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CALCULI IMPACTED IN THE URETERS.

PATHOLOGY, SYMPTOMS, AND SURGICAL TREATMENT.

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Numerous cases have been recorded where all the symptoms clearly pointed to the presence of a calculus in the renal pelvis, but when the kidney was explored no stone was found. Doubtless in many of these the stone had descended into the ureter, and so escaped observation. Now the rule is to explore the ureters, as calculi may be arrested at any part of their course.

Considering the anatomical arrangements of the ducts one would expect stones to become embedded where the pelves become narrowed to form the ureters, and where the ureters become constricted in their passage through the walls of the bladder, and from the statistics of cases of calculous anuria collected by Morris,¹ this is shown to be the case. He states that in 56 cases where the situations of the calculi were noted, obstruction took place as follows:

"1. In the renal pelvis and blocking of the upper orifice of the ureter, 7 cases. In 4 of these both ureters were blocked at the renal orifices.

"2. In the upper end of the ureters 30 cases. Both ureters were blocked in 5 of these cases. In 3 there was another stone impacted lower down (2 in the mid-part, and 1 near the bladder).

"3. In the middle portion of the ureter in 7 cases. In 1 case both ureters were blocked, and in 2 others there was a second blockage by calculus higher up.

"4. In the lower end of the ureter in 10 cases. In 1 of these there was an impacted stone also higher up, in 3 of them both ureters were obstructed.

"5. In 2 cases complete suppression was caused by obstruction of both kidneys by a large vesical calculus."

When the calculus is stopped at the upper end of the ureter it usually protrudes into the renal pelvis, and when it is embedded at the lower extremity of the canal it may, covered with vesical mucous membrane, project into the cavity of the bladder.

The impaction of calculus in the ureter is one of the most common causes of total obstruction to the escape of urine. When this occurs it is more certain to cause complete plugging than if the stone is lodged in the pelvis of the kidney. Should the ureter be suddenly and completely occluded, by the impaction of a stone in the lumen of the tube, the effect upon the corresponding kidney is very different from what is produced by incomplete and transitory blocking of the passage, as exemplified in cases of calculus in the renal pelvis, in the twisting of the ureters met with in movable kidney, or by the obstruction caused by the pressure of pelvic tumours.

The pathology may be examined under the following heads:

(1) Calculus impacted in one ureter, the other kidney being competent.

(a) The stone causing complete occlusion of one ureter.

(b) The stone causing incomplete plugging, with the escape of urine at intervals.

(2) Calculus in one ureter, the other kidney being incompetent.

(a) The stone causing complete occlusion of the ureter of the working kidney.

(b) The stone causing incomplete plugging, with the escape of urine at intervals.

The first class of cases to be studied are those where the patient possesses one active healthy kidney, the ureter of the other becoming blocked by a stone, which may cause either complete or partial obstruction to the escape of urine. When the lumen of one ureter is suddenly and completely closed, the backward fluid pressure of the urine very soon causes a marked diminution in the flow of blood through the kidney, atrophy of the organ rapidly takes place, and in most instances this is followed by a compensatory hypertrophy of the gland

at the opposite side. The destruction of the renal tissue is brought about in two ways: (1) By the insufficient blood supply consequent upon the pressure of the fluid in the capsules of the Malpighian bodies; and (2) by the pressure of the fluid within the pelvis causing dilatation. The pressure exerted by the urine which accumulates behind the obstruction leads to the expansion of the calices and flattening of the papillae. When the blocking is sudden and complete wasting of the kidney takes place without the pelvis becoming distended sufficiently to produce a swelling in the loin. The pelvis and calices of the kidney are not liable to sudden distension, they are only capable of slow and gradual dilatation. Should a stone become impacted, the secretion is arrested by inhibition of the corresponding kidney. If, on the other hand, the obstruction is incomplete or transitory, and the urine is permitted to flow into the bladder at intervals, advanced unilateral hydronephrosis develops. When relief occurs the previous high pressure within the uriniferous tubules and Malpighian capsules is suddenly diminished, and the vessels of the glomeruli being relieved from external pressure a considerable hyperæmia is induced, followed by rapid secretion of urine containing albumen. Supposing, however, instead of a sudden relief of the constriction, there is stricture rather than transitory obstruction, and only leakage from the narrow passage is possible. In these circumstances the activity of the gland is maintained, with sudden and occasional varying pressure within its cavity. If this be long continued, considerable hydronephrosis will result. There are, therefore, two conditions which cause marked distension, partial obstruction of the ureter with leakage, and complete transitory blocking associated with rapid and sudden collapses and dilatations of the upper urinary tract.

When the plugging of the ureter is incomplete, and the urine is allowed to escape at intervals, the pelvis of the kidney gradually becomes distended by the retained excretion and hydronephrosis results. It is in such cases when hydronephrosis reaches its highest degree of development, dilatation of the pelvis takes place behind the obstruction. The pressure exerted upon the structures leads to an expansion of the calices. Gradually the parenchyma of the kidney disappears and is replaced by fibrous tissue. As the pelvic cavity and the capsule approach one another, the renal form of the organ is rapidly lost, the outer surface may become rough, irregular, and lobulated, the depressions behind the lobules corresponding to the connective tissue within the sac, which indicates the remnants of the calyces of the kidney. The pouches communicate freely with one another, and in most instances with dilated pelvis, but in a few rare cases the sacs may be shut off from the pelvis by fibrous tissue. In the highest grades of hydronephrosis the kidney may be represented by an enormous membranous sac, which can only be recognised as renal in its origin on account of its relation to the ureter and colon. To the latter it is frequently adherent, but it may also be bound to other organs, such as the spleen, liver, pancreas, or it may be united to the peritoneum, omentum, or mesentery.

These changes are only possible when the kidney on the opposite side is able to perform its function in a way competent with life.

It is not often that both ureters become blocked at the same time, but the course of events may be as follows:

There is a history of repeated attacks of renal colic on one side, associated with the presence of hydronephrosis and other physical signs of obstruction. The symptoms become suddenly relieved, coincident with the escape of a large quantity of clear urine and some gravel, and followed by slight and transitory hæmaturia. These symptoms are repeated from time to time, then suddenly cease; the last attack is more prolonged than former ones, and the relief, in place of being sudden, is slow. There is no abrupt rush of urine, no escape of gravel, and no transitory hæmaturia. A stone has become firmly impacted in one ureter, and this accident will be followed by rapid and complete atrophy of the corresponding kidney and by hypertrophy of its neighbour. Years pass, these old attacks of nephritic colic are forgotten, but in the course of time the only working kidney becomes the seat of the old disease; a calculus forms in its pelvis, and, passing down into the ureter, becomes impacted there, and may cause either complete occlusion, followed by anuria, or the plugging

may be partial, and permit of the occasional escape of urine at intervals.

Suppression of urine means that the ureter of a working kidney has become completely blocked, while the other kidney has from some cause been rendered *hors de combat*. The nature of the injury or the character of the disease causing this varies greatly; they may be classified as follows:

1. Reflex inhibition of the function of the opposite healthy kidney.
2. Impaction of a stone at a previous date followed by hydronephrosis, or atrophy of the kidney on the opposite side to the one recently attacked.
3. Other unilateral diseases of the kidney, such as tuberculous nephritis, pyonephrosis, or congenital absence of one kidney.
4. Bilateral disease of the kidneys, including the various forms of Bright's disease, cystic degeneration, etc.

Suppression of urine may occur as a consequence of reflex inhibition of a disorganised kidney without the impaction being such as to mechanically close the ureter; the irritation of the calculus may produce suppression of urine. While the kidney, with the old-standing lesion, has had its function seriously impaired by disease, it may have been doing some work up to the time that the ureter of the working kidney became blocked. But when sudden obstruction occurs, not only is the escape of urine from the corresponding kidney checked, but the already impaired action of the other kidney is suppressed by reflex inhibition of its function. The activity of a diseased neighbour may be suppressed in this way, so also may the work of a healthy kidney be suddenly stopped. Examples of reflex inhibition of the functions of the kidney are numerous. Complete suppression of urine may follow the passage of a catheter and be succeeded by hæmaturia for some days. Then, again, cases occur of unilateral obstruction, such as is produced by the presence of a calculus in one ureter, causing complete anuria, which may last for a considerable time; or, in cases of transitory hydronephrosis from angular insertion of the ureter into the pelvis above, or into the bladder below, or from torsion of the ureter in movable kidney. When the obstruction on one side reaches a certain point, the kidney on the opposite side may fail to act, even while the hydronephrosis continues to increase in size.

Although symmetrical impaction of calculi is not very uncommon, the blocking of both ureters by stones passing downwards simultaneously from their corresponding kidneys must be very rare. Amoden records a case where a large stone embedded in the trigon area of the bladder obliterated the orifices of both ureters, and Morris states that a case illustrating the same condition occurred in the Middlesex Hospital.

Impaction of stone at a previous date, followed by hydronephrosis and atrophy of one kidney is the most common factor in predisposing to obstructive anuria. This question has been fully investigated by Luguen and Morris; the former writer points out that in an analysis of 30 cases on the side last obstructed, there was obliteration of the ureter in 23 instances, and stone in the kidney in other 7, on the opposite side there was atrophy of the kidney, or other changes consequent on calculus in 20, occlusion of the ureter in 6 and congenital absence of the kidney in 3. He found only 2 cases of fatal anuria where one kidney was sound. Morris states, as a result of his statistical inquiry, that "in 28 cases of those in my lists, in which the state of the two kidneys is given, the condition of the principal kidney was enlarged in 8, enlarged and congested in 4, small in 2, pyonephrotic in 6, and hydronephrotic in 8. The condition of the opposite kidney was as follows: No trace existing in 6 cases; marked atrophy in 8, in 2 of which the ureter had become impervious; almost entirely disorganised by calculus in 11; destroyed by a hydatid cyst in 1; enlarged in 2."

Other unilateral diseases of the kidney, such as tuberculous nephritis, pyonephrosis, and congenital absence of one kidney predispose the patient to an attack of anuria. In tuberculous nephritis and pyonephrosis the functional activity of the kidney may be altogether impaired; indeed, in tuberculous disease the whole mass of the organ may be replaced by caseous debris. In congenital absence of one kidney the remaining single kidney is very liable to disease, chronic nephritis, renal calculus, tuberculous disease, hydronephrosis,

pyonephrosis, and abscess being the most common maladies met with. When only one kidney exists, and that an "unsymmetrical" organ, there would seem to be a considerable disposition to renal calculus. Of 12 cases of "unsymmetrical" kidney collected by Mosler in 9 death was due more or less directly to calculus. Cases of calculus in "single kidney" are also published by Rhodius, Jobi, Rokitsansky, Bayer, C. Julia Fontenelle, Everard Home, and Sylvaticus.

Probably the most important bilateral disease which predisposes to anuria is cystic degeneration of both kidneys. Even when the disease is advanced there may be no symptoms to indicate impairment of the renal functions, but if one ureter becomes even partially blocked anuria, frequently of a rapidly fatal character, sets in. The same statement also applies to cases of advanced chronic interstitial nephritis or chronic tubular nephritis, but not perhaps to the same degree.

The symptoms depend upon whether the morbid processes involve one or both kidneys. When one organ is free from disease and a stone becomes embedded in the ureter of the other kidney, the phenomena are regulated by the amount of obstruction caused by the impacted body. If the plugging is complete the indications are generally acute but short in duration, and unless the obstruction is speedily relieved the corresponding kidney is rapidly destroyed. The blocking of the ureter is generally preceded by symptoms of stone in the corresponding kidney, renal colic on one side coincident with the presence of blood in the urine. The injury produced by an impacted calculus seldom causes much bleeding, but in some instances considerable hæmaturia may occur. The following case is an example of this, due to a stone impacted in the ureter at the point where it passes over the brim of the pelvis.

CASE 1. *Renal Colic on Three Occasions from Impaction of Renal Calculus in the Left Ureter: Transitory Hydronephrosis and Hæmaturia.*—A lady, aged 28, who had suffered from two attacks of acute renal colic, consulted me during the third onset of the disease. The patient was thin and the abdomen extremely lax. On palpating the left kidney the renal pelvis was found to be occupied by a hydronephrosis, and on passing the hand along the tract of the left ureter, on deep pressure a very painful spot was discovered just at the point where the ureter passes over the brim of the pelvis. The distended ureter could be traced down to the same point, and an examination *per vaginam* in the elbow-knee position showed the lower segment of the left ureter to be normal; the bladder and orifices of the ureters were also healthy. After the calculus had been impacted for five hours relief was obtained and 16 ounces of blood-stained urine was passed, the colour being like dark port wine. When a week had elapsed after the onset of the attack the left ureter was carefully massaged three times daily, and nine days after this treatment had been instituted a smooth uric acid calculus, the size of a lentil seed, dropped into the bladder.

In other cases the quantity of blood present in the urine may be very small, this is generally so when the calculus is little and its surface smooth, and when it is impacted close to the orifice of the ureter. When the patient is suffering from an attack of renal colic there may be little or no blood in the urine, but if there is even a little it may be taken as evidence that the ureter is not completely obstructed by the stone, unless possibly the blood is escaping from the ureter of the unaffected side. When the attack passes off, either as a consequence of the escape or from displacement of the calculus a small quantity of blood is almost certain to be found in the urine if a careful watch is kept for it.

The dull and aching pain is for a time localised in the lumbar region only, but suddenly it shifts to the groin, and on pressure with the hand over the line of the ureter the suffering of the patient is markedly increased, at the same time it may be observed that the hæmaturia is suddenly stopped. Disappearance of blood from the urine coincident with sudden shifting of the locality and an increase in the severity of the pain are symptoms strongly in favour of the diagnosis of a stone fixed in and completely plugging the ureter. While the ureter on one side is blocked, and no urine is being excreted by the corresponding kidney, the organ on the opposite side may be over-active and secreting a large quantity of urine of low specific gravity.

There may be calculus disease of both kidneys without the development of pronounced or permanent symptoms. Several instances have come under the notice of the writer where death has resulted from other maladies, and at the *post-mortem* examinations calculus disease was discovered in both kidneys, although careful inquiry into the previous history failed to elicit any information pointing to

renal trouble. A remarkable instance of double calculous disease of the class just referred to was placed in the Museum of the Glasgow Royal Infirmary by Dr. Charles Workman, and he has allowed illustrations to be taken from the specimens. (Figs. 1 and 11.) The following description is from the journal of the *post-mortem* room :

Fig. 1.

Fig. 2.

"The right kidney (Fig. 1) is greatly enlarged by enormous distension of the pelvis and calyces which are filled by numerous calculi, one of them being very large and branched or lobulated. The left kidney (Fig. 11) is greatly atrophied, its pelvis is much distended, and the ureter at its junction to the pelvis is blocked by a group of small rough calculi and a villous tumour on which the calculi appear to be entangled."

From the appearance of the specimens it is evident that the left kidney had long ago been rendered functionally useless by a complete obstruction due to the presence of a fimbriated papilloma of the ureter, in the network of which several small calculi had become entangled. The right kidney was the working organ. Although its pelvis was occupied by a perfect quarry of stones, the whole organ was enlarged, and there was an actual hypertrophy of renal parenchyma.

Calculus in one ureter causing complete occlusion, the other kidney being incompetent, leads very soon to complete suppression of urine. Before suppression occurs the patient experiences in the region of the affected kidney pain which may be limited to the lumbar region, or it may extend along the line of the ureters to the bladder or down the thighs. This may be associated with considerable vesical irritation and a desire to micturate, even although the bladder is empty or nearly so. The course of events that follows depend upon the nature of the obstruction and the degree to which the function of the kidney on the opposite side is impaired. Calculous anuria may last for many days without the development of symptoms of toxic poisoning, and if the kidney has previously been the site of hydronephrosis the period will be more prolonged than if the organ is not so affected. This delay in the development of so-called "uræmic symptoms" is the feature which distinguishes obstructive anuria from suppression of urine due to disease of the renal parenchyma. Indeed, in calculous anuria death may occur without the occurrence of any of the ordinary symptoms of uræmic poisoning. The early appearance of symptoms of toxic poisoning in the anuria of organic disease of the kidney is explained by the circumstance that during a long period prior to the actual suppression of urine there has been a steady impairment to the elimination of waste products, and a gradual storing up of toxins in the system, so that when the kidneys stop working the poisoned state of the circulation cannot be relieved sufficiently by the complementary action of other organs, such as the skin, the lungs, or the alimentary tract.

Calculous anuria may be divided into two stages—the tranquil term, and the toxic period.

The symptoms of toxic poisoning do not necessarily immediately follow the obstruction to the escape of urine or the total inhibition of the excretion. Sir William Roberts states that when suppression is complete life is generally prolonged for from nine to eleven days from the onset. In studying the recorded cases it will be found that after urine has ceased to flow the outburst of indications of toxic poisoning is sometimes delayed only for a few hours, while in other cases many days may pass without any serious toxic symptoms showing themselves. As a rule for some days the suppression of urine is unassociated with any serious symptoms. The pulse, respirations, and temperature are normal, the appetite may be good, the tongue clean, and there may be a total absence of digestive disturbance. There may be frequent or occasional desire to micturate, but no urine is passed except in small quantities and at long intervals. Sometimes a few ounces of urine of low specific gravity, slightly albuminous or even tinged with blood, may be voided; days pass, and the only obvious change is rapidly diminishing muscular strength, with at first occasional, at a later period frequently repeated, muscular twitchings. The mouth, tongue, and palate become dry, and all appetite for food is lost.

It is otherwise in the suppression of urine observed in the various forms of Bright's disease, and in zymotic diseases. In the latter, not only is there a stoppage to the excretion of the healthy constituents of urine, but the kidneys as eliminators of the toxins of disease are no longer working. It is now well known that in diseases such as scarlatina, pneumonia, cholera, influenza, erysipelas, and diphtheria, etc., specific poisons are eliminated by the kidney. It is also recognised that in many organic diseases of the kidney the functions of the organs are seriously impaired and excrementitious matter is allowed to accumulate in the tissues and in the blood, and it is a storing up of these waste products of the tissues which produces an intolerance of them and give rise to so-called uræmia.

After non-obstructive suppression, the return of the secretion of urine is slow, the quantity is small, the urine is of a high specific gravity, deeply coloured, and generally albuminous or may even contain blood, and therefore presents a complete contrast to what is observed in cases of obstructive suppression.

After calculous anuria is relieved the excretion is rapid and copious, and the urine is of low specific gravity, deficient in the constituents of healthy urine, and may contain a trace of albumen and some blood, but if the kidney is otherwise healthy the urine rarely deposits tube casts. There is no sudden escape of a large quantity as in transitory hydronephrosis, but in other respects the character of the excretion is similar. An occurrence sometimes happens which is apt to be misleading. In place of the irritation of the impacted calculus producing an inhibition of the impaired kidney on the opposite side, it may be stimulated to action of an inefficient kind, and a polyuria may be produced. While little more than water is eliminated, such escapes of urine must be carefully watched and not be allowed to draw the attention away from the main and important features of the case, namely, that the waste products are not being eliminated, and that toxic poisoning will soon develop. A by no means uncommon experience is to find uræmic symptoms in persons who are excreting a fair quantity of urine of normal specific gravity, so that while on the one hand we may have complete anuria, and an increase of urea in the blood without evidence of toxic poisoning, we may have evidence of toxæmia without diminution in the quantity of urine.

When anuria is continuous other organs endeavour to take up the task abandoned by the kidneys, but in this they can only succeed in a limited degree and for a short time. The lungs, the skin, and the alimentary tract attempt to do the work, and their vicarious labour is often the first indications of toxæmia. In calculous anuria the patient may show great desire to sleep; this is often one of the earliest indications of approaching toxæmia, and may be the forerunner of convulsions and the other graver symptoms which accompany them. The respirations are generally slow and laborious, and not infrequently the patient may suffer from paroxysms of dyspnoea,

but the breath has no peculiar ammoniacal odour. The pulse is generally full, slow, and wanting in arterial tension, and when the patient does become comatose and the breathing stridulous, considerable cardiac irregularity may be displayed, the strength and character of the pulse varying with the respiratory movements. Very rarely, if ever, is there evidence of venous stasis, as shown by œdema of the feet, diminution in the surface temperature, epistaxis, expectoration of blood-stained mucus, hæmatemesis, or bleeding from the bowel. Examination of the air escaping from the lungs shows it to contain active organic poisons considerably above what is observed in health. The patient may suffer from profuse perspiration, and the sweat is loaded with effete products and animal toxins, but there is never any ammoniacal or urinous odour from the skin.

Sometimes the skin refuses to act, and very occasionally the surface may become much irritated by the storing up of waste products, and even active cutaneous eruptions may be induced. The mental faculties are seldom impaired, intelligence being preserved to the last, and in pure obstructive anuria convulsions and coma are rarely seen.

Diagnosis involves several important questions. The first point is to determine, Is the obstruction of the ureter due to the presence of a stone, and, if so, where is it situated? The occurrence of repeated attacks of renal colic, associated with signs of hydronephrosis and followed by anuria, is not sufficient evidence that there is a calculous condition present. The proportion of cases of hydronephrosis in which a palpable abdominal swelling is discovered during life is small in all cases, but especially so when the disease is bilateral. The methods employed in making a differential diagnosis may be considered first, and, after they have been described, the diseases with which impacted calculus are likely to be confused may be discussed.

By palpation through the abdominal parietes much information may be gained when the stone is situated above the brim of the pelvis, provided the walls are flaccid and the patient thin; but when the muscles are rigid, which is often the case, or the patient is corpulent, the detection of a stone in the upper part of the ureter is almost impossible. Pressure with the hand, however, generally elicits tenderness in the locality of the stone, or may even induce acute pain.

When the calculus has passed to the lower third of the ureter, examination with the finger in the rectum or in the vagina, according to the sex, may lead to the detection of the stone and the exact situation occupied by it. A sound should be passed into the bladder, and with the left index finger in the vagina or rectum the back of the instrument is made to press upon the line of the ureters and their orifices. In the female the urethra may be dilated and the bladder explored by the finger.

Fig. 3 represents the position of the swelling in the bladder and the method of examining with the finger and sound when the calculus is caught at the vesicle orifice of the ureter, as in Case III.

Cystoscopic examination of the bladder may give valuable information. This is not the opinion held by Mr. Henry

Morris, who says³ "the cystoscope in the cases of anuria is quite unnecessary and out of place, as it can give no information which is not more fully ascertained by a rectal or vaginal examination and a sound in the bladder. Valuable time will be lost by such explorations of the ureter, and it would be far better to resort to exploration of the kidney."

Fig. 4 shows the relationship when the stone is caught in the ureter before it passes through the bladder wall, as in Case II.

A point of some importance in diagnosis is the appearance of the orifice of the ureter as seen by the cystoscope. It may be stated as a general observation that when there is distinct evidence of irritation at the orifice of one ureter, while the other is normal in appearance, it may be safely inferred that the lesion if unilateral is on the side of the morbid ureter. The following case illustrates this:

CASE II. *Sudden Severe and Prolonged Attacks of Renal Colic; Suppression of Urine; Sudden Relief; Recurrence in Three Weeks; Microscopic Quantity of Blood in the Urine.*⁴—A woman, aged 26, was on November 26th, 1896, suddenly seized with a severe attack of renal colic on the right side, with suppression of urine for 24 hours. The pain suddenly subsided, three hours afterwards the patient passed 5 ounces of concentrated urine, and the following day she was practically well. Three weeks afterwards she had a second attack, exactly the same as the first. On examination no renal swelling could be made out, but the right kidney was extremely tender and painful on pressure. No albumen or pus was found in the urine, but when present blood could be detected by the guaiacum test and by a microscopic examination of the deposit. The cystoscope revealed nothing abnormal in the bladder, except that the orifice of the right ureter seemed to project unduly and the mucous membrane surrounding it was deeply injected. No blood could be seen escaping from either ureter. On introducing the ureter catheter an obstruction was met with 1 inch from the orifice, and on passing the probe a calculus the size of a large horse bean was found in that situation; it was subsequently removed by operation through the bladder by rapid dilatation of the ureter.

Fig. 5 shows the relationship of the calculus to the vesical wall. The stone was caught at the point where the ureter enters the muscular wall, and the duct was considerably distended above the obstruction.

In some instances the calculus may pass along the ureter through the muscular portion of the bladder wall and become gripped only by the mucous membrane at the orifice of the ureter, so in place of passing through into the cavity of the bladder, the calculus, by obstructing the flow of urine, leads to the mucous membrane being pushed away from the muscular portion of the bladder, and a rounded tumour-like mass is formed which may be mistaken for a tumour of the bladder.

CASE III. History of Repeated Attacks of Renal Colic without Suppression of Urine, but followed by Hematuria: Marked Irritation of the Bladder, Frequent, but not Painful, Micturition, and latterly almost constant presence of Blood: No Renal Symptoms: Swelling in Bladder Diagnosed a Tumour, but at Operation Discovered to be a Small Calculus included in Mucous Membrane of Bladder.—J. H., aged 35, a marine engineer, first suffered from renal colic on a homeward voyage from India in December, 1893. The first attack lasted for about twenty-four hours only. Complete relief from pain followed, and lasted for seven weeks. Travelling from London to Leeds brought on a second seizure, which lasted for five hours, but although shorter in duration the suffering was more severe in this than in the first attack, and when the pain passed off the patient noticed that the urine contained blood. During 1894 the patient suffered from seven attacks, three of which were followed by hematuria. At no time were there any symptoms suggestive of suppression of urine nor of hydronephrosis. Towards the end of 1894 the patient complained greatly of frequent micturition; during the act he suffered little or no pain, but on many occasions blood appeared in the urine in moderate quantities. Only twice could the hematuria be described as profuse. There were no symptoms pointing to any renal lesion, nor could swelling or tenderness be made out in either lumbar region. No information was gained by rectal examination. No tube casts and no albumen were in the urine except from the presence of blood. A cystoscopic examination showed the presence of a rounded swelling immediately over the orifice of the right ureter, about the size of a small cherry, very vascular on the surface, but smooth and free from ulceration. The swelling was diagnosed as a fibroma of the bladder pressing upon the orifice of the ureter and so causing an obstruction to the escape of urine. Suprapubic cystotomy was performed, and the swelling was seized with ring vulsellum forceps. Immediately pressure was made, the swelling cracked, and a little traction brought away a calculus and a thin but complete covering of mucous membrane as shown in Fig. 6.

Fig. 6 shows a small calculus enclosed in a capsule of mucous membrane at the orifice of the right ureter.

CASE IV.—History of Rapid Profuse Hematuria with Irritable Bladder but without Attacks of Renal Colic or Suppression of Urine, Enlarged Prostate, Calculus in Bladder and at Orifice of Right Ureter.—Mr. M., aged 54, was admitted to the Sandyford Home in April, 1898. He had suffered from pain in the bladder for several years, and hematuria at intervals for eighteen months prior to admission, and recently the bleeding has become so severe that he has been unable to follow his occupation. No calculi have been passed, or is there any history of pain in either lumbar region, and the symptoms from the beginning of the complaint until admission all

Fig. 7 shows the position of a calculus in the bladder and another in the dilated end of the right ureter; also the enlargement of the prostate gland with the sulcus formed immediately behind.

pointed to vesical rather than renal disease. Previous to coming to the home two attempts were made to examine the bladder with the cystoscope, but the passage of the instrument caused so much bleeding that no observation could be made. The middle lobe of the prostate was greatly enlarged, soft, and spongy; behind the prostate a stone was discovered with the sound. Suprapubic cystotomy was performed on April 26th, and on open-

ing the bladder a soft phosphatic stone was found immediately behind the enlarged lobe of the prostate, but on further examination a little rounded nodule was discovered at the orifice of the right ureter; it had the appearance and size of a small red cherry. On laying hold of it with the vulsellum forceps it was found to be hard, but on even moderate pressure it broke, and several fragments of the calculus escaped between the rings of the forceps. Neither before nor after the operation were there any symptoms indicating impediment to the escape of urine from the right ureter.

The ureters may be explored with the sound from above, or they may be examined through the bladder from below. In the female the sound may be easily passed into the ureters by Kelly's method. Sounding has also been performed through an incision in the vagina, and by suprapubic cystotomy. These latter methods are, however, unsatisfactory.

Renal or ureteral calculus is so frequently simulated by other affections that any new aid to diagnosis has been eagerly employed; thus, when the properties of the Roentgen rays were discovered the hope was at once entertained that a useful and exact means might be introduced to detect and locate the position of the stone. Experience has, however, shown that the difficulties in employing the rays are so great, and the possible fallacies so numerous, that no reliance can be placed in the observations made by this method. We on several occasions failed to detect a stone which was afterwards proved to be present. No doubt within the last few years various observers have succeeded in demonstrating the presence of calculi in the kidney, and it has been proved that oxalate of lime gives the deepest shadow, uric acid the faintest, while the shadow of phosphatic stones occupies an intermediate position. The thickness of the parietes, the chances of the stone being overshadowed by bone, and the movement of the kidney during respiration are all difficulties to be overcome beyond the improvement required in technique. The subject has been carefully worked out by Albaran, Ringel, Braatz, Wagner, and others, who have shown that even with the most careful attention to detail the results from radiography are only valuable in exceptional cases, where probably the diagnosis could have been made without the aid of the rays.

Supposing all these devices of gaining information have failed; the patient is stout, or the abdominal muscles are rigid, and no stone can be discovered by digital examination; if the obstruction is unilateral expectant treatment may be employed, but if it is bilateral the kidney last involved must be explored, and if no calculus is found in the pelvis a sound should be passed from above into the ureter.

The conditions other than calculus which may cause obstruction to the ureter are very numerous. The following table⁶ shows the causes of acquired hydronephrosis in 665 cases:

	Hydronephrosis.	
	Double.	Single.
Simple or malignant tumours of pelvic organs causing pressure on ureters	143	41
Stricture of the urethra, enlarged prostate with hypertrophy of the bladder	195	39
Tumours or abscesses of pelvic organs leading to torsion of the ureters	23	9
Tumours or abscesses of abdominal organs	17	7
Displacement of pelvic organs, causing torsion of ureters... ..	23	20
Bands and adhesions	7	5
Renal calculi	17	51
Displacements of the kidney	1	16
Tuberculous disease of the bladder	13	17
Tumours of the bladder	3	7
Ureter entering renal pelvis at acute angle	6	5
	448	217
	Total, 665	

One important distinction between the course of events in calculous obstruction and that due to pressure from without is that while the latter is gradual and almost always produces considerable dilatation of the pelvis of the kidneys, the former is sudden, and on one side at least is unassociated with hydronephrosis. It is unnecessary to discuss in detail the points of distinction between pressure symptoms as induced

by the diseases above enumerated and the obstruction produced by calculus.

As a general rule, the disease causing pressure upon the ureters is itself so prominent that it is not likely to escape observation. But while a lesion may be discovered in one of the pelvic organs which may reasonably account for the obstruction, the surgeon must not conclude that a ureter is not also impacted by a calculus. A very striking example of this came under the observation of the writer. A woman with a large uterine fibroid complained of symptoms resembling renal colic, followed by suppression of urine, which lasted on several occasions for more than twenty-four hours, after which relief came with the escape of a large quantity of urine of low specific gravity. The conclusion came to was that the hydronephrosis and anuria were due to pressure of the tumour upon the ureters, but after death a calculus was found impacted in the left ureter as it passed over the brim of the pelvis. The most important cases to distinguish from calculous obstruction is where the flow is impeded by kinking of the ureter, as in movable kidney, or where the impediment arises from angular insertion of the ureter. Transitory hydronephrosis is met with in cases where the ureter is occluded only occasionally. Sudden accumulation and rapid subsidence of the swelling is an important characteristic of transitory hydronephrosis produced in this way, and while on the affected side the pelvis is still filling and becoming more and more tense, on the healthy side there may be complete inhibition of the function of the kidney. But while anuria may last sometimes for days, it is hardly ever so prolonged as to endanger the life of the patient.

The treatment must depend upon an exact appreciation of the state of the patient and of the morbid condition present. If there is reason to believe that one ureter only is blocked, and that the kidney on the opposite side is healthy, it is advisable to wait the course of events, as in many instances the obstruction is relieved spontaneously within a short time and no permanent harm results. This is especially to be recommended when there is evidence that the obstruction is incomplete or transitory. In such cases the use of massage, shampooing, and the application of fomentations sometimes relieves the spasm. Pain may be alleviated during an attack by the administration of anodynes such as morphine, belladonna, and opium, but the latter drug must be employed with great care, as even a small dose may produce alarming effects when there is any interference with the proper action of the kidneys. It is much safer to employ hot fomentations, emollient enemata, and hot baths; should the pain be extreme it may be necessary to place the patient under the influence of an anæsthetic, which may not only have the effect of relieving the suffering of the patient for the time being, but may also by abolishing spasm facilitate the passage of a calculus from the ureter. Under similar circumstances it has also been advised to give warm diluents and diuretics with the view of forcing the calculus down by an increased secretion of urine, but probably the beneficial action of these remedies is due more to the power they possess in reducing the irritating qualities of the urine than to any mechanical effect the pressure of urine may exert. Changes in the position of the patient sometimes cause relief from suffering either by altering the situation of the stone or by dislodging it from the ureter, in the same way external manipulation in the renal region or along the course of the ureters has been recommended. If the stone escapes well and good, but it must be remembered that in other respects the patient is in the same position as he occupied before the calculus showed itself. Another one may form unless precautions are taken.

When the ureter of the only working kidney is sealed, it is evident that the first point to attain to is immediate relief of the obstruction. In most cases there is a short period during which medicinal remedies may be employed, but unless relief is very speedy valuable time must not be wasted in waiting for the action of drugs. The only working ureter is plugged, and the obstruction can be removed by the surgeon, or an artificial exit can be made in the loin, so as to provide a channel for the passage of urine. In this way the immediate danger to life may be removed and a more careful search can be made for the stone later on and a method devised for its removal.

The operative procedure depends upon the position occupied by the stone:

(a) When the stone is sufficiently low down to be detected by digital examination in the vagina or rectum.

(b) When the stone is too high up to be felt by the finger, but occupies the middle third of the ureter.

(c) When the stone is in the upper third of the ureter.

If the stone had passed through the muscular wall of the bladder, and pushed the mucous membrane in front of it, the appearances presented by the cystoscope are liable to be mistaken for those of tumour. In this situation the stone may be removed by dilatation of the urethra in the female, by suprapubic cystotomy in the male, or by perineal opening. When the stone has become impacted above the vesical portion of the ureter, but still within the reach of the finger, it should be attacked from below.

In removing a stone from the ureter by an operation through the bladder, it may be possible to grasp the impacted body with forceps, and by a careful manipulation drag it away without making any incision in the vesical wall; but if the stone is too large for this, it is well to make a small incision and dilate the ureter with sinus forceps before attempting to extract the calculus.

Ceci has removed a ureteral calculus through the rectum, and Fenwick has employed a perineal incision; the removal through the vagina has been employed by Emmett, Cubot, Collerall, Fenwick, Reguey, and others. In such cases above the point of obstruction the ureter is dilated so that it can be easily felt with the finger. The ureter and the stone should be fixed by a small sharp hook, an incision is then made through the vaginal wall by cutting on the stone; when the incision is completed a rush of urine takes place and the calculus escapes along with it. The opening may be closed with sutures, but probably it is safer to keep it open by passing a drainage tube into the dilated ureter.

When the stone cannot be felt with the finger, it must be reached through the abdominal parietes. The ureter may be exposed without opening the peritoneum through an incision similar to the one used in ligaturing the common iliac artery and by retracting the peritoneum. The line of incision usually employed is one commencing an inch below the last rib at the outer edge of the erector spinæ muscles, and extending inwards and downwards in front of the anterior superior spinous process. The distance to which the incision is extended inwards depends upon the necessities of the individual case. If the patient is short and stout, the space may be extended by making a T-shaped incision through the above, or by incising a portion of the quadratus lumborum. When the transversalis fascia has been exposed and divided, the colon is seen. It should be retracted, and the hand introduced through the wound behind the peritoneum, when the kidney can be easily felt imbedded in its adipose capsule. The capsule is enclosed in a delicate connective-tissue envelope, which should be caught up with pressure forceps and divided, when the light yellow adipose tissue of the fatty capsule will pour out through the opening. This soft fat is easily separated from the kidney; when the organ has been fully exposed, a systematic examination must be made before the organ is disturbed from its natural bed. The ureter should be carefully searched, and if a stone be found, it may in many instances be readily pushed up into the pelvis and removed by an incision through the convex border of the kidney.

An incision through the substances of the kidney heals more readily than one through the wall of the pelvis. Supposing, however, that a stone is not found in the first examination with the kidney in its normal position, the attachments of the organ must be freed and the organ brought out through the wound sufficiently to permit the surgeon making a thorough inspection. When the hand fails to discover the presence of a stone, an incision should be made through the kidney on its outer aspect, and through the wound a digital exploration of the pelvis and calices should be made, and if a stone is found it may be removed. After the stone is extracted, a ureteral catheter or sound should be passed down the ureter into the bladder, so as to ensure that the passage is clear. It is not uncommon to find calculi both in the pelvis and ureter. If a stone is discovered in the lumen of the duct, an attempt should be made to press it up towards the kidney,

and generally this is easily accomplished, as the ureter is dilated above the point of impaction of the stone, but if it is firmly fixed an incision should be made through the wall of the ureter, and after the calculus has been extracted the incision may be closed by sutures.

REFERENCES.

- ¹ Hunterian Lectures, 1898, p. 93. ² Loc. cit., p. 106. ³ Loc. cit., p. 109. ⁴ Cases II, III, and IV were brought before the Glasgow Pathological and Clinical Society meeting, December 11th, 1899. ⁵ Newman, *Lectures on Surgical Diseases of the Kidney*, 1888, p. 114.

LARGE SARCOMATOUS NEUROMA OF THE INTERNAL POPLITEAL NERVE.

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[With a Pathological Report by Dr. MUIR, Professor of Pathology.]

A LARGE sarcomatous tumour of the trunk of a main nerve is a very uncommon occurrence. The following is a short clinical account of the case:

R. G., aged 20, had received about nine months earlier a blow from a piece of wood on the front of the thigh just above the knee. It gave him no trouble and he forgot all about it. Three months after he discovered a little lump the size of a filbert in his popliteal space. There was no pain or annoyance, but it gradually increased in size. For the last six weeks it has been enlarging more rapidly till it attained its present size.

Condition on Admission to Professor G. Buchanan's Ward in Western Infirmary, November 14th, 1899. The popliteal space is completely filled up by an ovoid tumour, resistant and elastic, and quite movable from side to side. The opinion was that it was an adenoma or a sarcoma, probably of a lymphatic gland. The patient can walk quite well, while motion and sensation were perfect down to the toes, except some anaesthesia of the sole of the foot; so there was no indication that the popliteal nerve was unduly pressed upon. There was no oedema below the knee, so the probability seemed to be that the tumour could be removed without any injury to the nerve or vessels of the popliteal space. Accordingly, on November 21st, an incision 6 inches in length was made over the tumour, and the capsule was exposed. The soft parts were easily stripped from the capsule over the front and sides, but on the back it was firmly adhering to the popliteal nerve. It was now found that the capsule was simply the nerve sheath expanding into and forming the capsule, and that the nerve itself was lost in the tumour, either by the nerve strands separating and enveloping the capsule, or passing through the tumour. In these circumstances the only course was to amputate the thigh, but as that had not been contemplated the patient and his parents had not been asked for permission if the tumour proved to be malignant. Therefore a small slice of the tumour was excised for examination, the edges of the cut capsule brought together, and the wound united by continuous suture. The piece was subsequently examined by Professor Muir, who pronounced it a round-cell sarcoma. Next day the father arrived from the country, but refused to allow amputation. However, when the nature of the growth was explained to him, he went home and consulted his wife, and returned with full permission, which the patient himself quite frankly consented to. On November 28th amputation was performed and the patient has progressed well. Immediately after amputation the tumour was exposed by a longitudinal section extending from the trunk of the nerve above to that below. It presented a greyish appearance, in consistence of a soft and pulpy nature, in the superficial half, but in the deep half more tough and fibrous, where it seemed to be continuous with nerve strands attached to the capsule. But it was impossible by the naked eye to discover in what way the nerve above communicated with the nerve below, so the limb was sent to the pathologist, who will give the pathological report. The length of nerve involved in the tumour is about 5 inches.

PATHOLOGICAL REPORT BY DR. MUIR.

A large somewhat fusiform tumour occupied the popliteal space; its extreme length was nearly 5 inches, its greatest width being 2 inches, and it tapered off above and below. It was somewhat adherent to the vessels beneath it, but these were not incorporated with it. The upper limit of the growth was just below the division of the great sciatic into internal and external popliteal nerves. (The division of the main trunk appeared to be a little lower than usual.) The tumour is apparently in the interior of the internal popliteal nerve, the sheath of the nerve being stretched over it and forming its capsule. On section, strands of nerve fibres can be seen passing through the tumour growth, a considerable disassociation of fibres having taken place.

The tumour was composed of soft cellular tissue of a greyish colour, in parts however very vascular and showing haemorrhages. There are also yellowish areas, apparently the result of degenerative changes. One of these was of the size of a small plum and situated in the part of the growth nearest the large vessels. The external popliteal nerve coursed over the surface of the tumour and was somewhat flattened, but was apparently free from infiltration.

Fresh sections microscopically examined showed the growth to be sarcomatous, most of the cells presenting a rounded form. In sections prepared after fixing the tissue in corrosive sublimate the cells have either an oval or pyramidal form with very little protoplasm. There is very little intracellular stroma. There are numerous haemorrhages and necrosed patches. Strands of fibrous tissue with nerve fibres running through the growth at intervals are noted. The tumour tissue is nowhere observed to penetrate the fibrous tissue sheath externally.

A portion of the internal popliteal nerve was removed below the growth, and treated by Marchi's method. It showed marked degenera-

tion in one or two small fasciculi, and a few degenerated fibres scattered here and there in the larger bundles. The great majority of the fibres, however, showed no degenerative change.

The condition is interesting as illustrating the fact that nerves may be extensively infiltrated and disassociated with comparatively little degeneration resulting, both the clinical facts and the microscopic examination in this case showing that only a small proportion of the fibres had suffered.

A CASE OF ENTERECTOMY BY END-TO-END SUTURE IN A BOY AGED 7.

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THE case described below may be taken as a type of the condition which always occurs when the small intestine has to be opened and a faecal fistula formed. The fluid contents of the intestine are constantly oozing from the opening, and therefore the skin is constantly in contact with this fluid, which, having powerful digestive properties, promptly begins to digest the skin. The epidermis soon disappears, and around the opening is an area of raw papillae, which bleed readily, and, as may be imagined, are most painful when touched. Such being the fact, any attempt to clean the surface or wash the part is immediately followed by strong contraction of the abdominal muscles; this contraction forces out the contents of the intestine, and so it goes on. The higher up the intestine the opening has been made the stronger will be the effect of the secretion on the skin, and (which may be much more serious) the length of intestine left for digestive purposes may be so curtailed as to make the question of nutrition of the patient a matter of anxiety.

In this case it was obvious that the intestine had been opened high up, both from the condition of the skin, and also from the fact that food appeared at the opening 2½ hours after it had been swallowed. The boy was quite thin, but otherwise healthy. Since the operation (December 1st) he has increased half a stone in weight. This in itself is a matter of interest, because for over ten months the greater part of his intestine was "out of action," and a certain amount of general atrophy had taken place. I should judge that the functions of the intestine below the join were in good working order after the ninth day, as after that time the motions became formed and normal, and before that, that is between the third and the ninth day, they were loose and offensive. Custard was given on the eleventh day, fish on the thirteenth, and meat on the fourteenth day. I mention this to strengthen my statement as to the probable time at which the intestine resumed its functions. As soon as the motions were of a normal character I felt I could with impunity increase his diet and put him on solid food, and his rapid increase in weight shows how he responded to it.

G. H., aged 7, was admitted to St. Monica's Home, Kilburn, on August 5th, 1899, with a faecal fistula, a marked prolapse of the bowel through the opening, and with the skin acutely tender and inflamed for an area of about 1½ inch round the wound, this last condition being due to partial digestion of skin by the faecal discharge.

History.—The previous history of the boy was that in 1895 he had tuberculous peritonitis, for which he was admitted to St. Bartholomew's Hospital, where he remained thirteen weeks. After this he kept well for three years, but on January 20th, 1899, he developed acute intestinal obstruction, for which he was readmitted to St. Bartholomew's, and an operation for its relief was performed on that night, an incision being made in the mid-line below the umbilicus, and a coil of small intestine above the obstruction was opened and stitched to the skin. Some time before his discharge from the hospital (August 3rd, 1899) an unsuccessful attempt was made to close the faecal fistula. When admitted on August 5th his condition was as described above, and was a most pitiable one. Attempts were made to get the skin into a less septic condition and to endeavour to lessen the prolapse. At the same time, as it was doubtful what part of the small intestine had been opened, various foods were given by the mouth such as cooked and uncooked rice, and it was noticed how soon afterwards any appeared at the opening. Boiled rice appeared in three hours forty minutes; raw rice showed itself two and a-half hours after it had been swallowed. The boy's weight was 2 stone 8 lbs. On November 2nd, acting on a suggestion of the nurse in charge of the boy, the patient was turned on his face, a firm band was placed over the lower part of the wound, leaving the bowel free, and the discharge was received into a bedpan covered with a round air cushion. This was continued for a week with such a satisfactory result as far as the skin was concerned that I decided to operate on December 1st.

Operation.—When the boy was anaesthetised, the skin was washed with soap and water, then ether, and finally with 1 in 500 perchloride solution. An incision was made through the skin about half an inch away from the opening of the bowel, and continued above and below so as to form an ellipse. All the tissues were cut through until the peritoneum was reached. Before this was opened the sides of the faecal fistula (into the opening of which a small sponge had been inserted) were closed by one or