

on the other hand, this entire absence of symptoms, local or general. The patient goes about well content. He eats, sleeps, and works pretty much as usual. Whatever pain he has had in the loin is past, and his present discomforts are insignificant. And yet all the while there is brewing within him a crisis swift and terrible.

Spontaneous recovery may occur. The obstruction is relieved; the urine gushes out, 3 or 4 litres a day, and all is well. This may occur in 20.8% (Morris) to 28.5% (Legueu) of all cases. In Legueu's¹ cases the spontaneous cure took place on the third day once, between the fifth and the tenth day twice; later still in five instances. Yet it is obvious (*Cf.* Treatment) that no time should be lost in the expectation of a spontaneous cure; for even if this occurs, unless the calculus is actually passed, the patient thereafter goes about in imminent danger of a recurrence of his attack.

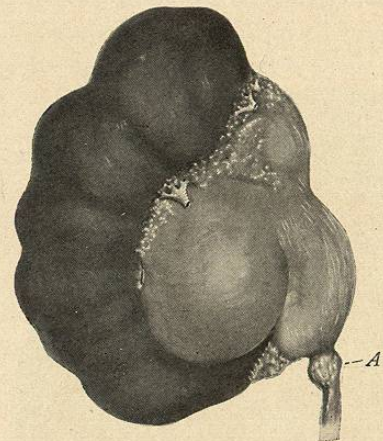


FIG. 147.—CALCULOUS HYDRONEPHROSIS.
A small stone was found lodged at A. This kidney is the fellow of the one shown in Fig. 146. They were obtained from a patient who died of calculus anuria.

When spontaneous recovery does not occur the patient passes into the third stage of the disease at the end of a week or ten days.

3. The *uremic stage* is usually ushered in by hiccough or vomiting. This is the first warning. It may continue for a day or two without additional symptoms. The pulse is tense, the temperature usually subnormal. Constipation becomes absolute and the intestines are distended with gas. The vomiting grows more severe, the intellect becomes dulled and stuporous. The patient's mind may wander a little, and he may even have maniacal attacks. There is often a restlessness of both mind and body. And thus he sinks away and dies, often within two or three days of the first hiccough or vomiting.

Such is the clinical picture of what Morris has aptly termed the gravest and most fatal of the many serious complications of urinary lithiasis. Of course there are atypical cases, the obstruction may be intermittent or partial; but such cases require no special notice.

Calculous Hydronephrosis.—Calculous hydronephrosis is due to the impaction of a stone in the ureter (Fig 147), or rarely

¹ Guyon's Annales, 1895, xiii, 865.

to a stricture secondary to a calculous ulceration. The development of the hydronephrosis is habitually marked by a series of renal colics, and hydronephrosis may be one of the features of calculous anuria. The symptoms and signs of hydronephrosis are detailed elsewhere.

Renal Suppuration.—Stone in the kidney is probably the most common cause of suppurating pyelo-nephritis. It also causes pyonephrosis (Fig. 148); while secondary phosphatic calculus or phosphatic deposit upon a pre-existing calculus results from the inflammation. Catarrhal inflammation is not encountered with calculus. The irritation caused by the stone is such that when inflammation occurs it promptly assumes a suppurative type.

The variations imprinted upon the classical picture of suppurative pyelo-nephritis by the presence of stone are few. There is the same urinary septicemia, the same absence of any great enlargement of the kidney. There may be colic, and there is usually a constant ache in the side. Hemorrhages occur from time to time.

The inflammation is rarely acute or virulent, but progresses slowly, involving the whole organ and terminating finally in pyonephrosis or perinephritic abscess.

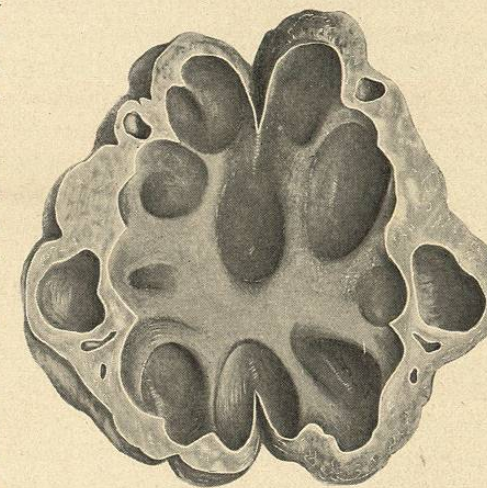


FIG. 148.—CALCULOUS PYONEPHROSIS.
This kidney contained the stone shown in Fig. 145.

DIAGNOSIS

Not one of the symptoms of renal calculus is absolutely pathognomonic. In another chapter I have collected cases illustrative of anuria, hematuria, and renal colic caused by something other than a calculus. Even the passage of a stone may be misleading. Not long ago a patient came to me with a history of having passed several calculi, and complaining of pain in her right loin. The urine showed evidence of mild suppurative pyelo-nephritis; there was local tenderness but no tumour. I performed nephrotomy, and found nothing but a dense spherical scar 2 cm. in diameter in the kidney substance and some thickening of the pelvis: no obstruction, no pouching, no stone. She was drained for several weeks, sent to a

mineral spring, kept on a long course of urotropin, and in six months the pus disappeared from her urine; she gained many pounds in weight and remains well now after three years. To be brief, there is no one subjective symptom of calculus that can be depended upon. The cessation of symptoms after a stone has been passed no more indicates the absence of another stone than their continuation indicates its presence. That a stone is present in the ureter or kidney cannot be absolutely affirmed unless it is seen or felt. Palpation, ureteral catheterism, skiagraphy, and exploratory nephrotomy constitute our diagnostic measures.

Palpation.—Palpation of the loin has been known to elicit a distinct grating of two or more renal calculi upon one another. In a few cases it has been possible to distinguish a large stone by palpation. These are most exceptional signs, and, as a rule, palpation is only employed to distinguish such renal enlargement or tenderness as characterizes hydronephrosis, or pyelo-nephritis, without any reference to the calculous nature of the disease. Abdominal palpation along the course of the ureter, and rectal (or vaginal) palpation of its lower extremity are useful to determine the presence of stone in these localities (p. 472).

Ureteral Catheterization.—Ureteral catheterization with wax-tipped bougies has been successfully employed by Howard Kelly for the diagnosis of pelvic or ureteral calculi. The stone leaves scratches upon the wax. This device will commend itself to those who frequently employ the ureteral catheter, but can never afford the satisfactory evidence obtainable from the X-rays.

Radiography.—Radiography will some day solve our diagnostic difficulties. It has not done so yet.¹ The possibility of X-ray burns has not been entirely eliminated, nor has sufficient experience accumulated to justify the belief that the skiagraph is an infallible index both of the presence and absence of a stone.² Yet experienced manipulators have already attained such perfection of technic that radiography stands first as a means of diagnosing ureteral and renal stones. The density of the shadow thrown by a stone seems to depend upon the amount of lime it contains. Hence oxalate and phosphate stones show well, while a pure uric-acid stone would be quite indistinguishable. Yet, clinically speaking, uric-acid calculi usu-

¹ J. of Cut. and G. U. Dis., 1901, xix, 341 and 368.

² Dr. C. L. Leonard (Annals of Surgery, 1900, xxxi, 163, and 1901, xxxiii, 435) has so perfected the technic that the examination of 136 cases, in 100 of which he made a negative diagnosis, has netted him only one known error. But there are numerous instances, especially in fat persons, in which most authorities are liable to err.

ally contain enough urate or phosphate of lime to produce a faint shadow (Williams¹).

I have employed radiography 7 times. In 3 cases the result was unsatisfactory—one of these probably has a stone. In 2 it was negative and correct. In 2 it was positive and correct; but I am strongly inclined to believe that in one of these the stone was bilateral, though the plate showed only one stone.

Radiography is useful in all cases, even when the presence of stone can be determined without it, for it shows every detail of position with the greatest accuracy. A good radiograph is therefore invaluable to the surgeon, since it tells him just where to look for the stone and relieves him of any responsibility as to the presence in ureter or kidney of other calculi that might be difficult to locate in the course of an operation.

Nephrotomy.—Exploratory nephrotomy until recent years has been the only accurate method of diagnosis. There has been keen discussion as to the relative merits of needling, pyelotomy, and nephrotomy for the discovery of calculi. Stones have been overlooked, no matter what the method employed; and since exploratory nephrotomy bids fair to be superseded by the X-ray, it need only be noted that palpation of the exterior of the kidney and the process known as needling—i. e., the insertion of needles into the kidney substance—may disclose the stone, but are peculiarly fallacious. In order to make an adequate examination the kidney must be laid open, every portion of its pelvis carefully palpated, and a probe inserted down the ureter into the bladder. The renal incision may pass through the pelvis or through the cortex (p. 639). I have not found it necessary to bisect the kidney. An incision in the lower pole large enough to admit the finger suffices for adequate examination of the entire organ.

Suggestive Symptoms.—Many renal conditions secondary to calculus require nephrotomy for their relief without reference to the presence or absence of stone. Such cases (e. g., anuria, pyonephrosis, hydronephrosis, pyelo-nephritis, persistent pain or hematuria) may be suspected to be calculous from the nature of their pain and hemorrhage and from the absence of the positive signs of tubercle or of neoplasm. Yet before operating, I repeat, it is convenient to have radiographic evidence of the exact position of any stones that may be present, in order to spare the patient a tedious and uncertain digital exploration.

¹ The Roentgen Rays in Medicine and Surgery, 1901.

TREATMENT

The *prophylactic treatment* has been discussed elsewhere (p. 439).

Palliative and Symptomatic Treatment.—Many of the morbid conditions caused by renal stone require palliative treatment, either in the hope that the stone will pass or for the purpose of alleviating symptoms until operation may be performed. These conditions are reducible to three—viz., colic, anuria, and suppuration.

The Treatment of Renal Colic.—The first thing demanded by a renal colic is relief from pain. A gramme of antipyrin may suffice—if not morphin should be injected hypodermically with a generous hand. Muscular relaxation should be encouraged by means of hot baths and by the local application of heat to the loins. Beer and gin are useful adjuvants to produce free diuresis. If the pain is not relieved by morphin administered to the limit of endurance, it is customary to administer chloroform, keeping the patient anesthetized to the obstetrical degree for as long as an hour. In such an emergency it is proper to introduce a ureteral catheter for the purpose of pushing the stone back into the pelvis of the kidney, or, if all else fails, to perform nephrotomy at once; this will afford immediate relief.

As the pain passes, the patient and his attendants should be warned to watch for the stone. If the point of maximum tenderness remains in one place, it may be inferred that the stone is immobile; but if the pain and tenderness pass down the course of the ureter, and cease after causing an attack of frequent and painful urination, the assumption is that the stone has passed into the bladder. For a week or ten days thereafter the closest watch should be kept for the stone. It may be ejected by the bladder without a symptom or with a sharp urethral spasm. It is not likely to become impacted in the urethra unless there is a pin-hole meatus. If the stone does not soon appear the bladder should be searched with a large litholapaxy tube (p. 452).

Whether the stone passes or not, the surgeon should explain to his patient that other stones may be present, and should insist that a radiograph be taken by an expert in order to clear up this point. Unless this is done the patient is blindly exposed to all the complications of renal stone, and is deprived of his safest opportunity of avoiding them. With a satisfactory radiograph before him the surgeon is in a position to declare that there are or are not any more stones present. If so, and they are very small and lie in the ureter or free in the pelvis, an attempt may be made to wash them through

by sharp diuresis. But if the stones are of such size or in such a position that the surgeon deems their spontaneous passage impossible, the patient should be so informed, and he should be enlightened upon the propriety and prospects of operation, to which he should be urged to submit.

The Treatment of Anuria.—Until within the last few years the treatment of calculous anuria has been expectant. It has been the custom, and still is the practice of many physicians, to stand by and watch the case, deluded by the absence of uremic symptoms and misguided by an occasional spontaneous recovery, until the sudden intense uremia closes the scene or summons the surgeon too late. Such a course of action cannot be too heartily condemned. Morris states that "so useless is medicinal and expectant treatment that I have refused to attend consultations in cases of calculous anuria unless I have permission beforehand to operate at once if I think the case suitable." Such should be the attitude of every surgeon. Though the patient, his family, or his physician may see fit to trifle with this swift and mortal condition the surgeon cannot afford to countenance any delay.

So much for what should not be done. The positive aspect of the situation is not so clear. It is true the majority of cases require nephrotomy; but there is a proportion of recoveries—one quarter of the recorded cases—that must be respected. In view of this, during the first forty-eight hours of the attack diuresis may be pushed to the utmost in the hope of dislodging the stone, and the opportunity of obtaining a radiograph should be seized; but if the anuria is not relieved on the third day, or if the patient is not seen until that time, no palliative measures may be considered; immediate operation must be insisted upon. The date of operation is recorded in 37 cases of Morris's list: 21 of these were operated upon on or before the fifth day, with 8 deaths, a mortality of 38%; 16 after the fifth day, with a mortality of 50%. Append the 75% mortality of the non-operative treatment of anuria and the inference is complete. No matter how well the patient may appear, the operation should not be postponed after the second day of anuria; in some cases it may be wiser to resort even sooner to the knife.

The Treatment of Calculous Pyelo-nephritis.—Renal suppuration due to stone may be only one degree less benign in appearance and less malignant in reality than anuria. Suppuration caused by calculus cannot be overcome by any medical or hygienic treatment. Unless the stone can be passed off spontaneously—an outcome to the last degree improbable in suppurating cases—its growth is fostered by secondary phosphatic deposit, while the irritation it provokes

in turn feeds the renal suppuration. Palliative treatment is futile except as a preparation for the knife.

Pyonephrosis and perinephritic abscess, whether calculous or not, require radical surgery.

Radical Treatment.—The radical treatment of renal and ureteral calculus consists of three operative procedures: nephrolithotomy, nephrotomy, and nephrectomy. Nephrolithotomy (pyelolithotomy or ureterolithotomy) is incision of the kidney (pelvis or ureter) for the purpose of extracting a stone. The term has been restricted by Morris to operations performed upon the aseptic kidney, to distinguish them from nephrotomy performed upon the suppurating kidney. This distinction is valuable from a surgical point of view. The term nephrolithotomy, therefore, will be employed to designate extraction of a stone from a non-suppurating kidney, while nephrotomy, in this connection, will imply lithotomy of a suppurating organ.

Indication for Operation.—The general indication for operation upon a calculous kidney is the presence of a stone too large to pass down the ureter. Leonard¹ has suggested that by means of the X-rays it is possible to estimate with great accuracy the size of small calculi. He mentions the recognition of 3 ureteral calculi weighing a grain or less, all of which were passed spontaneously. In such cases the surgeon may adopt expectant treatment and endeavour to expel the calculus by free diuresis. But if the calculus is too large to pass of itself it must be removed by the surgeon. Such then is the indication for operation—a stone that will not pass. In the preceding paragraphs the modifying circumstances have been discussed—the delusive nature of the calm succeeding a renal colic, the imperative necessity for operation during anuria, the futility of delay whether the kidney is suppurating or not.

Yet there is another point of view, one most frequently assumed by the patient—viz., What are the risks and inconveniences of operation? For to the patient the immediate horror of the knife is a far more potent incentive than the "ifs" and "ands" with which a conscientious surgeon must mitigate the non-operative prognosis. For calculous disease, though swift and fatal in anuria, torturing in colic, and slowly, grimly progressive in suppuration, also presents possible vistas of years of comparative health and comfort, a delusive prospect with which the timorous sufferer would fain brace his refusal of the knife. But the surgeon can offer a prognosis whose brilliancy eclipses anything the patient may expect from Nature's

¹ J. Am. Med. Ass'n, 1901, xxxvii, 1451.

unaided efforts. The general mortality from nephrolithotomy and ureterolithotomy does not run above 3% or 4%. That is to say, it is lower than the mortality of Bottini's operation, and almost equals that of litholapaxy. In fact, an experienced surgeon may assure the average patient that this operation is perfectly safe. Its discomforts are minimal. The distress so frequent after vesical, pelvic, and intestinal operations need not be anticipated, and the discomfort of lying in bed for about two weeks is almost the sum of the convalescence. Such a prospect with its assurance of future safety, its lack of present danger, and its unimportant discomforts, outweighs a single renal colic, and is not for a moment to be compared with the progressive unsafety and discomfort to which the patient subjects himself by refusing operation.

The advantage of early operation, before the kidney becomes infected, is still further enforced by the relative mortality of nephrolithotomy, nephrotomy, and nephrectomy. Nephrolithotomy—the removal of a stone from an uninflamed kidney or ureter—has, as remarked above, a mortality of 3% to 4%. Nephrotomy—the incision of a septic kidney—has a mortality of 20% to 25%, while the mortality of nephrectomy in like conditions runs from 30% upward. Add to this the mortality of nephrotomy for calculous anuria, 50%, and the conclusion is obvious that the patient who refuses surgical relief while the kidney is yet uninflamed spurns a comparatively safe and sure cure and subjects himself to a disease which, apart from its other dangers and discomforts, may at any moment bring him to a critical condition of renal obstruction or suppuration, from which he can only escape by submitting to an operation many times more dangerous and distressing than the one he seeks to avoid.

Nephrolithotomy.—No operation is more exact and straightforward than nephrolithotomy if a good skiagraph of the kidneys and ureters has been obtained. No operation is more indefinite in its possibilities nor more dependent for success upon the surgeon's experience and skill than is nephrolithotomy without a skiagraph. Therefore any amount of time and trouble may be deemed well spent if only it ends in the acquisition of an exact skiagraph. With this at hand the surgeon has but to cut boldly down upon the kidney and to extract the stone by pyelotomy or nephrotomy, as is most convenient. Without the skiagraph nephrolithotomy is a purely exploratory operation. Even if the surgeon feels sure that there is stone, he cannot ascertain to a certainty whether it is single or multiple, whether renal, pelvic, or ureteral; or, perchance, all three. The methods employed in this tedious and comparatively uncertain search have already been alluded to.

Ureterolithotomy.—A calculus may lodge at either end of the ureter or at the point where it crosses the brim of the pelvis. Several calculi may be found in different portions of the ureter. The seat of impaction is stated in 56 cases collected by Morris. Seven times the calculus lay in the renal pelvis blocking the upper end of the ureter (4 bilateral). Thirty times the stone occupied the upper extremity of the ureter (5 bilateral, 3 multiple). Seven times the stone lay at or near the brim of the pelvis (1 bilateral, 2 multiple). Ten times the stone lay within the bladder wall or just outside of it (3 bilateral, 1 multiple). Twice both ureters were obstructed by the pressure of a large vesical calculus.

The X-rays may be depended upon to locate a stone in any of these positions. Without their aid the surgeon needs all the information afforded by history and physical examination in order to decide upon what operation he should undertake, for different procedures are required to meet different conditions.

Calculus at the upper extremity of the ureter should be reached by the usual lumbar incision, and extracted by ureterotomy or pyelotomy.

Calculus at the brim of the pelvis may be attacked extraperitoneally through the lumbo-vaginal incision, or intraperitoneally through an incision in the linea semilunaris. In some measure the choice of route depends upon the surgeon's prejudices, though the extraperitoneal incision is usually preferred if there is infection.

Calculus at or near the vesical orifice of the ureter may be reached in a variety of ways. If the stone is within the bladder wall, bulging the mucous membrane or projecting into the vesical cavity, it may be extracted by a transvesical route. Dilatation of the urethra in the female, suprapubic cystotomy (Morris prefers perineal section) in the male, permits the removal of the stone by divulsion or incision of the ureteral orifice, perhaps aided by the lithotrite or scoop. I have performed this operation once successfully.

When the stone lies outside of the bladder, low down in the pelvis, it is singularly inaccessible. Sometimes it may be reached by an incision in the vault of the vagina—risking a uretero-vaginal fistula. Such a stone has been reached through a transverse perineal incision (Hurry Fenwick). The rectal route presents obvious objections. Morris has successfully operated by the sacral route. But usually the line of attack has been intraperitoneal or inguinal. These last two routes are probably preferable.

Technic.—Four technical points must be remembered in every ureterolithotomy:

1. The incision in the ureter should be longitudinal—i. e., parallel with its long axis.

2. Before making the incision the stone should be pushed up from the pouch in which it lies, in order that the incision made upon it may pass through a portion of the ureteral wall unaffected by pressure or ulceration.

3. Before closing the incision a long probe should be passed upward and downward in search of other stones, and the ureter should be minutely examined for stricture at the point where the stone has rested. If found the stricture is to be treated *secundum artem* (p. 486).

4. The ureteral incision may be closed by fine silk sutures not piercing the mucous membrane, or by catgut sutures through and through. Drainage is always appropriate to avoid a possible infiltration of urine.

Nephrotomy, Pyelotomy.—These operations are performed with the double purpose of removing the stone and of providing adequate drainage for pus. The incision in the kidney should preferably pass through renal tissue, but the main object to be kept in view is speed—without haste—in order to spare the patient the shock of a prolonged operation. The ureteral exploration must not be forgotten. The operative details are described elsewhere (p. 637).

Nephrectomy, Nephro-ureterectomy.—The indications for nephrectomy are those rehearsed in the preceding chapter (p. 577). When sacculated and full of calculi the ureter should be removed with the kidney.