

THE CHOICE OF METHODS EMPLOYED IN THE SURGICAL DIAGNOSIS OF RENAL DISEASE.*

By HENRY WADE.

THERE are some who believe that the future of medicine resides in the more accurate recognition of the earliest manifestations of disease. By none will those discoveries be more cordially welcomed than by members of the surgical profession, who have for long realised that successful surgery was largely dependent on early diagnosis and early radical treatment of the diseases that fall within their province.

In seeking for the earliest manifestations of disease there would appear to be two Schools of thought—those who rely mainly on the subjective sensations of the patient, such as the incidence of pain, its nature and distribution; and those who pin their faith to the detection by physical means of some departure from the anatomical standard of structure or contour of the healthy human body, or alteration in its normal physiological mechanism. The former I would call the Idealists, and the latter, of whom I would claim to be one, the Materialists of medicine.

Failure in the surgical diagnosis of renal disease is usually due to an omission to employ the most appropriate method for its recognition. These methods are, however, now so numerous and certain of them not devoid of danger that it is essential to make a judicious selection of the most suitable, based on the clinical findings of the case.

The difficulties of detecting a needle in a hay-stack are entirely dependent on the method employed. The solution of the problem is comparatively simple, if you will provide the necessary X-ray equipment and a Mackenzie-Davidson localiser. The problem before us this evening, succinctly, is this—when must we X-ray the hay-stack and how can it best be done?

The first question that arises is, what are the subjective symptoms or gross physical signs which warrant a detailed investigation of the genito-urinary system being carried out?

I do not wish to belittle the value of the patient's narrative in many cases, nor do I wish to cast doubts upon the value of

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that most valuable, but almost indefinable aid to diagnosis, the clinical instinct of the able physician, but at the same time I think it must be conceded that their greatest value is in carrying us to the threshold of discovery, the exact and accurate final diagnosis being largely achieved by instrumental aid.

(1) The popular symptom of renal disease is *pain in the loins*. "Every picture tells a story": frequently the narrative is a renal romance due to lumbago. It may, however, be renal in origin and due to renal residual urine retention producing pelvic distension.

(2) *Renal colic*.—This classic and characteristic agony is due to intermittent obstruction of the ureter and usually owes its origin to the presence of a calculus within the lumen, but occasionally may result from obstruction from without.

(3) *Frequency of micturition*.—It is noteworthy how often this is considered an indication only of vesical disease, whereas in many cases it is extra-vesical in origin and due to ureteral or prostatic disease.

(4) *Pus or blood in the urine* obviously indicate disease of the genito-urinary tract. In the case of the former, however, it is well to remember that although an abundant purulent discharge may be present, the urine may be sterile.

(5) *Bacilluria* or the presence of organisms in the urine is frequently a reason advanced for a detailed examination of the genito-urinary tract. Such is always justified, as by this means it is frequently found to be due to a chronic pyelitis. At the same time, it must be remembered that many such cases are eliminative in origin and arise from a primary lesion in the bowel or elsewhere.

(6) *The palpable kidney*.—When this is *bilateral* it is most commonly part of a general visceroptosis, a secondary consequence of a more generalised disease and seldom calls for detailed local investigation or local treatment. When both kidneys are palpable and there is no general visceroptosis, we very strongly suspect the presence of congenital multiple cystic disease and in those cases most careful further investigation is indicated. When the condition is *unilateral* and only one kidney is palpable, there is usually disease of the renal organ. At the same time, it must be remembered that in a patient with renal disease, the diseased kidney may not be palpable and the healthy one palpable, for the kidney that has undergone compensatory hypertrophy can usually be felt.

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When a detailed examination is warranted, what procedure is recommended to be followed?

Is it ever permissible to operate forthwith without further investigation? Such a course is justified where the kidney has been accidentally ruptured and serious hæmorrhage has resulted. It is also recommended where acute fulminating suppurative pyelonephritis seriously endangering the patient's life is present. In both cases, however, the functional activity of the opposite kidney must be investigated and the best course is to open the peritoneal cavity at the time of the operation, and by passing the hand across the abdomen examine the state of the healthy organ.

I will next rapidly review the routine examination carried out in all renal cases.

The usual *clinical examination* is of course made. Thereafter the urine is examined. A twenty-four hours' sample is collected in a large vessel, 5 c.c. of toluol being added to prevent decomposition. The percentage of the usual normal constituents, such as urea, is estimated, and any abnormal content examined for. Thereafter a freshly voided sample of morning urine is obtained, collected in a specimen bottle that can be easily sterilised and is sealed like a milk flask. The name and particulars of the patient are recorded on the sterilised cardboard stopper. From an immediate cytological and hasty bacteriological examination of this specimen much can be learned. If pus cells or organisms are present in a film made from the centrifuged deposit, it can safely be assumed that they are from the genito-urinary tract.

Next comes the *preliminary X-ray examination*, which includes the kidneys, ureter and bladder, and the photograph of the last should be taken with the direction of the rays at right angles to the plane of the pelvic brim, so as to reveal the bladder floor and ureteral orifices. Elaborate preparation of the bowel for this examination is in my opinion not necessary. I would not emphasise the necessity of this preliminary X-ray examination if it were not for the fact of my having had recently under my care two cases, both patients who had been treated for several years for persistent cystitis without relief and both having been cystoscoped without an X-ray examination. Dr Hope Fowler's photographs of these cases showed in each a kidney destroyed by caseous tubercle.

Finally, comes the usual simple *cystoscopic examination*.

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This can best be done in the great majority of cases without a general anæsthetic, and for some time now I have dispensed with a local anæsthetic. In the female patient, it should never cause pain, but naturally often creates much mental distress, to mitigate which two things are necessary—suitable environment for the examination, and a nurse experienced in the preliminary arranging and preparation of the patient. If pain is caused in a male patient, it is not an indication for a general anæsthetic, but for the use of a smaller cystoscope.

On the findings revealed by this routine examination the necessity for further investigation will be determined, and that will probably be conducted to determine—(1) the source of suspected renal hæmorrhage; (2) the source of pus in the urine; (3) the nature of a suspicious shadow revealed by the X-ray examination; (4) the explanation of an apparent increase in the size of the kidney; (5) whether an abnormal swelling felt within the abdomen is a displaced kidney; (6) whether vague discomforts in the loin are renal in origin.

To achieve success in these endeavours, the methods at our disposal are (1) chromocystoscopy; (2) ureteral catheterisation; (3) estimation of pelvic capacity by renal lavage; (4) passage of an X-ray catheter which is photographed *in situ*; (5) pyelography; (6) a detailed cytological and bacteriological examination of the urine with the injection of a guinea-pig if necessary; (7) blood analysis.

(1) Investigation of the cause of *suspected renal hæmorrhage*.—In a case of intermittent hæmorrhage, it is a sound policy to wait and examine at the time when bleeding is taking place. If this is not possible and no vesical cause such as a villous papilloma or trigonitis is seen on cystoscopic examination, what assistance does the ureteral catheter provide? Not so much as some imagine. The vascular mucous membrane of the ureter and renal pelvis bleed readily, even when a soft catheter is gently introduced. A trace of blood often appears after the catheter has been inserted for ten minutes, owing to the irritation of its presence. If, however, urine tinged with blood appears immediately on introducing the catheter into the renal pelvis it can safely be assumed that the hæmorrhage is due to a pathological lesion and is most likely produced by chronic pyelitis. If the introduction of the catheter into the pelvis is followed by the sudden escape of bright blood, which soon stops when a clot forms inside the catheter, the likeliest

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explanation is the presence of a vascular tumour, such as a hypernephroma invading the renal pelvis.

Confirmatory evidence of the presence of chronic pyelitis is usually obtained by estimating the capacity of the renal pelvis. This is done by renal lavage. A 10 c.c. syringe containing sterile boric lotion is attached to the catheter and the fluid very gently introduced. The patient is told to mention at once when any discomfort is felt. The healthy renal pelvis has a capacity of from 5 to 7 c.c., and in the normal pelvis when this amount of fluid has been introduced the patient at once complains of a sharp pain in the loin.

When slight hydronephrosis is present, as is always the case where chronic pyelitis exists, 15, 20, or 30 c.c. may be introduced before discomfort is complained of.

To confirm the diagnosis of the presence of a renal neoplasm, a pyelogram must be taken. The technique is very similar to that of renal lavage, except that the fluid introduced is 15 or 20 per cent. sterile sodium bromide. As soon as the pelvis and calyces are distended the photograph is taken. In doing so, naturally the more rapid the exposure the better the result. The photograph or pyelogram will reveal the diagnostic signs of tumour growth in the drawing out of the calyces and the pelvis in the direction of the tumour and later their destruction. The value of this sign is very great, and by its employment one can confidently anticipate being able to accomplish the recognition of cases of tumours of the kidney at a much earlier stage than has previously been possible.

(2) *The source of pus in the urine.*—If both ureters be catheterised and samples of urine obtained from both kidneys, it is an extremely simple proceeding to determine which kidney is infected. I have followed this practice for many years and have found it simple to carry out and most satisfactory in the results obtained.

You may have observed, however, in a recent article by Frank Kidd that he holds strongly the opinion that bilateral ureteral catheterisation is not to be recommended. Emanating from such a source, this opinion merits careful consideration. Personally, I hold different views based on my own experience. I must certainly have carried out a bilateral ureteral catheterisation on over a thousand patients, and I do not know of one case where any serious complication followed this. In doing it, however, there are certain rules I have always followed.

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It is never done on an out-patient, nor on a patient allowed to go home immediately after the examination. In all cases, the patient comes to the theatre with the kidneys functioning actively, having recently taken two pints of weak tea. After the examination, the patient is transported to bed, where he is given another warm drink and 10 grains of urotropine. If this practice is followed, I have no hesitation in saying that bilateral ureteral catheterisation may be safely practised.

(3) The *nature of a suspicious shadow* revealed by the X-ray examination.

Not infrequently there arises the problem of determining whether a shadow situated in the region of the kidney is due to a renal calculus or an extra-renal concretion, such as a calcified tuberculous gland. Sometimes two or three shadows may be in close proximity. The presence in the urine of one or two red-blood cells or pus and catarrhal cells is presumptive evidence in favour of renal calculi. The diagnosis of course is not established, especially as there is no means I know of whereby the urine from each kidney can be collected without the possibility of causing one or two red-blood cells to appear in the excretion from that side. It is also of great importance to remember that calculi may be present in the kidney or ureter, cause only a sensation of vague and indefinite discomfort and lead to the presence of no red-blood cells in the sample of urine from that kidney, or interfere with its functional activity.

A case that illustrated this point very well was one I had the privilege of examining for Sir Harold Stiles. The following are the notes concerning the patient.

“The patient is 48 years of age and has led an active life. He at present suffers from vague pains and uneasiness in the left loin. These commenced about ten years ago and have recurred at intervals since. The pain is of a dull aching character, which remains local and does not appear to have the character of renal colic. It is associated with no frequency of micturition, nor has there been at any time the presence of blood in the urine. Careful physical examination reveals no evidence of disease. Neither kidney is palpable. An X-ray examination was carried out recently by Dr Hope Fowler and it shows the presence of three oval shadows in the region of the pelvis of the left kidney. The nature of these is uncertain.

A cystoscopic examination was carried out which at first was associated with a certain degree of discomfort. Ultimately, this passed off. The bladder capacity was found to be normal. The

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bladder walls were healthy. Both ureteral openings observed to be of normal appearance. Ureteral catheters passed without producing any appreciable discomfort and without meeting with any obstruction up into both renal pelves. No renal residual urine from either pelvis. An abundant flow of urine of natural appearance obtained from both kidneys. Two samples from each kidney and one from bladder collected and handed to Dr Logan for bacteriological report.

Report by Dr Logan on Specimen of Urine from Bladder and Right and Left Ureters.

Bladder specimen showed fair numbers of red-blood cells, a few polymorphs, some epithelial cells and oxalate crystals. The polymorphs are probably not more numerous than can be accounted for by the presence of blood.

Right ureter—red-blood cells, epithelial cells and some aggregations of cells without nuclei, like mulberries in appearance: some brown unorganised debris.

Left ureter—practically no red-blood cells, but very numerous epithelial cells of different types and also some pseudocasts (not true casts); some brown unorganised debris.

As Dr Hope Fowler was not available owing to illness, arrangements for a pyelogram being taken could not be made.

The patient returned home on the evening of the examination in satisfactory health.

The results of this examination were inconclusive, and as the vague pains and uneasiness in the left loin still persisted he was operated on by Sir Harold Stiles. Several renal calculi were discovered in the left kidney and were removed.

In reviewing the examination of this case, it will be observed that estimation of the renal capacity was omitted. If it had been carried out it would undoubtedly have shown dilatation of the renal pelvis to be present and provided further confirmatory evidence in favour of a lesion of that kidney. If, in addition to this, a pyelogram had been obtained, it would have confirmed the diagnosis of renal calculi by the incorporation of the original shadows revealed within the shadow produced by the opaque fluid introduced into the renal pelvis.

The illustration (shown) demonstrates this last point well. It is a pyelogram of a normal renal pelvis and ureter with an abnormal shadow beneath the lowest calyx. It is from a young girl who suffered from tuberculous disease. The

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abnormal shadow was considered to be due in all likelihood to the presence of a tuberculous lymphatic gland. The kidney was exposed by operation, as early cortical tuberculous disease was suspected. At the operation a minute focus of early tuberculous disease was found and the shadow was observed to be due to enlarged tuberculous glands behind the kidney.

Where doubtful shadows are observed in the course of the ureter, these may be due to ureteral calculi. The commonest source of error on the right side is calcified tuberculous mesenteric glands. Next in frequency comes phleboliths in the ovarian or spermatic vein, which runs parallel and in close proximity to the ureter.

I will briefly describe a most interesting case illustrating the former. It is from the Clinique of Mr Miles. The patient was a young boy who had suffered from repeated attacks of renal colic. The X-ray photograph showed what appeared to be a typical shadow of a ureteral calculus. There were, however, no red blood cells in the urine. I remember his case well, as during the clinical examination for the Fellowship of the Royal College of Surgeons held last summer I was engaged with a candidate at the next bed to this patient. While thus occupied the boy developed a typical attack of renal colic. He rolled on his side, obviously suffering great pain. He became pale, was sick and vomited, and the muscles on that side became very rigid. His condition was so urgent we interrupted the examination to obtain relief for the boy. Mr Miles was so kind as to entrust me with the care of this patient. As the case was so typical and the shadow was distinct and at that time I did not possess the necessary instrument to catheterise the ureter of a young boy without a general anæsthetic, we operated without further investigation. The ureter was exposed in the usual way. It was found to be slightly dilated at its upper part, but on palpation it contained no stone. We therefore opened the peritoneal cavity in front of it and found that a calcified tuberculous gland was adherent firmly to its anterior aspect. This was dissected free and removed and the patient made an excellent recovery.

The interest of this case is not only the error in exact diagnosis with which it was associated, but also in being able to prove the presence of a stricture of the ureter of extra-ureteric origin. According to Hunner, this state of affairs is of comparatively frequent occurrence and he has published records of a thousand cases where he has met with this and treated it by dilating the ureter.

The means of differential diagnosis in cases of suspected

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ureteric calculi is by the use of the X-ray catheter. The tip of the catheter is stopped virtually in all cases by the foreign body and the subsequent X-ray photograph shows it in contact with it.

My efforts to obtain information of value with the use of the wax-tip catheter have not been attended with appreciable success.

Where doubtful shadows are observed in the pelvis, these are most usually due to the presence of phleboliths. They can in the great majority of cases be recognised from their structure, contour, and situation. They have a uniform density, a smooth contour, and although they may be found in any situation are most commonly met with grouped around the ischial spine to the outer side of the course of the ureter.

(4) *The explanation of apparent increase in the size of the kidney.*—A kidney may become enlarged from many causes. When due to hydronephrosis, pyonephrosis, or such like conditions, the diagnosis is simple. The ureteral catheter, which usually enters the renal pelvis without difficulty, at once reveals the state of affairs present in the escape of an unusually large amount of renal residual urine, probably purulent. Estimation of the capacity of the renal pelvis at once shows it to be much dilated.

When due to tumour or a large solitary cyst the diagnosis is more difficult and we have here always the possibility of the enlargement being due to compensatory hypertrophy in a case of a single functioning kidney. It is therefore essential to determine forthwith, as it always is before any operative interference is contemplated, whether the patient has one or two functioning renal organs. This subject is of more than merely academic interest. Probably about one person in 120 has a single functioning kidney.

Congenital absence or extreme congenital atrophy of one kidney is considered by some surgeons to be very rare. Morris found only three such cases in 15,904 post-mortem examinations. In 500 post-mortem examinations conducted by myself in the Royal Infirmary, I met with the condition five times. A year ago being interested in a case of acute pyelitis that had terminated fatally, I attended the pathological department of the Simpson Memorial Hospital and found Dr Rutherford concluding the post-mortem examination of another case. The finding in it that appealed to me of most interest was that

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here again we had unexpectedly revealed a single functioning kidney. He then informed me that out of about 300 post-mortem examinations conducted by himself he had observed this condition twice previously. A few months ago a patient under my care in the Royal Infirmary, who suffered from advanced carcinoma of bladder, died. The post-mortem examination was conducted by Dr Alexander and again only one kidney was found, the other organ being entirely absent. This was Dr Alexander's third experience of this nature in some 400 post-mortem examinations.

The simplest and safest method of demonstrating that only one kidney is functioning is by chromocystoscopy. Cystoscopy alone is not enough, as a kidney congenitally destroyed may possess a ureter which will admit a size 5 French catheter.

The technique of this examination is well known and very simple. Four c.c. of a saturated solution of indigo carmine is injected intramuscularly into the patient, who for preference is not under a general anæsthetic and has recently imbibed a large quantity of fluid. In seven to ten minutes the pigmented urine is observed to be propelled from the ureter into the bladder from the excreting kidney.

Much can be learned from this method of examination. As a means of estimating diminished functional activity in one organ, it is not of so great value as other methods. It is, however, of great value in determining the degree of obstruction produced in a ureter by an impacted ureteral calculus. In such a case the pigmented urine is observed to be jetted forth in a vigorous manner from the healthy ureter. Where a ureteral calculus is producing partial obstruction, the pigmented urine escapes like smoke from a slow-burning fire.

Where renal enlargement is due to an hydatid cyst, the exact diagnosis is naturally difficult. It was not so, however, in the case from which this specimen (shown) was obtained. His narrative lucidly established the diagnosis. He came from Shetland, kept dogs, and complained of passing grape skins in his urine.

The kidney was much enlarged, and on ureteral catheterisation its functional activity was only a third of that of the healthy side.

(5) *Determination whether an abnormal swelling within the abdomen is renal in origin.*—The commonest of these are the congenitally displaced kidney, especially the pelvic kidney, and

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the horse-shoe kidney. The best method of settling this point is by means of a pyelogram. If the swelling in the bony pelvis is revealed by pyelography to have a pelvis and calyces, it is of course a kidney. If the swelling be due to a horse-shoe kidney, the only certain way to demonstrate this is by pyelography again. Here is such a case from Sir Harold Stiles' Clinic. You will observe a double pyelogram has been taken and it shows the diagnostic feature of a horse-shoe kidney in the direction inwards of the lower calyces which in all other conditions pass laterally from the pelvis, never medially.

(6) *Whether vague discomfords in the loin are renal in origin.*—When such exist without the preliminary X-ray examination revealing any abnormality and the urine is healthy, diagnosis is difficult. If, in addition, as is sometimes the case with a military pensioner, other influences cloud the clinical picture, it is still more so. Recently I had one such case under my care in Craigleith Hospital. On ureteral catheterisation both renal pelves were readily entered and normal urine came from both sides. On testing the pelvic capacity, however, whereas on the left or healthy side a sharp pain was produced when 7 c.c. were injected, on the other side 30 c.c. were contained before discomfort was felt. The ease with which the renal pelvis was entered being against stricture of the uretero-pelvic junction, an abnormal artery to the lower pole was suspected and this was confirmed at operation to be the cause of a slight hydronephrosis.

The value of a detailed cytological and bacteriological examination of the urine is too large a subject to discuss at length. I may mention, however, I have never found any value in the nature of the cells present as a means of localising the site of a lesion of the genito-urinary tract.

A detailed bacteriological examination is always worth while. I would especially recommend it in separating a clinical from an actual cure in cases of *B. coli* pyelitis. If the patient is clinically in good health, but *B. coli* are still present in the urine, it is probable that a recurrence will take place if treatment is not continued until the urine is germ free.

(7) *Value of blood analysis.*—We have now had sufficient cases examined by the staff of the biochemical laboratory to have formed an opinion of the value of blood analysis as a clinical aid. The object of it is the determination of the renal functional activity. We have used it as an index of the value

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of preliminary preparation carried out and as a guide to operation. In local renal lesions it is of no special assistance. Its value is, however, great in cases of backward pressure, especially when due to prostatic enlargement.

The non-protein nitrogen and urea nitrogen records of our cases have conformed to the standard of others. The estimation of creatinine has in almost all cases been much higher than, for example, those recorded by Bentley Squier. We have several times had patients with a creatinine reading well above his danger line who recovered after operation.

At first sight it appeared to us that the best confirmatory diagnosis of congenital cystic kidney would be by blood analysis. This is not so. The congenital cystic kidney is like the diseased but compensated heart. Except in their terminal stages what they both possess is not a lack of functional efficiency but functional reserve efficiency. Thus, we have had cases where although the disease was pronounced the blood urea record was normal. In one such case, however, in which a carcinoma of the splenic flexure was suspected, after an exploratory operation the blood urea record rose to over 100 mg. urea nitrogen per 100 c.c. of blood and the patient gradually sank and died.

Each case investigated presents its own problems for solution. With time, patience and adequate appliances most can be solved. One class of case has proved specially difficult and it is advanced tuberculous disease of the kidney with tuberculous disease of the bladder, rendering bilateral ureteral catheterisation difficult. Usually in such a case one ureter can be catheterised. If in the sample of urine from that side tubercle bacilli are present and these germs are also found in the sample of bladder urine, the problem is—is the other kidney also affected by tuberculous disease?

The plan I have followed has been to repeat the examination under a general anæsthetic, and if this fails, to arrange for suitable constitutional treatment in convalescent home or elsewhere for a month before again examining the patient. When, as has happened to me twice recently, success attends this examination and unilateral renal disease is revealed, I have followed the course of removing by operation the diseased organ.

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DISCUSSION.

Sir David Wallace said he had been much interested in the important paper which Mr Wade had read, but the field it covered was so large that it was impossible to discuss the various points in detail. Mr Wade had referred to two Schools in connection with clinical work—the Materialistic and the Idealistic. Sir David fancied that the majority would like to belong to the idealistic, while taking advantage of the materialistic, but there was no doubt that there was a tendency at the present time to throw over clinical observation and trust too much to specialised methods. This, he thought, was a mistake. In his remarks, Mr Wade took no note of what, in the speaker's opinion, was important in connection with renal cases—that is the influence that the diseased kidney had upon the healthy kidney. He believed a stone in one kidney not infrequently produces pain in the other kidney and influences its function. While he did not believe that in the majority of cases there was any risk in ureteral catheterisation, he did believe that in some cases the catheter temporarily induces changes in the function of the kidney. Mr Wade alluded to hæmaturia, and stated that in a difficult case the passage of a catheter into the pelvis of the kidney induces bleeding and enables the affected kidney to be determined. He himself was very doubtful if this is reliable. No doubt if the affected part could be reached by the catheter, bleeding might be induced, but how frequently would this not be so. Regarding radiography to determine the position of a ureteral calculus, and to differentiate between a stone in the ureter and a calcareous gland external to it, a ureteral catheter which gave a shadow was of much value, but he would remind the Society that more than twenty years ago Harry Fenwick introduced a shadowgram bougie for this purpose, and in certain cases it was very valuable.

Mr Stuart described a case illustrating a possible fallacy in chromocystoscopy. The patient had a large tender left kidney and suffered from hæmaturia. Chromocystoscopic examination showed that no pigment was being excreted from the left ureter, while pigmented urine was issuing freely from the right ureter. The left kidney was removed, and at the last moment a second ureter was found emerging from near the lower pole. The man died, and post-mortem examination revealed the absence of a right kidney, and that the two ureters from the left kidney entered the bladder at the normal positions of the right and left ureters.

Professor Meakins said that he was glad that Mr Wade had taken such a conservative view about what the chemist could do to help the surgeon. By that he meant that, if the surgeon had a case about

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which he was uncertain as to whether he was fit for operation, the chemist after certain examinations could help him, and more especially in cases where the patient looked fit but where on closer examination it was found that he was not fit. On the other hand, if it was found that the patient was not fit for operation and the treatment appropriate to the case was followed out, he thought that in time the chemist could give the surgeon an extremely accurate indication as to whether the treatment indicated an improvement or otherwise with regard to future operation. In regard to creatinine in the blood, it had been lately found that the serious prognostication of high creatinine in the blood might be quite wrong, as it was still to be definitely determined as to whether the present-day reactions to creatinine in the blood were exact. The more careful biological chemists were doubtful as to its accuracy and additional experimental evidence added to the suspicion. Further careful biochemical studies would determine the point at issue.

Mr Wade said, in reply to Sir David Wallace, that he had endeavoured to make it clear in his paper that it was only in those cases where a vascular tumour, such as a hypernephroma, had invaded the renal pelvis that the introduction of a ureteral catheter would be followed by the induction of hæmorrhage. In those cases where the tumour had not invaded the renal pelvis, naturally the introduction of a catheter would not be associated with the production of any hæmorrhage. It was in this latter class of case especially that most valuable assistance was to be obtained from the taking of a pyelogram which would reveal the characteristic appearances of tumour growth in the lengthening, and later destruction, of the calyces in the region of the kidney in which it was situated.

As regards the early diagnosis of renal tuberculosis Sir David Wallace had raised his hopes when he referred to the recognition of an early focus of tuberculous disease situated in the cortex without the pelvis being invaded. In recognising such cases, the difficulties of exact diagnosis were very great and much had still to be learnt. It would appear that in many of them exact diagnosis would only be obtained when the kidney had been exposed by operation.

Mr Stuart's case was one of great interest. As has been already mentioned a single functioning kidney was of frequent occurrence. A double ureter with two ureteral openings into the bladder was also frequently met with. Mr Stuart's case was unique, however, in that as revealed by chromocystoscopy the bladder possessed two ureteral openings normally situated and from these pigmented urine was seen to be vigorously voided, while the operation revealed that these two channels came from a single kidney. As far as Mr Wade was aware,

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no similar state of affairs had ever previously been recorded.* Its diagnosis of course would be an easy matter by an X-ray catheter or other means. The problem was—when was its presence likely to be suspected, so that such a detailed examination would be indicated?

Professor Meakins had most properly emphasised the valuable knowledge the biochemist could provide to the clinician. Mr Wade remarked that in recognising when a patient was really ill, or when his general health was good, the clinical instinct of the medical man with experience was seldom at fault. He had had two cases of prostatic enlargement where the patients looked in good health and appeared as if they would stand operative treatment well. The report from the biochemist, however, in both of them gave a dangerously high level of blood urea. In both cases the critical condition that developed after operation supported the biochemist's grave prognosis.

* The most likely explanation of Mr Stuart's case would appear to be that it was one of a unilateral fused kidney.

In the *Journal of Urology*, volume vii (1922), page 321, Hyman records two such cases diagnosed during life by the use of X-ray catheters. In these cases the catheters entered ureteral orifices normally placed, but both passed to a fused kidney situated on one side.