CASE II.

John R., aged 48, from Pontypridd, a collier, was admitted to the Infirmary on June 13th, 1907. Patient was engaged in "timbering," and one of the pieces of timber became dislodged; he saw it falling and tried to get out of the way, but one end of the timber struck him on the left loin a severe blow. He left work and was sent to Cardiff (about 13 miles distance).

Condition on Admission.

When first seen by the house-surgeon the patient was in a kneeling position in the receiving-room upon the floor, unable either to sit up or lie down without pain. He was placed upon a couch and lay with knees drawn up, any attempt to straighten them causing great pain in the abdomen. The abdominal muscles were kept very rigid; tenderness was marked over the left lumbar region, which was also dull on percussion, the dullness extending forward in a curved line as far as the level of the anterior spine of the iliac crest. There was a good pulse of 88, but the patient was vomiting bile-stained material. A specimen of urine passed after the accident was brought with the patient, and contained bright red blood. A diagnosis of rupture of the left kidney was made and the patient removed immediately to the operating theatre.

Operation.

The usual lumbar incision was made and the left kidney found after removing large clots of blood. A large transverse tear was seen nearly separating the lower third of the kidney. The original incision was converted into a J shape in order to expose the upper part of the kidney, when another tear, longitudinal in direction, was found reaching nearly to but not quite joining the transverse one. This vertical wound was midway between the convex border and hilum, upon the posterior surface, but no wound was found in the pelvis or ureter. On attempting to close the wounds in the kidney with iodized catgut, it proved so extremely friable that the sutures cut through its substance on very slight traction (mattress sutures were employed); a few, however, were put in, and the surfaces of the wounds very lightly approximated. I then made use of the fibro-fatty capsule, and sewed the kidney up in that as in a bag. The wound was closed by a series of catgut sutures, provision being made for drainage by a rubber tube reaching the kidney capsule. The patient was put to bed in good condition.

Progress.

The next day (June 14th), there having been free oozing of blood, the dressings were changed. Temperature, 99°. Blood in urine. June 15th. Dressed; temperature, 100°; blood (less) in urine; condition good. June 18th. Drainage tube removed. June 19th. Urine free from blood; trace of albumen. July 4th. Patient got up; wound nearly closed. July 6th. Discharged well.

Subparietal—as distinguished from incised, punctured, and gunshot—injuries are the most common of the injuries to which the kidney is liable, and I think the two cases I have quoted are fairly typical of this class of injury; they are also more common than one might at first be inclined to believe, considering the protected situation of the organ in question.

The history also is fairly common—a severe blow over the region of the kidney; but crushes, falls from a height, and "run over" are more usual causes than simple blows. It also must be borne in mind that the kidney can be ruptured without any externally-applied violence at all. Morris¹ quotes three cases in which the kidney was ruptured by muscular violence, simple muscular contraction.

How far the condition of the kidney contributes to its rupture I cannot say, but I was struck by the extreme friability of the organ in the second case, and I could not help wondering whether its very friability had not much to do with its rupture, or whether contusion had made it friable. It certainly did not look particularly bruised.

Haemorrhage, indicated by blood in the urine, was present in both cases, and it is typical of ruptured kidney; but here, again, we must not forget those cases in which haemorrhage may apparently be absent because the ureter is blocked by clot, or those cases in which the ureter has been torn across, or, again, in milder cases of injury where there is a subcapsular haemorrhage without haematuria. That haematuria following abdominal injury is not pathognomonic of kidney injury must also be remembered. Morris quotes the case of a boy with a villous growth in the bladder, but who only had haematuria after an injury to the abdomen.

Abdominal pain, especially in my second case, where it was most marked, raised the question of intraperitoneal injury, which is an unfortunate but not uncommon occurrence in cases of ruptured kidney, from the simple leaking of blood through a torn peritoneum to the

crushing of other viscera, etc., but no peritoneal injury was discovered at the operation.

In each of my cases it was the left kidney which received injury, but I believe the accident is rather more common on the right side.

With regard to the treatment of ruptured kidney, it may be said, without going into statistics, that the percentage of cases operated upon followed by recovery is greater than that of cases treated by palliative measures.

As to the exact nature of the operation, that, of course, must be decided on the merits of the case; I would not hesitate to remove a hopelessly disorganized kidney, or a completely detached portion of a kidney. In both these cases the whole kidney was fortunately saved.

REFERENCE.

¹ *Surgical Diseases of the Kidney and Ureter* (Henry Morris).

CERTAIN INFECTIONS OF THE URINARY TRACT, WITH SPECIAL REFERENCE TO TUBERCLE, GONOCOCCUS, AND BACILLUS COLI COMMUNIS.*

By G. LESLIE EASTES, M.B., B.Sc.LOND.

THE infections of the urinary tract might well be compared to antimony, of which the chemist of old said that a man might spend his lifetime in investigating it without exhausting its properties. Hence, to-night I am limiting my remarks to the three commonest microbic infections of the tract, dealing with certain aspects of the clinical pathology and treatment by bacterial remedies.

To those who, like myself, have suffered themselves to be bound to the seats of the mighty microbe, the outlook is necessarily narrowed though the magnification is increased, and in concentrating the vision upon the parasite the host may be overlooked, so I must ask your forbearance if I deal too closely with the minute.

The first essential in clinical pathology is to know the anatomy and histology of the normal, and I will briefly enumerate the salient points in order to elucidate the reasons for inferences drawn from observations upon clinical material.

The urinary organs consist of an unbroken epithelial tract, from the Malpighian bodies to the meatus. The character of the epithelium varies with its functions, being in part secretive and excretive, in part protective or transmissive. The structure of each organ depends upon the function of its epithelium. As the renal epithelium is wholly secretory and excretory, it demands a relatively enormous contiguity with blood vessels, hence the unusually close capillary network surrounding each Malpighian body and tubule, and hence also the length of the tubule.

As the intact epithelium of the Malpighian body affords the head of fluid which is to wash out the urinary salts in the tubule excreted by the lining membrane of that part, there is no need for any muscular apparatus. But in order that the secreting apparatus may be in the highest state of efficiency, the secretory layer is reduced to one cell thick, the cells being columnar, almost cubical, in shape.

The renal pelvis has a different part to play. It is but the gathering ground of all the minute tributaries to the combined stream, and acts as a conduit to the aqueduct which serves to convey the urine from the position of security in which the kidneys are lodged, to the organ which has been evolved in the course of ages for temporary storage. As neither renal pelvis, ureter, nor bladder plays any part in excretion, the epithelium is of a different character, and approximates to that of the skin, being several layers thick, to serve as a protection. As the ureter and bladder are transmissive in function, the walls of each are provided with involuntary muscular layers. The renal pelvic and ureteral epithelium is identical, and belongs to the small transitional type, and in transverse section it is seen to consist of a layer of cells, four or five thick, of which the superficial are flattened, the deeper pear shaped or spindle.

The epithelium of the bladder belongs to the large transitional type, the individual cells being larger than

* Read at a meeting of the Kensington Division of the British Medical Association.

those just described, and usually six to eight are superimposed. There are also slight microscopical differences in the finer structure of the cells. This vesical epithelium is continued through the neck of the bladder down to the upper layer of the triangular ligament, where it rather abruptly changes to the columnar ciliated type, which lines the urethra to the ampulla, where larger transitional or squamous epithelium is again found. The columnar ciliated cells are, of course, only one cell deep, and the direction of ciliary activity is towards the meatus. Mucous cells, by which I mean cells which excrete mucus, are found in the renal pelvis and ureter and urethra. There are none in the bladder.

Certain peculiarities in the minute structure of these organs call for remark. Thus the lumen of the terminal collecting tubules, known as the ducts of Bellini, is double that of the more truly excretory tubules (or loop of Henle). The renal pelvis has an unusually rich plexus of lymphatics, and a very intimate connexion with the great sympathetic ganglia. The submucosa of the ureter is loose and relatively ill-supplied with blood vessels. Around the neck of the bladder is the pampiniform plexus of thin-walled blood vessels, relatively richer on the inferior aspect than on the superior. In the urethra are numerous crypts or lacunae, the use of which no physiologist has yet discovered, but the presence of which every urinary surgeon deplures.

In the male, too, in this region there are the openings of the prostatic ducts, some twenty to forty in number, and the openings of the genital ducts.

The knowledge of these facts and many more is an absolute essential to him who would rightly interpret analytical data, especially as, in the three diseases with which we are specially concerned to-day, the microscopical findings are all-important for diagnosis, for the composition of the urine is affected in respect to the cellular content vastly more than in its chemical composition. In fact, except for the presence of proteids, we may at once dismiss the chemistry of urine in these three diseases, as restricted to the urinary tract, with the brief remark that the saline ratios remain normal so long as there is no intercurrent renal or general metabolic dyscrasia.

I propose now to lay down some general rules for guidance in interpretation of analytical data. These data apply to freshly-passed urine, obtained in a proper vessel.

If the urine be bright and clear, free from threads or shreds, and from albumen, with rare exceptions, each of these three diseases can be excluded.

If pus be present, the item of prime importance is the associated epithelium, as that serves to locate the lesion. From what has been previously stated, a skilled observer can determine the source of any epithelium which is present in excess, except that, in chronic suppuration, there may be no epithelium on the site of disease, and the cells in its neighbourhood may be so altered by inflammatory changes involving chemosis, etc., as to be unrecognizable. Even in this case some help can be obtained by inferential diagnosis. A lesion involving any part of renal tissue, even if in the renal pelvis, will induce some reaction in the neighbouring tissue which finds its expression in the form of tube casts, hyaline or granular, sometimes comprising pus or blood cells. Any inflammatory lesion of the kidney or its pelvis will be accompanied by a higher proportion of serum-albumen than the same extent of lesion in the bladder or ureter remote from the kidney.

A lesion of the renal pelvis, or ureter, or urethra will be accompanied by more mucus than one of the bladder alone. In the absence of chronic renal disease, a vesical or urethral infection will not be accompanied by tube casts unless sufficient toxin is produced and absorbed to injuriously affect the kidneys.

In the presence of pus, next determine whether it appears in advance of the stream or intimately mixed with the urine, whether it is accompanied by gross or minute haemorrhage. Finally, whether it is only present in the form of threads or shreds.

The clinical symptoms do not come within the scope of this paper, so that we can pass on to some details of the three diseases *seriatim*.

My experience, extending now over eleven years devoted entirely to clinical pathology, enables me to say positively that when tuberculosis of the urinary organs has

passed the miliary stage, tubercle bacilli can almost invariably be detected in the urine by the help of the centrifugal machine and microscope. In this disease I have noted again and again that a purulent deposit showing a visible trace of blood contains plenty of tubercle bacilli. When ulceration is in progress, if, after proper centrifugalization, no tubercle bacilli can be found in the deposit, it is almost certain that the case is not tuberculous.

Having established the presence of the bacilli, the inferential diagnosis as to the site of the lesion depends upon the factors previously noted—that is, the association of casts and specialized epithelium.

I know that tuberculosis of the tract is frequently suspected from clinical symptoms when not present, even when each organ is functioning normally, just as stone is suspected when renal neuralgia is the true cause of the pain. But the microscopical test in proper hands is so reliable and so easy of application, that there is no excuse for omitting it.

Finally, if ocular demonstration of active tuberculosis be required, it can be obtained with Calmette's ophthaimo-reaction, which is better than von Pirquet's skin inoculation.

In the great majority of cases previous to the use of instruments the infection is single, and will remain unmixed throughout the course of the disease if manipulation be avoided. And, as a secondary infection is the most undesirable complication, this leads me to enter a strong protest against instrumentation, except for the most cogent reason. I have so frequently seen disastrous results follow the introduction of a second organism, that instruments should be the last resource in diagnosis and treatment. This warning is intended to apply to all urinary diseases with as much force as in tuberculosis.

With reference to treatment by tuberculin, I know of cases which have improved and others which have not been benefited. The treatment should be adopted in all cases in which the opsonic index is fairly good—that is, above 0.6—when the case first comes under observation, and in which there is no secondary infection of the tract and no widespread pulmonary disease. Where the cost of controlling progress by the index is prohibitive I advise estimating the index on the fifth day after each injection, or, if still too costly, after every third injection, but then the doses of tuberculin used must be smaller and given less frequently than the patient may be able to respond to fully, and the course of treatment will consequently be prolonged.

If there is a secondary infection, vaccine treatment had better be suspended till the second organism has been abolished; or if it prove to be resistant to drugs, then a double vaccine, consisting of tuberculin and an emulsion of the secondary organism, may be used.

Occasionally I find that the secondary microbe is a streptococcus or, less frequently, staphylococcus, which is also secondarily infecting a tuberculous lesion elsewhere—for example, lungs. If the former, antistreptococcal serum should be given, and I have seen the streptococci subsequently disappear from sputum and urine, together with the symptoms due to the secondary organism—that is, most of the pyrexia, sweating, loss of flesh, and hectic. This factor of double infection is rarely taken into consideration, but in most cases it plays a very serious part in the illness; the tendency in simple tuberculosis is towards cure, most of the untoward symptoms being due to the associated organism. Witness the benign character of the so-called "cold abscess," and the riot and havoc that occurs when a freshly-opened psoas abscess becomes secondarily infected. This mixed infection theory is applicable to all microbic diseases, whether in the urinary tract or not.

The commonest of all organisms infecting the tract is beyond question the *B. coli communis*, but in general it may be stated that such infection is in the majority of cases unmixed.

This bacillus plays havoc with the perirenal tissues, the renal pelvis, the ureter, and the bladder, and is occasionally the cause of urethritis. It may be primarily infective in any one of these regions. I have been able to diagnose primary "coli" urethritis from an examination of the urine, a diagnosis which was verified by the clinical features of the case, and later by the passage of veritable "mucous casts" of the affected ureter.

I am frequently asked the paths of infection in "coll" bacilluria. Dr. Box has recently insisted upon the upward infection from without in children, and there is no doubt that is very frequently the route. But as in adults it is a common sequela of appendicitis, mucous colitis, and other intestinal troubles, even following prolonged voluntary retention of urine, I am certain the lymphatic route is common. Few people are aware of the frequency of primary coll urethritis, and the tendency of such an infection is undoubtedly to spread upwards rather than downwards. The manifestations and symptoms of coli infection are legion, and, though the commonest effect is pyuria, many patients exhibit general toxæmia of varying grade, from headache and slight feverishness to profound septic intoxication.

Passing over pure surgery, which I am convinced is the correct form of treatment in acute coll nephritis in some of its forms, it may be remarked that drugs fall us utterly all too frequently.

Many patients have been through the whole gamut of urinary antiseptics and disinfectants without receiving any permanent benefit. In passing, I would like to state that the addition of small doses (about 3 gr.) of an iodide renders more efficient the action of almost every urinary disinfectant drug with which it is not incompatible. It is these people with resistant coli-form bacilli who have provided such an immense field for treatment with bacterial emulsion. There is a consensus of opinion that such a vaccine cannot be prepared from a stock laboratory "coll," but must be made from each patient's own infecting bacillus. I find that in general 200 millions is an appropriate first dose, and that gradual increase of about 100 millions is sufficient. Such a vaccine may be given every eighth day, and it is not essential to control the treatment by the opsonic index.

A note of warning may be sounded that vaccines, to which lysol has been added as preservative, are occasionally the subject of complaint from ladies, who attribute rose spots, which are apt to appear on the face, to its use. Hence I use glycerine, which has the advantage of yielding a better emulsion of more lasting keeping quality. In my experience under vaccine treatment, the subjects of coli bacilluria can be promised diminution of pus, gradual loss of toxic symptoms, increased appetite, and consequent increase of weight. The outlook becomes brighter. A tendency to melancholia, so often exhibited by "coll"-infected people, completely disappears. They must not be promised absolute cure of bacilluria, but, under a course of vaccine treatment, the infected tissues will gain a certain degree of immunity, such as the intestinal epithelium may be considered to possess, and consequently the bacilli are rendered harmless.

The treatment of certain intestinal intoxications is at the present time being attacked upon novel lines. Briefly put, the practice is to turn out the entire intestinal flora by the introduction of a new and harmless intestinal inhabitant. There are two strains of the *B. acidi lactici* whose services have been engaged for this interesting operation. Metchnikoff, Tissier, and Fournier have shown that by frequent small doses of these lactic acid bacilli the other bacteria of the bowel are gradually eliminated and replaced by the *B. acidi lactici*.

I have wondered whether, in cases of intestinal disorder, accompanied or complicated by coli bacilluria, the turning out of the intestinal coli-form bacilli might leave the opsonins freer to work upon the coli bacilli infecting the urinary epithelium, and thus hasten the cure.

Again, speaking speculatively from the bacteriologist's point of view, I wonder whether malachite green, which proves in culture media inimical to the growth of the colon bacillus, would be of any service internally.

I do not intend to discuss gonococcus infection at great length. The subject of the sequelæ of gonorrhoea is one of the utmost importance to the general practitioner, and which exercises a most peculiar influence upon the mental attitude of some patients.

The persistence with which the latter allow urethral threads to prey upon their happiness is most deplorable, and, as such threads are nearly always the expression of a secondary infection of soil prepared by the gonococcus, it behoves us to prevent such an event, or, if it has come about, to cure it.

All other remedial agencies failing, the assistance of the bacteriologist is invited, and his duty is first to

examine the threads, carefully determining the presence or absence of gonococci, and isolating the other organisms. These threads usually present a staphylococcus, and a bacillus of the xerosis type. The latter is negligible, but a vaccine should be prepared from the staphylococcus. If gonococci persist, to each dose of the staphylococcus emulsion a small dose of gonococcus vaccine should be added. The latter vaccine is of the greatest service in gonorrhoeal rheumatism, and suffices, under properly graded administration, of itself not only to permanently cure the systemic infection, but also to remove the concomitant effects, such as infiltration of tendinous structures and the consequent swelling and stiffness.

In pure gonococcus infections of the urethra which light up with extraordinary virulence at each attempt at topical medication, gonococcus vaccine is again most useful, raising the resistance of the tissues until a point is reached when local applications act like a charm in curing the disease.

I may mention that this vaccine is the most difficult of all to prepare, owing to the well-known reluctance of the gonococcus to grow upon any artificial medium except such as contain human protoids or their derivatives, and to its own constitutional delicacy in artificial surroundings.

THE DIAGNOSIS OF IMPACTED CALCULUS IN THE URETER.*

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THE diagnosis of impacted stone in the ureter presents many difficulties. According to Hurry Fenwick:

Before the routine employment of expert radiography in cases of renal pain the diagnosis of stone in the kidney and ureter was merely speculative. The clinician was rarely certain as to whether a stone was present or not, or if he was assured in his own mind that a calculus did exist, he could not say whether it was imprisoned in the kidney or whether it had passed into and become arrested in the ureter, so similar are the symptoms of stone in either position. The surgeon was forced, therefore, to explore first the kidney and then the ureter before he could declare the patient free from stone.

In the BRITISH MEDICAL JOURNAL of June 17th, 1905, Fenwick gives the following three great features of ureteric stone shadows: They are in the line of the ureter; their outlines are sharp; and their shapes are more or less oval. He also draws attention to the value of a shadowgraph ureteric bougie in the precise surgery of renal calculus.

The case I wish to record is one in which an erroneous diagnosis of impacted calculus in the ureter was made in spite of the assistance of an excellent radiogram taken with a shadowgraph bougie *in situ*.

A man aged 26 was admitted to Sir Patrick Dun's Hospital on January 18th, 1908, suffering from two fistulae in the right flank, from which urine flowed continuously.

Previous History.

He stated that he had been operated on in another hospital about six months previously, and that four stones had been removed from his kidney, one about the size of a damson and three smaller ones. Since the operation urine had flowed continuously from the wound, which had never completely healed. He complained that he passed very little urine, and that more came through the fistula in his side than through the bladder. The pain he had suffered from had been relieved by the removal of the stones.

Examination.

An oblique scar was found in the lumbar region, from two small openings in which urine came in drops. The bladder was examined with the cystoscope. The right ureteral orifice appeared small and almost obliterated; no movement or efflux of urine was observed. Urine was seen flowing freely from the left ureter.

Diagnosis.

The possibility of obstruction of the right ureter by a calculus naturally suggested itself, and Dr. Watson kindly took a radiogram of the patient. A small oval shadow was found in the line of the ureter just at the upper part of the sacro-iliac articulation, and this was confirmed by a second radiogram a few days later. The diagnosis of an impacted stone in the ureter now seemed clear. There was obstruction of the ureter, and the x-rays showed a suitable shadow in the right place. But in order to exclude the possibility of the shadow being

* Read before the Surgical Section of the Royal Academy of Medicine in Ireland.