cholesterinaemia, and the tophus is only the external reflection of the humoral syndrome. It seems as though the tophus represents an effort of liberation on the part of the organism, a local deposit assisting in the elimination from the circulation of the excess of uric acid and cholesterolin.

In all that has preceded we have described gout in the static stage when compensation is complete; but what happens when it passes to the dynamic state as evidenced by an acute crisis? At the moment we can only reason by analogy, and we are reminded of the suddenness of onset of similar acute attacks of asthma, migraine, urticaria—all paroxysmal illnesses and allied to gout by certain clinical affinities.

Since the researches of Widal, Abrami, and Iancovescu we have come to look on these morbid crises as precipitated by a disturbance of the colloidal equilibrium, very similar to anaphylactic reactions, with special modification in the number and percentage of the leucocytes, of the blood pressure, and albuminoid content of the plasma. All these crises can cause local lesions such as the oedema of the skin in urticaria and eosinophilic expectoration in asthma. I think that it is along these lines that we must search for the explanation of the acute crisis of gout. Perhaps in the first place, as suggested by the researches of M. P. Weil and Guillaumin,⁷ the uric acid is in the free state in the plasma, for the greater part at least, and in the combined state in the blood cells. Guillaumin's technique seems to permit this differentiation.

In whatever ill-defined and colloidal form it exists the excess of uric acid places the gouty in a state of unstable humoral equilibrium, which may at any time be imperilled or destroyed under the influence of divers disturbing causes—errors of diet, traumatism of joints, in particular of the great toe, by fatigue or an ill-fitting boot, dampness and cold, and the seasonal changes to which the gouty are so sensitive.

Every gouty patient is sensitive to some disturbing agent or other, and there are those who cannot take a glass of champagne or burgundy without their having almost immediately an attack of pain in the toe. To the general sensitiveness must be added a local sensitiveness which causes the inflammatory process to light up always at the same point, creating thus true centres of uric acid crystallization.

If the disturbance of the humoral equilibrium is sufficiently intense the acute attack of gout flares up, and we can look on it as a true local shock, comparable to the shock of a migraine crisis. Latent sensitiveness of the gouty, provocative cause, and sudden shock in the affected area—these are the three periods of the course of gout, and we can compare the third of these to the local serological shocks which reproduce true local anaphylactic reactions, recently studied by G. Bouché and A. Hustin.⁸

In both cases there appears an active local vascular dilatation—vascular or sympathetic phase, "vasotropic shock" of Bouché and Hustin—to which is added the painful reaction of the sensitive nerves. But in the gouty the process is complicated by a specific local reaction, the deposition, or rather the local flocculation, of sodium urate in the region of the inflamed joint. Does there exist at the commencement of the attack the haemoclastic reaction so well described by Widal and Abrami? We do not yet know, and it would be very interesting, although in practice very difficult, to investigate the point.

However that may be, if this explanation of an attack of gout be accepted we are led to consider the uric acid present in excess in the serum of the gouty as a potential exciting cause, capable under the action of the provocative agent of determining a local and elective shock with urate flocculation; a process of this kind recalls the curious experiments of A. Lumière⁹ on barium sulphate, which in the molecular state of dispersion can be injected into the circulation without causing shock, whilst in the flocculated state it invariably gives rise to the symptoms of shock.

If one day the existence of this process could be demonstrated in gout we should have made a great step towards the explanation of the symptoms of an acute attack of gout. This will be the progress of to-morrow, the counterpart of the admirable work of Sydenham and of Garrod, who will always remain our guides in clinical gout, our undoubted masters in the study of this great humoral disease.

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A British Medical Association Lecture

ON

PYELOGRAPHY.*

BY

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[With Special Plate.]

LITTLE time was lost after Roentgen had discovered the penetrating power of x rays in applying them to the detection of concretions in the urinary tract; but it was not until 1906 that it occurred to Voelcker and Lichtenberg to take advantage of the cystoscope and ureteric catheter so as to fill up the pelvis of the kidney with a fluid opaque to x rays and thereby obtain a photographic outline of the shape of the ureter and pelvis of the kidney. The paper published by these workers received scant notice for a considerable time, and it was not until some years later that their idea was taken up seriously by a number of workers in various countries and developed to its full possibilities. From 1910 onwards I worked at this subject extensively at the London Hospital, and in 1913 I published a full account of what I had been able to achieve on the clinical side, accompanying this with an account of experiments on sheep's kidneys, showing what happened to colloid suspensions when injected into the renal pelvis under varying degrees of pressure, and pointing out certain dangers and difficulties and how to avoid them.¹ I also produced evidence that the injection of such fluids under proper safeguards does no serious or permanent damage to the kidney.

During the last decade the method has been employed more and more until it has become recognized universally amongst urologists as an essential factor in their work. Pyelography was one of the chief subjects for discussion at the 1921 Congress of the Société Internationale d'Urologie held in Paris; at that Congress it was agreed that the method had come to stay and was one that had been developed to a high degree of safety in the hands of competent urologists. Dangers which were at first encountered by too strenuous workers have been gradually eliminated, and in the course of time improved injection fluids were discovered that cast deep shadows without irritating the kidney substance. At first various preparations of colloid silver were used, and later such substances as silver iodide, thorium nitrate, and potassium iodide, but none of these proved to be ideal. The silver preparations did not always cast a clear shadow, except in very strong suspensions, and the other substances sometimes gave rise to toxic symptoms. In 1918 Weld introduced sodium bromide, a 20 per cent. sterilized solution for the kidney and a 10 per cent. solution for the bladder. This though not an antiseptic is non-toxic and has the merit of casting a very distinct shadow. Nevertheless, it is sometimes very irritating if injected into a bladder the victim of a chronic cystitis, and in such cases I find it better to use a 10 per cent. suspension of colloid silver.

Pyelography enables us to study exactly the surgical anatomy of the kidneys, ureters, and bladder before proceeding to operation or treatment in a way which has been compared to the giving of opaque meals in the x-ray diagnosis of disorders of the alimentary tract. In practice it is found to yield a more accurate account as compared with the opaque meal or enema, which are frequently open to doubtful interpretations, the surgeon often failing to find what he has expected after a study of the opaque meal pictures. In dealing with the urinary tract it is seldom that we fail to find the exact condition revealed by the pyelo-radiogram or cystogram, though considerable experience is needed in interpretation of

* Delivered before a joint meeting of the Nottingham Medical Society and the Nottingham Division of the British Medical Association on March 15th, 1922.

the plates. Before the introduction of pyelography great strides had already been made with the introduction of the cystoscope and the ureteric catheter in the accurate diagnosis of the physiological and pathological state of the kidneys and bladder. Pyelography supplied a means of studying the surgical anatomy and completed the chain of evidence needed to secure a full diagnosis in any particular case. These methods taken together have made urinary surgery one of the most accurate lines of surgery at the present day. It is seldom that a urinary surgeon is obliged to cut down for exploratory purposes. If he has made a complete study of his case he should know exactly what he is cutting down for and know any variation in the anatomy that may be present in any particular case, so that he can go straight to the diseased point and correct it. Recently Carelli² and others have introduced a method wherein they pass a hollow needle into the perirenal fat and fill up this fat with carbon dioxide or oxygen. X-ray pictures taken under these conditions will often show up with extraordinary clearness, not only the outline of the kidneys but the suprarenal capsules as well. At first sight this might seem to be a very great advance, and as regards the suprarenal capsules it is undoubtedly a great advance, but as regards the kidneys I do not think the method adds very much to what we can already obtain without it. With a good modern x-ray outfit it is usually possible to show up a clear shadow of both kidneys if the patient has been properly prepared—not quite as dense, it is true, as by Carelli's method, but quite dense enough for practical purposes. If we wish to make a further study of the anatomy of the kidneys we can get more information by filling up the pelvis with sodium bromide through the ureteric catheter than we can by the method of Carelli. The former method shows up the anatomy of the ureter, pelvis, and calyces, and also the outline of the kidney, whereas the method of Carelli only gives the outline of the kidney. When in addition we consider that the passage of a ureteric catheter is probably less painful and less dangerous than passing a hollow needle and filling up the perirenal fat with gas, then we shall conclude that pyelography will continue to hold the field. Carelli's method will be chiefly reserved for a few exceptional cases where we suspect a tumour of the kidney, and where it is not possible to show this up by means of pyelography.

I will not detain you now with the history of the development of the method, but will content myself with stating clearly the technique which I at present employ as a result of eleven years' experience.

1. *I consider it absolutely necessary to possess an x-ray plant of my own.*

I often have need to apply this method to several patients in the course of a single day, and I soon found that it was quite impossible to arrange to take the patients round to a radiographer's house, get ready for cystoscopy, and clear up everything afterwards. The whole thing was time-consuming and wearing to a degree. I therefore resolved to put in my own x-ray apparatus, and I have never regretted it. I planned my x-ray room so that I could carry out cystoscopy without any waste of time on the same table on which I take my x-ray photographs. Catheterizing cystoscopes and ureteric catheters are ready at hand. In suitable cases, having taken ordinary x-ray plates, I proceed to catheterize the ureter, a process which does not take more than a few minutes, and I am then ready, with the patient on the table, to take as many further x-ray photographs as I require. I make use of a tungsten target tube, worked by a mercury interrupter and a 16-inch coil. I use an Albers-Schoenberg compressor, diaphragm, and air-pad, with the tube above and the film underneath the patient's back. The patient's legs are flexed so as to abolish the lumbar curve, and I employ on an average an exposure of two to three seconds, using up to 12 milliamperes and a 6-inch spark-gap. I use a double intensifying screen and duplitzed films. I endeavour to take as short an exposure as possible. The essential point in taking kidney radiograms is to use tubes which are capable of giving a picture with a very short exposure. The patient is then able to hold his breath for the second or two during which exposure lasts, and there is no movement. If there is no movement then a clear shadow is thrown; if there is movement the kidney outline becomes obscured. Needless to say, the patient must have been properly prepared beforehand to ensure that the bowel is clear.

2. *No anaesthetic should ever be used in taking pyelograms.*

If the patient is under an anaesthetic it is possible to over-distend the pelvis of the kidney and so to damage the kidney. If he is conscious and the matter has been explained to him beforehand he will know at once if there is the slightest over-distension of the pelvis, as he will feel a sudden dull pain in the back of the loin. He is, therefore, asked to state at once if he notices any such pain. If he says he feels this pain, not only is the injection at once stopped but a little of the fluid is at once sucked out through the catheter before a pyelogram is taken. I cannot too strongly warn you against the use of an anaesthetic. This factor prevents those who are not very expert in the use of the cystoscope from employing the method. You need to have long practice in passing a cystoscope and passing ureteric catheters, especially in the male, if you are to avoid causing pain. It can only bring discredit on medicine when men try to employ methods in which they are not expert, and this is how damage gets done and methods fall into disrepute. The method is essentially one only to be carried out by the professed and trained urologist.

3. *Only one kidney should be done at any one sitting.*

At one time I used to try doing both kidneys, and in America it is, I believe, a common custom to do both kidneys at one sitting; but for a long time I have taught that it is not wise to pass ureteric catheters on both ureters at one sitting except under exceptional circumstances. It is far better, if you wish to get a picture of both kidneys, to bring the patient up again a few days later and do the other ureter and kidney. If you confine yourself to doing one kidney at a time you seldom, if ever, get rigors or any constitutional upset, whereas if you do both kidneys at a time you are liable to get vomiting and fever and the patient may have to go to bed for a day or two. For a long time now I have had no trouble of any serious kind after pyelography, and the patients are able to go home straight away. I always advise them to remain indoors and rest for the remainder of the day, but they are able to return to work the next day without any drawbacks.

4. *I consider it is a mistake to employ too large a ureteric catheter.*

This is sometimes done with the idea of blocking the ureter and preventing reflux, an idea that has been adopted by many authorities. In the average case I make use of a gum-elastic ureteric catheter with an olive end of a size No. 5½ Charrière. No. 6 is a little too large, No. 5 is a little too small, so that I select catheters of an intermediate size, picking them out by means of a gauge. Catheters with an olive tip pass more readily than those with a conical end. The catheters are placed in silk petticoats and are sterilized in a hot formalin vapour sterilizer specially made for me by the Genito-Urinary Manufacturing Company of London. By means of this sterilizer hot formalin vapour can be blown through the lumen of the catheters as well as around their surfaces. By sterilizing my catheters in this manner with meticulous care I have been able to avoid implanting infection in the kidney. If I employ a catheter for a tuberculous case I always destroy it afterwards and never use it again. In the case of a male patient I inject 2 drachms of a 5 per cent. solution of stovaine into the urethra with a urethral syringe and hold it in place for ten minutes. I wash out the urethra with a pint of 1 in 4,000 mercury oxycyanide solution, then pass a No. 9 English scale "Marshall" gum-elastic catheter, sterilized by boiling and lubricated with "lubafax," and empty the bladder. I wash the bladder clear and fill it with 8 oz. of a 1 in 4,000 mercury oxycyanide solution. Then I pass the catheterizing cystoscope, sterilized in formalin vapour and armed with a catheter, catheterize the ureter, and leave the catheter *in situ*, removing the cystoscope. The cystoscope I am accustomed to employ is one specially made for me by the Genito-Urinary Manufacturing Company. It is nowhere larger than 24 Charrière, an exception to most catheterizing cystoscopes. It is specially rounded and smoothed off so that the lever when lowered does not project at all, and so that its passage is as easy and painless as that of the ordinary inspecting cystoscope. Very little attention has been paid to this point by most makers of cystoscopes, and this is one of the chief reasons

for difficulties experienced in passing the catheterizing cystoscope on the conscious male. The cystoscope is a single catheterizing cystoscope. I never employ a double catheterizing cystoscope, which is a clumsy and painful instrument and quite an unnecessary adjunct to the armamentarium of the urologist. I warn my younger readers to resist the blandishments of the instrument makers, and when starting to buy an outfit to refuse to purchase a double catheterizing cystoscope and remain content with a single catheterizing cystoscope. If by any chance I need to catheterize both ureters at a sitting, a practice I try to avoid, I remove the cystoscope, rearm it, and pass it afresh, and so catheterize the other ureter. Having passed a catheter up the ureter selected for examination I place its end in a sterile glass test tube and collect a specimen of urine for bacteriological and cytological examination. In some cases little if any urine comes through at all for some minutes, in others a lot of pale urine comes away at once; but whatever happens depends entirely on the reflex effect the catheter has had upon the kidney. Usually it produces no effect, but it may produce a temporary oliguria or a temporary polyuria. *It is quite a useless procedure to measure the amount of urine coming away, with the idea that this will give information as to whether the renal pelvis is a large one or a small one, and as to how much fluid to inject before taking a picture.* Failure to appreciate this fact has led to most of the accidents. If you find a lot of pale clear fluid has come away in a short time and therefore think that you can inject a similar amount, you will make many mistakes and cause your patients severe pain. *This is the bed-rock difficulty in pyelography, in that you do not really know in any particular case how much fluid the pelvis will take.* How this can be got over will appear in the sequel. The patient now lies on his back with the knees and hips bent so as to abolish the lumbar curve. The plate is placed behind the kidney area and the compressor and x-ray tube placed in position, the radiographer standing ready to give the exposure at the word of command. I now take my syringe and fill it with warmed sterilized 20 per cent. sodium bromide. I only fill it with 10 c.cm. to start with, and I commence with the idea that I am dealing with a pelvis of normal size—that is, one that can contain on an average 6 c.cm. I instruct the patient to tell me at once if he feels the slightest dull ache or pain in the back of the loin, as this is the best guide to overdistension. Then very slowly and with the utmost gentleness I begin to press the piston of the syringe home, watching the ease with which it goes. It usually goes quite easily up to 6 c.cm. At this point I ask the patient if there is any pain; if not and if the piston is travelling easily, I usually let in one or two cubic centimetres more and then give the word for the exposure. Immediately I suck out the fluid from the kidney by means of the syringe until I have sucked out the exact amount I have put in. This is a most important and helpful point. I then remove the syringe from the catheter and leave the catheter draining for a few minutes while the plate is being developed. When the plate has been developed I examine it, and if it shows that the kidney has been adequately filled I take no more pictures. If, on the other hand, there appears to be merely a faint and irregular shadow, this suggests that there is a hydronephrosis full of fluid which has diluted the sodium bromide solution until it no longer throws a dense shadow. When I know that, I can proceed to take a further picture. This time I fill up the pelvis first with 10 c.cm.; if no pain is felt I go up to 20 c.cm.; if no pain is felt I go up to 30 c.cm. (I seldom go beyond 30 c.cm.), and I then take another plate, and in this way get the pictures I show you to-night of congenital hydronephroses holding a large quantity of fluid. By thus taking the pictures in two stages you are able to avoid overdistending a kidney with a pelvis of normal size, and it is a technique that I have worked out for myself and can recommend to others.

At one time I made use of a burette, letting in the fluid by pressure from a height. But I find that by using a syringe with a perfectly smooth and easy-running piston I get much better results, and the advantage of the syringe is that it also enables one to withdraw the fluid at once. I use a graduated all-quartz syringe made of vitreosil.

If the kidney is already infected I usually finish by washing out the kidney with 4 c.cm. of 5 per cent. colloidal silver,* but if not I do not wash the kidney out at all. Sodium bromide

is not in itself an antiseptic. I am therefore accustomed to add 1 c.cm. of a 1 in 1,000 mercury oxycyanide solution to every 9 c.cm. of 20 per cent. sodium bromide solution. This makes a weak antiseptic solution and one which in practice in my hands has been found to prevent infection of the kidney. I am indebted to Professor Leguen for the idea of adding the mercury oxycyanide, which acts as an additional safeguard.

Until recently one of the chief difficulties in this work was that when one used a syringe or burette one had to pass the fluid into the ureteric catheter through a very fine nozzle, finer than the internal lumen of the ureteric catheter; but for the last two years I have used a most ingenious piece of apparatus brought to my notice by the Genito-Urinary Manufacturing Company, which originated, I believe, from Paris. It consists of a small tube of rubber about an inch long. This, instead of having a cylindrical lumen, has a lumen consisting of two inverted cones. At each end the lumen is wide, but it narrows rapidly towards the centre of the tube, where it is quite small and less than the size of a No. 5 ureteric catheter. One end of the rubber tube is fitted on to the large nozzle of the syringe, the other end fits over the ureteric catheter, which is pushed up until it is firmly lodged in the narrow end of the cone. In this way fluid passes quite easily from syringe to ureteric catheter and back again. It has made just all the difference to me in ease of manipulation.

A great deal has been made of the dangers of this method of examination. Abroad and in America one or two deaths have been reported, mostly in the early days, when great force was often used, so that kidneys were overdistended, and in one or two cases the pelvis was actually ruptured. One fatal case occurred recently in America, caused by poisoning from stale thorium nitrate. It is to be remembered that when drugs are injected under too great tension into the renal pelvis they may be absorbed into the lymphatics and even into the blood stream. It is, therefore, not wise to inject poisons into the renal pelvis, and it has lately been proved that stale thorium nitrate and potassium iodide are poisonous in large doses, but that sodium bromide and colloidal silver are not poisonous. I have never employed any other materials than the two latter, and I have never seen any fatal result, and no result for which I have had to cut down on the kidney, as has been reported in the literature. Once or twice in my early days the patient has experienced considerable pain afterwards for some hours, has vomited, and has even had a little fever, accompanied by a rigor; but for the last two years, since I have used the improved technique described above, I have not seen any of these complications. Occasionally the patient suffers with a mild pain for a few minutes after the examination is finished, but this is quickly recovered from and yields readily to a dose of aspirin and rest in the recumbent position for half an hour. I do not meet even with this in one case in thirty, and it is never more than a mild and quickly passing phenomenon. If the patient does complain of slight renal pain after the injection it is an additional help in the diagnosis. He can then say the pain is exactly similar to the pain from which he has been suffering, or he can say it is quite different; in other words, an artificial renal pain has been created and enables the patient to distinguish between that and the usual pain of which he complains. Nevertheless I always ask the patient to drive home at once and go to bed for the rest of the day; or if he comes from a distance I persuade him to go into a nursing home for the night, though many reject the advice as they say they feel quite normal, and usually they are none the worse for it.

It is necessary to sound a warning. This method should not be used except by men who have trained themselves as experts in the use of the catheterizing cystoscope and in the use of this method. It needs several years of careful practice before one can carry it out without producing pain and discomfort. It is also necessary to exercise wise judgement in selecting cases for this examination. This method is not to be used routinely for all renal cases, as is commonly done abroad; it is only to be used when it is impossible to make a full diagnosis without its use, and when all other methods have been previously tried. There is no doubt it has been used too extensively by certain workers as a routine method. If you can make a full and accurate diagnosis by simple methods, do not strain at a gnat and insist upon carrying out all the full paraphernalia of possible urological research. Thereby you may swallow a camel and your patient be worse rather than better.

* Five per cent. and 10 per cent. suspensions of colloidal silver are now prepared for me ready for use by the Crookes Laboratories, 22, Chenies Street, London, W.C.1.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

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FIG. 19.

FIG. 20.

FIG. 21.

The lecturer then exhibited a series of lantern pictures illustrating a large number of pathological conditions. A selection has been made from these for publication as a Special Plate. The following notes are descriptive of the conditions shown.

Normal Kidney.

Fig. 1.—Showing the normal appearances of a normal kidney. Note the axis of the ureter running upwards to the upper portion of the pelvis, the necks of the calyces arranged in an upper, middle, and lower group (anterior and posterior), and the outline of the nipples of the pyramids opening into each calyx.

Congenital Abnormalities.

Figs. 2 and 3.—Showing a large solitary kidney on the left side, with the ureter on the right side ending blindly, or congenital absence of one kidney, by no means an uncommon phenomenon. The patient complained of aching in the left kidney, which was too heavy and had dropped considerably, and asked for its removal. Needless to say the request was refused and a belt brought relief.

Figs. 4 and 5.—Showing a case with four ureters opening into the bladder, all of which were catheterized. There is a double kidney on the left side and a double kidney on the right side with an early tumour of the lower pole. The patient complained of haematuria. The double kidney and tumour on the right side were removed.

Fig. 6.—Showing a horseshoe kidney. The upper part of the kidney is above the limits of the plate.

Fig. 7.—Showing an early hydronephrosis associated with a large aberrant renal artery pressing forwards on to an S-shaped kink of the ureter. The patient complained of renal crises. The artery was divided and a plastic operation performed on the kink. The kidney was saved, with complete relief of the symptoms.

Dilatation of Renal Pelvis associated with "Dietl's Crises."

A. *Congenital Hydronephroses.*—The lecturer said: I am not dealing now with large cystic hydronephroses of the kidney, which are quite obvious on abdominal palpation, and which are usually operated on for pain, bleeding, or infection, without any need for pyelo-radiography. I am dealing now with people who are born with congenital strictures, kinks, or valves in their ureters, or with abnormal renal arteries and bands pressing on their ureters, and who later on in life develop gradually increasing degrees of hydronephrosis. These patients complain of intermittent attacks of renal pain, and though it is sometimes possible during an attack of pain to feel a certain amount of enlargement of the kidney, yet as soon as the pain has passed the kidney returns to its normal size as it empties itself of any excess of fluid. These are the cases where the pyelo-radiogram comes as help to the diagnostician. Ordinary x-ray examination reveals no stone; a ureteric catheter is passed, and such pictures are obtained as are shown in the series of pyelo-radiograms. In these cases dilatation always falls primarily on the renal pelvis, and to a far greater extent in the early stages than on the substance of the kidney. The kidney substance is also thinned out, it is true, but the kidney lies like a cap on top of the dilated cystic pelvis—exactly the reverse to what usually happens when the pelvis is blocked by a small stone; then the pelvis shrinks on to the stone, and the kidney substance itself becomes a large distended cyst.

Fig. 8.—This shows the earliest degree of ballooning of the pelvis. The necks of the calyces are not yet distended at all. The patient complained of left renal crises.

Fig. 9.—This shows a higher degree of ballooning, and now a distinct dilatation or clubbing of the neck of the upper calyx can be seen. This illustrated another rule which I have observed—namely, that in hydronephrosis the stress always falls on the upper and lower calyces long before it falls upon and dilates the middle group of calyces. Attacks of pain. Kidney removed.

Fig. 10.—This shows a further stage in the development of hydronephrosis. The ureter is strictured at its junction with the pelvis and is inserted in a valve-like manner high up on the wall of the pelvis. There is advanced dilatation or clubbing of all the calyces. Attacks of pain. Kidney removed.

In none of these cases could the kidney be felt to be enlarged.

Fig. 11.—Showing the final stage of hydronephrosis. This was a large cystic kidney that could be felt on abdominal palpation. It took 40 c.cm. of fluid and even then was not nearly fully filled. It shows the extreme dilatation of the necks of the calyces. Attacks of pain. Kidney removed.

B. *Movable Kidney.*—Another form of dilatation of the pelvis of the kidney is seen in cases of movable kidney. A true hydronephrosis of the congenital type is never produced by mere excessive mobility of the kidney. Movable kidney can only produce a certain amount of ballooning and hollowing of the renal pelvis and calyces associated with

intermittent kinking of the ureter. The process can be followed in a series of pyelo-radiograms here shown.

Fig. 12.—The earliest degree is a kidney too low and too movable, with slight bending rather than a kink of the ureter, and with only the slightest ballooning. Fig. 13 shows an increase in the ballooning; and finally Figs. 14 and 15 exhibit a corkscrew-like kinking of the ureter.

Personally I always endeavour to avoid operating on movable kidneys. Those that are due to slack abdominal muscles can usually be relieved by abdominal exercises and strapping or a belt. Those that are due to a congenital narrow chest are often simply tender spots, the reflexes of an overwrought nervous system. If the nervous system can be rested and treated the kidney ceases to be tender. Nevertheless in this class of case patients are met with who get occasional attacks of most violent colic associated with anuria and followed by polyuria, "Dietl's crises." In between the crises they are often quite free from pain and do not complain of an aching kidney. It is in these we get pictures such as I show (Figs. 14 and 15) with marked kinking of the ureter and dropping of the kidney. I am willing to operate on such cases, as anchoring the kidney in its proper position does relieve them of these attacks of colic. Nevertheless the operation is a difficult one to perform satisfactorily. Far too often the surgeon cuts down and fixes the kidney either too low or else too high, and the condition is not relieved. In Fig. 16 I show an example of a kidney which has been fixed in too low a position by a surgeon. The colics were not relieved, and were so severe that I had finally to remove the kidney.

C. Sometimes inflammatory strictures of the ureter arise either from long-continued infection of the kidney or from the previous passage of a stone. In these cases there is usually an associated fibrotic thickening of the pelvis of the kidney, or you get a shrunken pelvis with an irregular outline (examples of which were shown).

Renal Tumours and Painless Haematuria.

In a certain number of cases where we can detect bleeding coming from one kidney, we are still in doubt as to whether we are dealing with a renal tumour, because we may not be able to feel a very large kidney on that side. In such doubtful cases pyelography is often of great service, as it may show the tumour projecting into the pelvis and altering the shape of the pelvis. Fig. 17 is an example of this. Here a tumour is growing from the lower pole of the kidney and has obliterated all but the upper portion of the renal pelvis.

From Other Abdominal Tumours.

Cases are often brought to me with a diagnosis of renal tumour and very often one is in doubt as to whether one is dealing with a renal tumour or a tumour of the liver, gall bladder, or other abdominal organ. Pyelography soon settles the question. If it shows up a normal kidney the tumour must be something other than a renal tumour.

Renal Pain.

Other cases are sent up to me with a diagnosis of renal pain or renal colic. X-ray examination fails to reveal a stone and the urine is free from pathological elements. In these cases I am accustomed to obtain a pyelo-radiogram. In many cases I can say definitely that the kidney is normal in size and position and cannot be the cause of pain, and such information is of considerable value. In other cases I find some cause for the pain in the kidney, such as a too movable kidney with a kinked ureter.

Stones.

A certain number of stones are of such composition that they fail to show up well on ordinary x-ray examination. In these cases it is sometimes possible to show up a stone by injecting colloid silver or sodium bromide into the renal pelvis and taking two plates, one at the time, the other five or ten minutes later. Very often one can see the alteration in a calyx or pelvis caused by the stone, and some of the colloid silver may adhere to the stone and show up in the picture taken five or ten minutes later.

Infections of the Kidney.

In some cases of obstinate chronic pyelitis due to the colon bacillus I find this method of value. In some of these cases the ureter has become narrowed by the disease, in others there is a chronic abscess present in the kidney. If one of

these cases fails to react quickly to renal lavage then I am accustomed to take a pyelo-radiogram to see if I can detect narrowing of the ureter, fibrosis of the renal pelvis, or even an abscess in a portion of the kidney.

Ureterograms.

In most cases it is possible to show up the anatomy of the ureter by this method and exclude phleboliths, glands, etc. In a certain number of cases of ureteric calculus the calculus does not appear on the x-ray plate, especially if the stone is lying in front of bone. A catheter is passed and is found to stop four to six inches up the ureter. A film is then placed beneath the pelvic portion of the ureter, sodium bromide injected, and an x-ray picture taken. This may then show up a stone impacted in the ureter, the ureter dilated below the stone, the catheter running up to the stone, and very often some of the bromide will run past the stone and show up the dilated ureter above the stone and a stricture at the site of the stone. Fig. 18 illustrates this particularly well.

Fig. 19 provides another interesting example. The patient came to me suffering from pyelitis of pregnancy which persisted after the child was born. I catheterized the right ureter and filled it up with colloid silver. It shows very well the dilated condition of the whole ureter. As I have pointed out before,³ the ureter in pregnant women undergoes dilatation due to loss of tone in the muscle of the ureter rather than to pressure of the uterus. This tone returns very slowly after pregnancy. This is the first time I have been able to demonstrate this fact by the ureterogram in the living subject.

Cystograms.

From time to time it is of value to take x-ray pictures of the bladder when filled with opaque solutions. I find that sodium bromide, even in strengths of 10 or 15 per cent., is apt to be very irritating to the bladder and cause great pain, especially if the bladder is inflamed. I therefore prefer to employ 10 per cent. colloid silver. This does not cause any pain in the bladder, and shows up quite well enough for practical purposes. Pictures should be taken in the antero-posterior and also in the lateral positions. The method is useful chiefly for showing up the extent of bladder pouches. One can see the openings of the mouths of the pouches with the cystoscope, but very often one can have no idea as to how large the pouches are until one takes a cystogram (Fig. 20).

Another use for this method is to study the outline of the bladder and prostatic cavity after prostatectomy, and it is also possible to determine by this method whether the ureters are allowing fluid to run from the bladder into the kidney in cases of back pressure. The bladder is filled with colloid silver, and the patient is placed with the head down. In some cases the colloid silver is found to run back from the bladder into one or both kidneys in cases of back pressure, also in some cases of tuberculosis and other infections of the kidney with dilated ureters.

Finally, Fig. 21 shows a case of recto-vesical fistula in a man following on a fractured pelvis. I was able to cut down, excise the fistula, and cut off the rectum from emptying its contents into the bladder.

Conclusion.

Pyelography has established its position as a valuable method of clinical research in urology. It is indicated particularly in cases of severe abdominal pain of doubtful origin, to determine also the nature of abdominal tumours, and to complete the diagnosis in many cases of haematuria and pyuria.

REFERENCES.

¹ Pyelo-radiography: A Clinical Study. *Proc. Roy. Soc. Med.*, Surgical Section, 1913, vol. vii, pp. 16-40. ² Carelli: Royal Society of Medicine, December 8th, 1921. ³ *Common Infections of the Kidney*, p. 97.

THE Fifth Congress of French-speaking Paediatrists will be held in Paris on July 10th, under the presidency of Professor Weill of Lyons, when the following subjects will be discussed: (1) The place of pituitary and pineal glands in infantile dystrophy, introduced by Dr. P. Lereboullet. (2) Infantile diabetes mellitus, introduced by Dr. Rohmer of Strasbourg. (3) Congenital scoliosis, introduced by Drs. Mouchet and C. Roederer. (4) The rearing of children outside the family, introduced by Drs. H. Méry and Ribadeau-Dumas. (5) Infantile hygiene in Switzerland from the social standpoint, introduced by Dr. A. D'Espine and Dr. Reh of Geneva. Further information can be obtained from the general secretary, Dr. Péhu, 24, Place Bellecour, Lyons.

The Milroy Lectures

ON THE

INFLUENCE OF INDUSTRIAL EMPLOYMENT UPON GENERAL HEALTH.

DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS
OF LONDON ON MARCH 9TH, 14TH, AND 16TH, 1922,

BY

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LECTURE III.

So far we have investigated the hygienic importance of industry by the topographical and historical methods; the result has been to show that some conditions of industrial life are correlated with factors of excessive mortality; we have failed to establish a causal nexus—to pass from correlation to causation. We have now to consider whether other methods of study lead to more precise conclusions. We might, in the first place, retain the topographical method and adopt another unit—for instance, the physique of the inhabitants of different towns. But unfortunately such data as exist are quite inadequate, so I pass to another line of inquiry—namely, occupational comparisons, the unit of comparison being a rate of mortality.

Occupational Mortality in General.

In this region Dr. Farr was, as in so many other regions, the pioneer, and decennial evaluations of occupational mortality in England and Wales go back fifty years; in any compilation of industrial rates of mortality the English statistics are predominant, and they have done duty in arguments and influenced legislation in all parts of the world. It was therefore to be expected that their value would be frequently criticized. The criticisms to which such statistics are exposed fall into two classes: (1) It is doubted whether the rate of mortality shown in a particular occupation does in fact represent the "real" mortality of that occupation; (2) it is doubted whether, even if the former question is answered affirmatively, an excess of mortality in a particular occupation is really cogent evidence that such occupation is unhealthy.

The weaknesses which authorize the criticisms under (1) are: (a) That the basis of classification has not only been changed from census to census, but is still (I am speaking of the census of 1911) "only truly occupational in parts, being as regards manufacture for the most part frankly industrial. Thus the driver of a motor car is classified as a chauffeur—his occupation; but the workman engaged upon its manufacture is classed either as a motor-car chassis maker or as a motor-car body maker—headings which indicate merely the industry in connexion with which he plies his trade, whether it be that of tinsmith, moulder, fitter, sandblast-man, painter, or what not" (General Report of Census of England and Wales, 1911, Cmd. 8491 of 1917, p. 12). (b) That there is no guarantee that the occupational description in virtue of which an individual contributes to the total years of life lived, to the denominator of the fraction measuring the rate of mortality, will be the same as that upon the death certificate which admits him to the numerator.

The occupational complexity of our own profession is not greater than that of most industries, but it sufficiently illustrates the point. The industrial description of all persons admitted to the *Medical Register* since 1886 would be, I suppose, physician, or surgeon, or accoucheur, any one of the terms implying both the others. Consider the troubles that would await a statistician who wished to determine whether the rate of mortality of physicians in the occupational sense differed from that of physicians in the industrial sense. It is quite as much for these reasons as for the desire to base rates upon large numbers that the statistical grouping of occupations is a coarse one.

There is a further point: although the method of inquiry which we are discussing formally renounces geographical or topographical differences, for some of the largest industries of the country the renunciation is purely formal. In 1911 83.2 per cent. of the total number of persons engaged in cotton manufacture were enumerated in Lancashire and nearly all the remainder in the adjoining counties of the West Riding of Yorkshire and Cheshire; 88.7 per cent. of those engaged in wool and worsted manufacture were enumerated in the West Riding of Yorkshire. When we compare the rates of mortality of cotton manufacturers with those of, say, printers,