to attempt to hurry his surgeon; but the enterprise is of too much moment to permit any sordid motive to endanger its favorable termination. In cases of a graver character this preliminary period of rest is still more important, and necessarily of longer duration.

<sup>1</sup> "Notes on Lithotrity," *Medico-Chirurgical Transactions*, London, 1855, vol. xxxviii., p. 169.

In a healthy adult with a small calculus we should have to deal most probably with uric acid or its compounds, and here plain and simple diet, with lessened quantities of animal food, and increased allowance of fresh fruits and succulent vegetables, with half a drachm of citrate of potash, thrice daily, in plenty of carbonic-acid water or flaxseed-tea, would be a suitable regimen, calculated to counteract constitutional tendencies, to increase the quantity of the urine, and render its quality more mild and less acrid; and thus to diminish existing irritation of the bladder, and of all the urinary surfaces. Lying on the back, with the hips more or less raised, tends to keep the calculus out of contact with the neck of the bladder, and this position has often a marked influence in lengthening the intervals between the calls to urinate—a result which it is especially desirable to favor. Meanwhile instruments are to be employed, at judicious intervals, with the object of completing diagnosis, and also for the purpose of gradually lessening the sensibility of the urethra to their contact. How often to introduce instruments into the urethra for this purpose is a delicate question; if the interval be too short there is danger of increasing the irritability we are striving to subdue, and this is an error not uncommonly committed. At first the interval should be longer—from three to five days—if the patient be very sensitive; the effect should be closely watched, and, if the operation is followed by no perceptible harm, the instrument may be used a day earlier each succeeding time. This is a matter in which tact must take the place of rules. In the majority of cases, perhaps, this desired result will be attained in a few days; but it is well to know that the most sensitive urethra may be trained to daily harmless contact with the lithotrite, if sufficient tact and patience are brought to the task. In very sensitive patients the soft French olivary bougie, anointed with cerate and then oiled, is to be employed at first; after this a conical steel sound, gradually increasing its size; then the metallic sound with a short curve; and, finally, the lithotrite.

For a case of more serious nature—of longer duration, with a larger stone, a bladder yielding more or less pus, and broken health from suffering and loss of rest—a longer period of preliminary treatment will be required. As already indicated, the treatment should include all measures likely to improve the general condition of the patient, as well as that of the urinary organs. Unremitting efforts to attain a more complete knowledge of the condition of the internal organs will bring to light evidences, probably, of more or less impaired digestion and nutrition, which should be met by appropriate dietetic suggestions: cod-liver oil, quinine, iron in some of its forms, are invaluable additions, under these circumstances, to well-selected and easily-digestible food. The patient's habit of body should be studied, and the natural and regular action of the bowels solicited by the simplest means. Active purgatives are to be avoided; they are liable to irritate the lower bowel, and to

render the urine concentrated. Straining at stool is always injurious to a calculous patient; both the attitude and the effort tend to bring the stone into painful contact with the neck of the bladder. The mildest laxative, aided in its operation by an enema of warm water, in the horizontal position, and the use of a bed-pan, are preferable. While it is desirable to keep the urine copious and diluted, it is to be borne in mind that the too free use of diluents is liable, in some cases, to impair the tone of the stomach, and also to increase the frequency of urination.

The condition of the vital organs is to be scrupulously observed, and any evidences of lesion of the ureters and kidneys, noted carefully, as of serious import. Painful sensitiveness of the urethra is often kept up by the habitual contact of purulent and ammoniacal urine; it is desirable, therefore, in addition to the means employed to improve the general health, as soon as the urethra has proved tolerant of soft instruments, to make use of injections of tepid water into the bladder, pure or medicated, as often as they can be employed to advantage.

In this class of cases absolute rest is generally advisable; but sometimes, and especially where anodynes have been freely employed, the nervous irritability is greater in proportion than the local inflammatory lesions, and where this condition is suspected it would be well to try the effect of a daily walk in the fresh air—riding being more likely to increase the local pain. Where opium has become necessary from habitual use, it is better to manage it judiciously until after the operation, and then withhold it. The warm bath, or frictions to the skin by hand-rubbing, or hair mittens, is often of service. The patient should be distracted as much as possible from mental preoccupation with his condition, and he should be encouraged as to the future; there are no local diseases which so uniformly give rise to exaggerated mental depression as those of the urinary organs.

In the large and important class of cases of stone complicated with enlargement of the prostate, it is especially desirable to secure the entire docility of the patient. He is advanced in life; has already, perhaps, been compelled to learn to relieve himself by the catheter; may not, in fact, be able to empty his bladder without the instrument, in consequence of atony. He will probably, therefore, have notions of his own, and be hard to teach. Local explorations for the sake of diagnosis are to be conducted in such cases with extreme care and circumspection. In case of atony, if the patient is not already familiar with the manœuvre, it will be necessary to teach him to introduce a large-eyed evacuating catheter, through which to drain off the urine, and wash out the detritus, and this will be a task of little difficulty, for where atony exists there is usually great tolerance of the bladder—unless, indeed, the case be so far advanced in disease as to preclude all attempts at relief. If the atony is only discovered to exist when the patient first seeks advice, the surgeon will secure his entire confidence,

readily and at once—for there is no condition in which more marked relief can be afforded than in this—by instructing the patient how to use the catheter for himself, and afterward employing vesical injections.

The nervous impressibility of calculous patients is usually so considerable, and the influence of fear, anxiety, and painful anticipation upon the action of the bladder is so marked, that it is good practice, when the patient is in condition to have his stone crushed, for his surgeon to give him no previous notice of the fact, but to introduce the lithotrite as on previous visits—where it was done for exploration—to seize the stone, if it should lie favorably, and crush it without further ceremony.



FIG. 78.



FIG. 79.

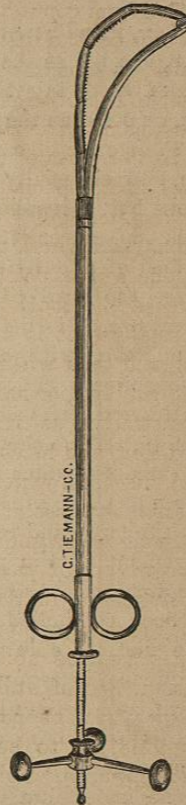


FIG. 80.

INSTRUMENTS REQUIRED FOR THE OPERATION.—The surgeon who would master the art of lithotripsy must make himself thoroughly familiar with the construction and qualities of the instruments which have been contrived with the object of reducing a stone in the bladder to powder. The lithotrite is the perfected result of many trials, and of the correc-

tion of faults, as found out by experience, in instruments previously invented, modified, and thrown aside. Amussat and Key had recently established the fact that straight instruments could be passed through the urethra into the bladder with a certain degree of facility, and for this reason, apparently, the earlier efforts to bring a perforating, grinding, or triturating power to bear upon the stone were made by Civiale and his followers, with straight instruments. This surgeon made his first great success with his "litholabe"—a straight instrument—and for

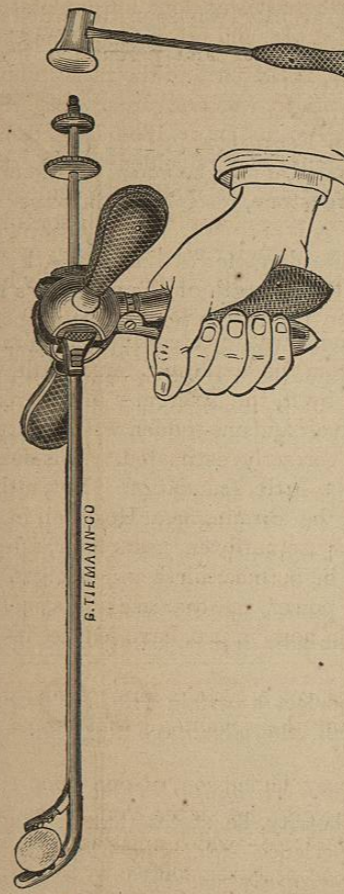


FIG. 81.

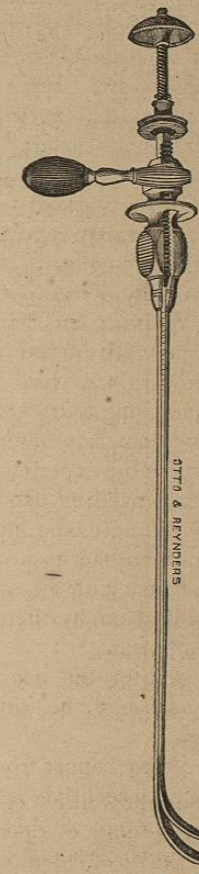


FIG. 82.

ten years no other than straight instruments were used for lithotripsy. The "trilabe"—also known as Hunter's forceps (Fig. 78)—is still occasionally employed to catch last fragments, and in case of impaction of a fragment in the urethra. About the year 1834 the articulated lithotrite of Jacobson (Figs. 79, 80), and the curved lithotrite, with jaws

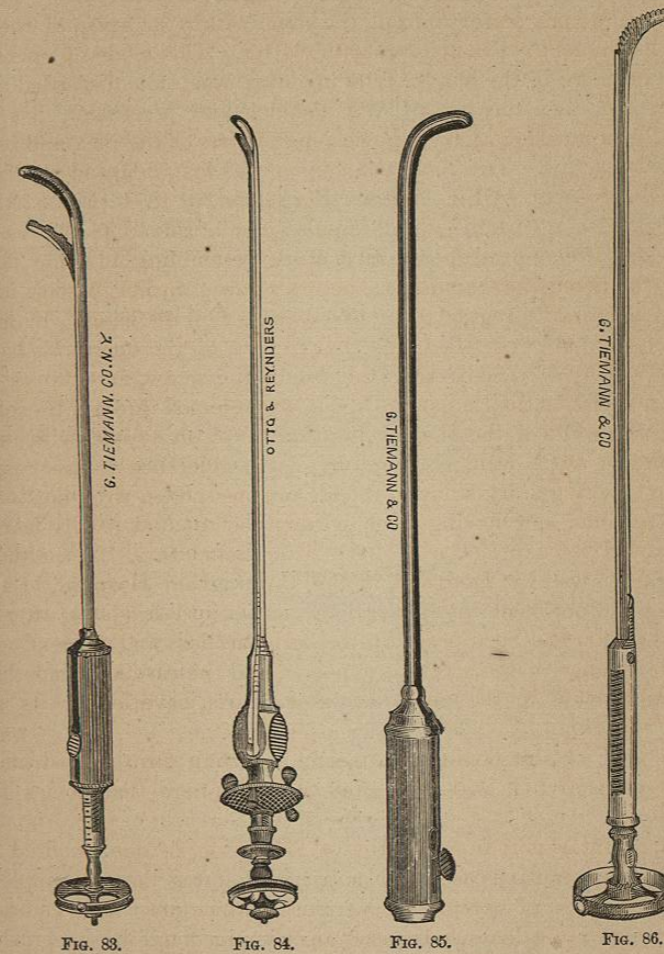
to open and shut, devised by Weiss, of London, began to be substituted for the "trilabe," and Heurteloup so modified this latter invention that percussion, by means of a hammer applied to the free extremity of its movable or male blade (Fig. 81), could be brought to bear upon the stone. Heurteloup also used a table to which the patient was strapped; so constructed that the position of his whole body, and consequently of the stone in the bladder, could be changed at will, thereby placing it in the surgeon's power to bring the stone within the grasp of the jaws of the instrument, without moving the latter. This mode of operating, though effective in the hands of its inventor, was soon discarded as too cumbersome, and the use of the hammer and percussion has been gradually superseded by lever-power, in the form of the rack and pinion, and of the screw. The rack and pinion was first adapted to Weiss's curved instrument by Sir William Fergusson, in 1834 (Fig. 82). By this mechanism a certain jerking impulse may be added to the crushing force which it exercises upon a hard stone, resembling in some degree that of the percussion-hammer. The lever-power in Fergusson's instrument is necessarily regulated by the diameter of the handle, by means of which the force is applied, and the strength of the operator's hand.

It is worthy of remark that the use of the screw, first proposed, in 1824, by Weiss to Sir Benjamin Brodie, was rejected through fear of violence to the walls of the bladder from the explosive force with which fragments of stone were scattered by it, the difference in this respect, between cracking a dry stone in the air and one sodden with moisture in a fluid medium, not having been correctly estimated. This fear has been proved by experience to have little foundation. Yet, although actually employed by Hodgson, in the Birmingham Hospital, in 1825, the screw did not come into general use until ten years later, after the rack and pinion had been proved to be both harmless and efficient. The greater efficiency of the screw as a power, and the ease and smoothness of its application by the mechanism now in use, have led to its very general adoption.

It is well for the beginner to select a certain form of instrument, and always use it; he will thus gain the advantage that comes from familiarity.

In a recent report from Sir Henry Thompson, of one hundred and eighty-four consecutive cases of lithotripsy, he states that he employed in this wide range of operative experience—which must have embraced all the varieties of calculous disease properly remediable by the crushing operation—but two lithotrites, a stronger instrument for first crushings, and another, with plain blades, for reducing the fragments to powder. These instruments, known by his name (Fig. 83), are at the present time very generally in favor, and with justice, for the perfection of their construction leaves little to be desired. French lithotrites (Fig. 84), which have essentially the same construction, with slight differences in detail,

may be possibly superior in finish; but, where the full power of the crushing instrument is wanted, the English steel is more reliable. A less practised operator would probably require also a third lithotrite, with broader, shorter, and entirely smooth, plain blades or jaws for finding last fragments and making explorations and measurements. Formerly, when it was thought desirable to bring away as much as possible of the



detritus of the crushed calculus between its jaws, this style of instrument was known as the scoop-lithotrite (Fig. 82). At the present time this is not considered good practice, as it exposes the neck of the bladder and the urethra to risk of injury.

In describing a lithotrite, we speak of its "handle," "shaft," and