

likely to be terminated within a limited period not very far distant. But we are compelled by the requirements of practice to reduce these questions to a narrower limit. Cases are constantly presenting themselves in which the patient's age is not extreme, and his general health sufficiently vigorous, but his stone so large that it can be removed only with the aid of the knife—by an operation the mortality of which modern science has not been able greatly to reduce. Here the judgment of the surgeon is to be guided by the following considerations: the degree of the patient's sufferings; the probable amount of relief to be expected from palliative measures, and the temper and circumstances of the patient, as measuring his probable capacity to properly care for himself, and command the comforts of an invalid. In the case of an old man able to command all the comforts of life, with a large stone, suffering only moderately, and able still further to lessen existing suffering by skillful care, it would be obviously the part of wisdom and humanity to hesitate in advising an operation. The simple fact that an operation can be done is no reason why it should be done in the face of very serious risk to life; and it is hardly necessary to say that the temptation to perform a capital operation, even at his urgent request, should never weigh for a moment against the best interests of the patient who places his life in our hands. The considerations which influenced Franklin and D'Alembert to decline lithotomy at the hands of Desault, at Paris, in 1784, still hold good, for the mortality of this operation has not diminished since the days of Cheselden.

Having determined, then, that it is proper, in certain cases, to decline an operation for stone, what course should be adopted after an examination has ascertained the presence in the bladder of a movable calculus of moderate dimensions? The amount of inconvenience caused by the operation of sounding should be observed, as indicating, in a general way, the condition of the bladder, and the measure of the patient's tolerance; and further exploration should be deferred until all increased trouble that may have been caused by it shall have subsided. Meanwhile the patient's history and present general condition should be carefully studied, and the vital organs subjected to physical exploration. Especial attention should be devoted to the kidneys and bladder, both by physical exploration, externally from the abdomen, the loins, and rectum, to detect tenderness on pressure, or tumor, and also by careful and repeated microscopical and chemical examinations of the urine. Much information will thus be obtained as to the condition of the bladder, the constitution of the urine, and an accurate idea of the size and state of the prostate. When the proper interval has elapsed a full-sized sound or bougie is to be introduced through the urethra for the purpose of testing the temper and capacity of this canal, and to detect the existence of stricture, if present. If the patient be sensitive, this may be repeated several times, at proper intervals, as it

serves to diminish abnormal irritability of the urethra, often present from habitual contact of altered urine; to educate the passage, as it were, to tolerance of instruments; to familiarize the patient to his surgeon; and to lessen the nervous dread, which always exists in some degree, of his manipulations. If the urethra has been proved to be healthy, and of normal capacity; if the patient can retain his urine from one and a half to two hours, and is in fair general condition, the introduction of a lithotrite may be undertaken. Its object is to seize and measure the exact size of the stone; to ascertain, while the stone is in the grasp of the lithotrite, if there be any other stones present in the bladder (for it is only by this manoeuvre that the presence of other calculi can be certainly demonstrated); to recognize any abnormal condition of the internal surface of the bladder, such as undue prominence of its muscular fasciculi, or possibly the existence of sacculi; and to determine with more accuracy the degree of tolerance of the organ, in view of the feasibility of lithotrity. An instrument of moderate size, and with perfectly smooth blades, should be selected for this operation, and it should be introduced, and managed, while in the bladder, in the manner hereafter described. The lithotrite should not be kept in the bladder longer than three minutes. If this exploration is satisfactorily accomplished, if the stone does not measure more than one and a half to two inches in diameter, is solitary, and the bladder has proved tolerant of the presence of the instrument, and of the whole proceeding, it may be safely concluded that the case is a proper one for the crushing operation.

Thus far the patient has been assumed to present conditions entirely favorable to lithotrity, viz., good general health, a tolerant bladder, a urethra of normal capacity, and a moderately soft stone, not more than an inch in diameter. But cases of this kind constitute but a small percentage of the aggregate encountered in practice. It is necessary that the surgeon should have an accurate perception of all the conditions that justify this mode of cure; and that he should be ready to reject, without hesitation, those cases which do not properly come within its scope. The choice of a mode of cure in a given case is not a matter to be decided by personal preference, or by partisan feeling—it must be determined entirely in the patient's interest, and after careful study of the case, especially in reference to the following points, which include the conditions usually presented, favorable or otherwise, to the crushing operation: the period of life; general or local disease, especially of bladder and urethra; degree of tolerance of instrumental manipulation; size and quality of the calculus.

A few words will be necessary on each of these points:

The *age* of the patient will determine the mode of cure in about one-half of the cases which present themselves in general practice; for the most reliable statistics teach that "one-half the entire number occurs be-

fore the thirteenth year is completed." Now the limited proportions of the male urethra before puberty, the excessive sensibility of the child's bladder, and the want of docility and self-control at this time of life are all unfavorable to lithotripsy; while it is just in this class of cases that the cutting operation has attained its greatest success—a mortality varying from one in eleven to one in twenty-eight, the mean mortality of the whole period of life, below the age of fourteen, being about one in fifteen. As a rule, then, to which exceptions are rare, lithotomy is the preferable method of cure for male children under the age of fourteen. The exceptions are, when the stone has been discovered just after its formation, while still very small, so that one or two operations with a slender lithotrite will certainly remove it. In these operations an anæsthetic would be required. In the future progress of lithotripsy these exceptions may become more numerous.

In case of general disease, involving vital organs and threatening life, the performance of any surgical operation, with the object of removing a stone from the bladder, must necessarily be regarded as an exceptional proceeding, warranted only by the certainty of being able to remove immediate danger to life, or to relieve extreme pain, not otherwise relievable, with the prospect of prolonging life for a limited period. Where any operation is determined upon, under these circumstances, it would, probably, be more judicious to take the chances of securing relief at once, by lithotomy. An exception, here, would be a case in which there was great tolerance of the bladder, such as generally accompanies atony of that organ—a condition in which the practised lithotritist could do pretty much as he pleased.

By local disease of the urinary organs is understood, practically, stricture of the urethra, enlargement of the prostate, intense or persistent cystitis, and organic alteration of the kidneys.

The existence of confirmed organic stricture at one or more points of the urethra, is a serious impediment to lithotripsy. A fully distensible canal, with healthy walls, is an indispensable requisite for the easy introduction of the instruments employed in crushing calculus, as well as for the ready escape of the detritus resulting from the operation. The question may be asked, Cannot the stricture be cured, and the patient afterward be subjected to lithotripsy? The answer is, to restore the walls of a strictured urethra to their original suppleness, distensibility, and smoothness of surface, is a remote and rather uncertain possibility, if indeed it be a possibility; and the arrest of fragments at any point in the urethra where a stricture has once existed, is an accident always liable to occur. Yet there are instances on record in which this impediment has been overcome with more or less success; and a surgeon of tact and experience may, in a case entirely favorable in other respects, successfully compromise with this disadvantage when existing in

¹ Thompson, "Practical Lithotomy and Lithotripsy."

a moderate degree.¹ In old cases of stricture, where stone has formed in the bladder, cystitis, of more or less intensity, is necessarily present; and here a resort to the knife is imperative—for an additional reason also, that, by a modification of median lithotomy, the stricture may be possibly treated successfully by external incision at the same time that the calculus is removed from the bladder.

CASE XXVII.—In 1869, a gentleman with an old and obstinate stricture, complicated with chronic cystitis, came to New York for relief. It was with difficulty that the smallest bougies could be introduced into the bladder. From the constantly-recurring exacerbations of intense pain in micturition, and the occasional presence of phosphatic sand in the urine, the suspicion arose that a stone had formed in the bladder. As the stricture was not amenable to treatment by dilatation, in consequence of the presence of false passages and extreme sensibility of the urethra, a very small whalebone bougie was introduced to serve as a guide, and, on this, division of the stricture was effected by perineal section; and the incision afterward prolonged to the neck of the bladder, whence were removed two phosphatic calculi of moderate size, which had been promptly discovered after division of the stricture. The patient made a good recovery, and learned to introduce for himself a full-sized steel sound, No. 17.

It would have been impossible to treat such a case by lithotripsy.

Enlargement of the prostate is not an objection to lithotripsy so long as it offers no obstacle to the ready passage of the necessary instruments into the bladder. Nor is the condition of atony, or impaired contractility of the bladder, so common a complication of the enlarged prostate, to be regarded as an unfavorable circumstance. On the contrary, it is in cases of this kind that the trained lithotritist is sometimes able to manage successfully the largest calculi removable by the crushing operation.

Chronic cystitis of a very intense and persistent character, *without stricture* or any obvious cause save the presence of the stone, is a valid objection against lithotripsy. While the bladder is acutely intolerant of its contents, sufficient urine cannot accumulate within its cavity to afford an area in which the lithotrite can be safely manoeuvred. Apart from the danger of still further increasing the intensity of the inflammation by interference, the simple attempt to introduce the instrument into the bladder is liable to bring on acute spasmodic contractions, by which its contents are forcibly ejected. Means must be employed, therefore, to lower the grade of the inflammation, to improve the quality of the urine, and to diminish the frequency of the calls to urinate, before the feasibility of lithotripsy can be determined; and, if this improvement cannot be accomplished after a reasonable trial, the crushing operation must be abandoned. There is a wide margin here for skill and tact, in the employment of medical treatment to improve the condition of the bladder. When a degree of tolerance has been attained in which the intervals between the calls has reached an hour and a half, the contents of the bladder equaling about three ounces, and the improvement is progres-

¹ Walter J. Coulson, F. R. C. S., *op. cit.*, p. 52, *et seq.*, has cases illustrative of this point.

sive, then the use of instruments, in the gentlest manner, may be tried. Cases are on record in which, where the calculus has been small, and the patient otherwise healthy, the fact having been clearly established that the cystitis was being kept up solely by the stone's presence in the bladder, anæsthesia has been employed, and the calculus removed successfully at one operation. This is an exceptional application of lithotomy, justifiable only in the hands of a master of the art.

Long-continued obstructive disease of the urinary organs, either from urethral stricture or enlarged prostate, is often complicated, not only by chronic cystitis, but by deeper lesions, involving vital organs; dilated and tortuous ureters, evidences of chronic pyelitis of low grade, with atrophy and other profound alterations of the kidneys. During life, however, the existence of these serious complications cannot be made out with any absolute degree of certainty; habitual tenderness on deep pressure over the kidneys, tendency to chill on slight provocation, increased frequency of pulse toward evening, nausea and capricious appetite, with feeble digestion, and similar evidences of failing health, which cannot be otherwise adequately explained, are symptoms from which the existence of these lesions may be inferred. Any operation undertaken upon a person in this condition is liable to be followed by rapidly-fatal symptoms, due most probably to uræmia.

The form of renal degeneration known commonly as Bright's disease, a malady entirely different in its pathological signification from that sequence of morbid changes due to urinary obstruction which has just been described, seems, in fact, to be rather rarely associated with calculus disease. It often occurs in connection with cardiac lesion, and is readily recognizable by unmistakable symptoms, of which the most characteristic are the presence of albumen in the urine, and of casts of the uriniferous tubes in its sediment. When present, it constitutes a grave objection to operative interference of any kind.

What we require to know especially concerning the stone, in the next place, is its *size and degree of hardness*; or, if there be more than one, their aggregate volume, so that the amount of *débris* which would result from their crushing might be estimated with some approach to accuracy; and this knowledge, already attained in some degree by exploration with the lithotrite, is to be used conjointly with what has been learned as to the condition and degree of tolerance of the bladder; for the surgeon would be justified in attacking a much larger phosphatic calculus in the tolerant or atonized bladder of an old man, than one of uric acid of smaller size in the more irritable bladder of a younger subject. Again, a calculus of uric acid breaks into wedge-shaped fragments, with acute angles; and the mulberry calculus, from its extreme hardness, yields but few, and consequently large fragments, with very sharp edges; the result of a crushing in either case would involve more risk of subsequent inflammation than the less irritating and more pulverulent

detritus of a phosphatic stone. It becomes obvious, therefore, that in fixing a rule which shall determine the choice between the crushing and cutting operations, as based upon the size of the stone, a standard must be adopted which shall vary with its quality. It is safe to say that all stones under an inch in diameter may be crushed; but it would not be judicious to conclude that all stones beyond this size must of necessity be reserved for lithotomy. Here is room for the exercise of sound judgment, and to this end an accurate diagnosis must be made as to the nature of the calculus, as well as to the condition of the bladder. For this purpose, careful microscopic study of the patient's urine, and inquiry as to when it first became turbid, and what changes it has undergone, will give much assistance. The habitual presence in the urinary sediment of the octahedral crystals of oxalate of lime, the prisms of the triple phosphate, of the common and varied crystals of uric acid, or of the purulent sediment of the amorphous urates, would add much certainly to the diagnosis of the probable nature of the calculus; while a close and searching inquiry into the history of the patient, his antecedents, his earlier symptoms, and their different phases as the malady progressed, the possible occurrence of previous attacks of renal colic, and the habits of the patient, as influencing them, with a review of his inherited or acquired constitutional peculiarities, could hardly fail to elicit valuable information.

The probability of a central nucleus of uric acid, from its extreme frequency, is very great; but the possibility of finding a nucleus in the shape of a foreign substance which had got into the bladder from without, such as a fragment of bone, or wood, which it would be impossible to crush, is not to be forgotten.¹

¹ In the collection of calculi in the Museum of the Royal College of Surgeons of London, according to the catalogue, out of 649 calculi, 212 are composed of uric acid alone; and, in 65 others, it forms the nucleus. Urates are given as constituting the entire calculi in 14, and the nucleus of 187 out of the 649; 13 are composed entirely of oxalate of lime; it forms the nucleus in 62.

In a successful case of lithotomy, which occurred in this city during the late war, under the care of Drs. Livingston and Markoe, a quadrangular fragment of bone was found in the centre of the calculus. It had been broken off by a bullet, which had passed completely through the bladder, leaving the piece of bone to become the nucleus of a stone. The size of this fragment was too great to permit its withdrawal through the urethra in the jaws of a lithotrite, and its consistence too solid and resisting to allow of its being crushed.