THE DIAGNOSIS AND TREATMENT OF CALCULUS IN THE PELVIC PORTION OF THE URETER.*

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AS the majority of the cases on which this communication is based were examined by me when on service with the Army in the East, I purpose mentioning first of all the circumstances under which so large a number came under my care.

There are few indications of injury or disease that produce more alarm in the mind of the layman of our race than the appearance of blood in the urine he voids. At the same time the medical man in attendance on such cases realises that an accurate knowledge of the cause of the bleeding is usually impossible without the assistance of the centrifuge, the microscope, and the radiogram.

When, therefore, as occurred so frequently with us in Palestine, the Regimental Medical Officer had such a case, it was his custom to send his patient at once down the line for admission to hospital for diagnosis and treatment. The long single line of communication through the desert, and the numerous halting-places by the way, not infrequently meant that a full fortnight might elapse before he was admitted to one of the larger hospitals in Egypt, where a complete examination of his case could be carried out. In certain cases by that time the patient was found to be apparently cured; but in view of the fact that the round trip back to his unit occupied frequently as long as five weeks, it was considered advisable in these cases to exclude finally the presence of a calculus or other more serious cause of the bleeding. To shorten this period, in the later stages of the war, centres where a complete examination could be carried out were formed closer to the troops in the field.

The incidence of hæmaturia was probably more commonly met with in the troops in the East than on any other front, and in the Egyptian Expeditionary Force great importance was attached to its occurrence, owing to the possibility of it being due to bilharziasis.

About 90 per cent. of the adult fellaheen population of

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Egypt suffer from this disease. They spend a great part of their life paddling in the water that irrigates their fields, and when there the minute cercariæ, liberated from the body of the infected snail, penetrate their skin, inducing the disease or leading to another reinfection.

Fortunately, few of our men were infected. A number of Australians, when encamped at Tel-el-Kebir, contracted the disease. A serious outbreak occurred among the troopers of the West Riding Yeomanry, who were infected when stationed in the Fayoum, and some men contracted vesical bilharziasis when quartered near Suez. Although the cases were few, all the troops stationed in Egypt, or those passing through that country, were exposed to the liability of infection. We had therefore to be constantly on the outlook for the occurrence of the disease. Any case, therefore, of hæmaturia was examined most carefully, especially as it was not always possible to detect the ova in the urine.

The life led by the troops in the Desert of Sinai was such as to predispose unduly to the production of calculi. They existed on a limited water ration of half a gallon per man per day. This ration was for all purposes—drinking, cooking food, and washing. A bath in fresh water was therefore often unknown for weeks on end. The troops lived in the sandy desert where in summer the mid-day temperature frequently rose to 110° F. in the shade. They naturally perspired abundantly. Finally, their diet consisted of the usual army rations of bully beef, biscuit or bread, bacon, and tea. Oxaluria and calculus formation were under these circumstances not uncommon.

Many cases of this nature came under my care, and the material was so abundant we were able to establish a routine method of examination.

The cases were in the great majority ones of early disease and arrived with the provisional diagnosis of hæmaturia, oxaluria, renal colic, or renal calculus. Here I may mention that the incidence of oxaluria was greatly diminished as our accuracy in the diagnosis of renal and ureteral calculi increased.

The characteristic clinical indications of a stone in the ureter can be best illustrated by a typical case :—

Case.—This officer was examined by me in consultation with Lieut.-Colonel Newton, Officer Commanding New Zealand Mounted Brigade Field Ambulance. Colonel Newton had been consulted by him on several occasions during the previous year for what was taken to be

either attacks of oxaluria or calculus in the ureter. As these attacks had become more severe and more frequent, he came to Cairo for further examination, and treatment if necessary.

Colonel Newton provided the following notes with reference to his patient's health :—" During the last year the patient has had about six definite attacks which have had much in common, but have presented certain points of difference. The leading features of a typical attack are as follows :—Vague malaise for a few hours followed by an acute attack of vomiting, abdominal pain, and backache. In from four to six hours after treatment the acute symptoms subsided, and a convalescence follows of two to seven days' duration. In the intervals between the attacks the patient is in good general health and attends to his important duties in the field."

The leading features of the syndrome are :—*Vomiting*—This is usually severe and bears no relationship to the taking of food which does not relieve the pain. The vomiting is frequently repeated. In one or two attacks it has only been a slight feature of his illness. *Pain*—This has been the most constant symptom. It is very severe and causes the patient to look drawn and anxious. The site of the pain varies. It frequently is most severe over the left lumbar muscles of the back. It is frequently abdominal, and this slightly in the epigastrium, but particularly in the lumbar region, but *never* the right half of the abdomen. In one attack the pain was so localised to the back that it suggested a very acute lumbago, but there was on this occasion very severe vomiting. The pain at certain periods descends towards the left groin, but not to the penis or testicles. The pain is relieved by the application of hot fomentations, but only after two or three hours of vigorous treatment. Shock is always a prominent feature of this case. The abdomen is always soft and flaccid. *Tenderness*—This is always present, being situated either in the lumbar region of the back or abdominally in the neighbourhood of the left kidney. The tenderness persists for from twenty-four to seventy-two hours. There is never any palpable abdominal swelling. *Diarrhœa*—This is never a prominent feature and possibly has resulted from the taking of purgative pills on the occasion on which it has occurred. There has never been melæna.

Urine—This has been examined on two or three occasions, and the following is the report of the analysis made by the Anzac Pathological Laboratory of a twenty-four hours' sample :—Quantity, 42 oz.; reaction, acid; sp. g., 1018; no blood or sugar; very faint cloud of albumen. The microscopic examination of a centrifuged specimen shows one or two epithelial cells; no blood cells; urates, and a few oxalate crystals.

The blood-pressure is raised during an attack. The patient is

liable to colds and has twice had tracheitis. There are no signs of tuberculous disease of the lungs. *Nervous System*—His knee jerks at present. The pupils react to light. His eyesight is satisfactory.

Frequency of Micturition—This has been a marked feature of one or two attacks, and was particularly evident during the last one. Patient's temperature is never raised.

The following is a report on the patient's health during an attack on May 22-23:—

The patient suffered from malaise for two days before the 22nd. On the morning of the 22nd he was seized with acute diarrhœa. At 13.00 the patient complained of considerable abdominal pain and nausea. Vomiting commenced at 13.30. Frequency of micturition and pain on micturition was complained of at this time. On examination the abdomen was flaccid. No tenderness could be elicited. The skin was cold and sweating. The patient was obviously suffering from shock. His temperature was subnormal. Later in the day the patient complained of pain in the back.

When originally examined by me in consultation with Colonel Newton, the patient's history was taken to indicate the presence of a calculus in the left ureter. His general health was good, and the only physical sign detected was a palpable kidney which was prolapsed, but neither tender nor apparently unduly enlarged.

With a view to further examination, he was transferred to Nasrieh Schools Hospital, Cairo, under the care of Captain Duggan. The urine on examination was found to contain a few oxalate of lime crystals, but no red blood cells. After the customary preparation of the patient, an X-ray examination was carried out. The X-ray photograph of the left kidney showed no evidence of the presence of a stone. A photograph was taken of the bony pelvis, using the intensifying screen which rendered the plate so granular as to make the findings uncertain, and in consequence another photograph was taken on account of two suspicious shadows seen in it. This latter photograph showed two distinct round shadows over the spine of the ischium on the left side, and above and to the inner side of these a faint irregular shadow. This irregular shadow was suspected to be due to a calculus in the pelvic portion of the left ureter, and consequently further examination was carried out.

On cystoscopic examination the bladder wall appeared healthy. Both ureteral openings were normal. An X-ray

ureteral catheter passed readily up the right ureter into the renal pelvis. On the left side the ureteral catheter entered the ureteral opening readily, but was arrested 2·5 cms. from the orifice. The catheters were therefore left in position, and another X-ray photograph was taken. This showed the faintly outlined shadow with irregular contour to be a calculus in the left ureter, the tip of the catheter lying in proximity to it where it had been arrested in its progress. The small circular shadows were demonstrated to lie some distance from the ureter and they were taken to be due to small circular phleboliths.

The renal secretions from both kidneys were collected for twenty minutes after the X-ray examination. The amount secreted on the right side was about one-third greater than from the left kidney. The examination, which was conducted under local anæsthesia, was followed by no discomfort or complications, and the state of affairs that existed was explained to the patient.

Further operative treatment for the removal of the calculus was contra-indicated; no further hospital treatment was considered advisable.

The patient elected to return to his duties in the field, where he was under the care of Colonel Newton. He was advised as regards his diet and he took with him two dozen bottles of Contrexeville water, obtained by local purchase in Cairo.

Four weeks after leaving hospital he had another mild attack that lasted for one day. During the advance on Jerusalem he had another attack, but although indisposed carried on with his duties. During the summer of 1918, when serving in the Jordan Valley and on the other side of the Jordan, he had good health, but, prior to the final advance in September 1918, he had a third and most serious attack, accompanied by visible blood in the urine.

During this period I saw him on several occasions, and he was in good health. After the Armistice, a final X-ray examination was carried out, and the calculus was found to have passed into the bladder and to have been voided naturally.

The prominent features of a typical attack of renal colic due to a calculus in the ureter, as illustrated in this case, and borne out in many others, seem to be as follows:—

The profound general prostration that accompanies it, the patient looking obviously seriously ill.

The pain of a typical attack does not seem to radiate so frequently as is generally believed. Many complain only of severe lumbar pain. This is, however, usually confined entirely to one side of the body.

The associated frequency of a desire to micturate is in my opinion an indication of great significance.

When examined in the interval between attacks, the patient usually appears in perfect health. The only physical sign I found frequently enough to warrant being recorded was prolapse of the kidney on the side affected. Frequently it is palpable but not tender. This displacement is not difficult to account for, when the great engorgement of it that temporary obstruction of the ureter produces is realised. This increase in the size of the organ produces displacement and atrophy of the perinephric fat and consequent prolapse.

Absence of blood in the urine on microscopical examination at this period is of course no contra-indication of the presence of a stone in the ureter.

The value of an X-ray examination is realised by all. In my opinion a good radiogram should always show the shadow of a stone. The commonest source of error are phleboliths. There are of course other possible fallacies. In two cases, what appeared to have been ossific deposits in the quadratus lumborum muscle were taken at first sight to be calculi in the abdominal ureter.

Cystoscopic examination of the ureteral orifices most frequently gives no positive evidence, even when the stone is situated as closely as 1·5 cms. from the opening. The stone may in certain cases, however, be seen projecting from the opening, or the orifice may show the damage, the result of its passage. When first seen this damage may appear very great, the lips of the opening being torn and ragged, swollen and œdematous, with a bullous cystitis in the neighbourhood. This is, however, rapidly recovered from.

The passage of an X-ray catheter is by far and away the most accurate and certain means of diagnosing the presence of a stone, locating its position, and estimating the harm that its presence is producing. Incidentally, it is also an excellent form of treatment.

The routine method of examination we employed was to

examine a centrifuged deposit of urine in all cases of hæmaturia. The patient having been prepared, a complete X-ray examination of both kidneys, ureters, and bladder was then done. If a suspicion of calculus existed, a cystoscopic examination was then carried out under a local anæsthetic and an X-ray catheter passed up both ureters. If obstruction was met with, the catheters were left in position and an X-ray photograph taken, after which the urine from both kidneys was collected for twenty minutes and examined.

In a few selected cases pyelography was practised by filling the renal pelvis and ureter with 15 per cent. collargol, and then taking a photograph. By this means not only the nature and site of obstruction could be determined, but its degree could also be estimated and the amount of damage to the kidney it was producing revealed.

If the presence of a stone was diagnosed and the damage not great, as was virtually always the case, time was allowed to elapse to see whether a natural expulsion would result. A subsequent X-ray photograph was taken and compared with the former to determine whether the stone had been moved from its former site.

In certain cases chromocystoscopy was employed to determine the amount of obstruction at this stage.

Out of over fifty cases that were examined, I have the records of only six that were operated on, and two of these were extracted out of the ureter by intravesical forceps. Of the remaining four, two were impacted in the ureteral orifice and removed by suprapubic cystotomy, and only two were removed by suprapubic opening of the ureter.

The justification for operation is based on our knowledge of the surgical pathology of the disease. The stone is usually voided naturally. It may become impacted and cause obstruction; consequently renal infection is a possibility, but the most usual and most insidious damage is hydronephrosis and renal atrophy, or a movable kidney. It may remain *in situ* and increase to great size. It may be voided into the bladder and remain there, forming the nucleus of a vesical calculus.

The problem, therefore, is when to trust to a natural expulsion occurring at a reasonably early date without serious impairment of the functional activity of the kidney above, and this can be best determined by the method already described, which is at the same time the most useful form of treatment to hasten the passing of the stone.

This examination having been carried out, the patient is encouraged to lead an active life, to drink fluids in excess, Contrexeville or Salutaris water, if he so desire, and be prepared for a subsequent attack, the nature and possible benefits of which he has had explained to him.

The suprapubic removal of a calculus from the pelvic ureter is a major operation attended with a mortality of 2 per cent. The number of cases requiring this will in the near future be further reduced by intravesical operative treatment. The lines on which this is at present being conducted are as follows:—

1. Injection of glycerine into the ureter. I have done it on several occasions. It is easy of practice, but difficult to prove the utility of.

2. Slitting the ureteral orifice with the intravesical knife. This sounds difficult, but is really easy to do, and is of benefit in the case of impacted stone at the opening.

3. Dilatation of the ureter by graduated bougie.

4. Dilatation of the ureter by the active electrode of a high frequency or diathermy current. This last method was introduced by Buerger of New York and appears to warrant further trial.

The recognition of a case of renal or ureteral calculus when the patient is enduring a severe attack of renal colic is not difficult. When, however, the attack having passed off, he is observed for the first time by the surgeon, the diagnosis of his ailment and the decision as regards the best course of treatment to follow is a much more difficult matter, as he is frequently then apparently in perfect health. In the latter case, when the history of the attacks of renal colic he had endured is being investigated, the most important clinical indications of a calculus impacted in the ureter are as follows:—

More important than the classical radiation of the pain is the fact that it is so constantly confined entirely to one side of the body. The presence of blood in the urine is usually then observed and described as having occurred. In almost every case information with regard to the presence of an increased frequency in the desire to micturate will be volunteered as having been associated with the attacks he suffered from.

When examined some time after the acute attack has subsided, the only physical sign observed frequently by me in these cases at the clinical examination has been the palpable kidney on the affected side. The organ is felt to be prolapsed,

but is neither tender nor enlarged. The presence of a few red blood cells in the urine, detected when the urine is centrifuged and the deposit examined, is strong presumptive evidence that a calculus is present. The absence of these cells, however, in no way contra-indicates its presence, as frequently cases are met with where a calculus of appreciable size is impacted in the ureter and no ulceration has resulted.

The history and the facts previously mentioned having warranted further examination, an X-ray photograph of the entire urinary tract is taken. The presence of phleboliths in the pelvis leads to confusion, as they are liable to be mistaken for calculi. In differentiating between the two, it is of importance to remember that the majority of phleboliths are observed situated to the outer side of the normal position of the ureter, the commonest situation in which they occur being in the neighbourhood of the ischial spines. They may, however, be situated directly in the normal line of the ureter; but even then their nature can usually be suspected if not recognised by the fact that they are of circular or oval contour with a smooth and sharply defined margin.

The exact differential diagnosis is, however, not possible without a further cystoscopic examination. For this purpose a local anæsthetic is much to be preferred. It is also essential that facilities exist for the examination being conducted in immediate proximity to the X-ray apparatus. The cystoscopic examination may show the stone protruding from the ureter, which may be damaged from its presence close to the orifice. In the great majority of cases, however, even when the stone is as close as 2 cms. to the opening, no alteration is seen in the ureter on that side.

When a catheter is passed, it will be arrested when it comes in contact with the stone in virtually all cases, and a subsequent photograph reveals the cause of the obstruction. It is to be advised that after the photograph has been taken, the catheters be left in position for twenty minutes or half an hour, and the secretion from the two kidneys be collected. Usually the secretion on the side obstructed is slightly less than on the other side. When, however, the flow from both sides is abundant and the disproportion not undue, the obstruction may be considered as in no way seriously impairing the functional power of the kidney above.

In such cases the course of treatment advised is to wait

and see whether a natural expulsion of the stone will take place. The passage of the catheter often expedites this. After a few weeks it is advisable to take another X-ray photograph on the exact same plane as the previous one and observe whether the stone has passed further down the ureter.

When the delay is prolonged or the attacks of colic of repeated incidence, intravesical dilatation of the ureter is to be strongly recommended, employing any of the various methods already described. If these fail, or if the obstruction be more severe, and especially if infection of the renal pelvis above be revealed, operative treatment where the ureter is opened from above is then to be recommended. In such cases the extra-peritoneal route is usually employed. In several cases however, I have employed the trans-peritoneal route without regretting it.