Br. abortus. A positive reaction is characterized by the appearance in six hours of a slightly raised oedematous plaque, 4 to 6 cm. in diameter, distinguished in colour from that of the surrounding skin; the reaction, which may be accompanied by pain, persists for about two days. According to Burnet, the intradermal test is often positive when the agglutination reaction is negative, and he considers, therefore, that it is of greater diagnostic value than the agglutination test. This may hold true in *melitensis* infections, but it is doubtful in *abortus* infections; Huddleson and Johnson,³ for example, in a small series of cases, encountered one subject who failed to react to the intradermal test, even though his serum had an agglutinin titre of 1 in 500. The test has the advantage of simplicity, and is well worthy of trial on a large scale.

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HYDRONEPHROSIS DUE TO KINKING OF THE UPPER END OF THE URETER.

BY

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HYDRONEPHROSIS is usually due to obstruction of the flow of urine along the ureter. The obstruction may be a stone or other body within the ureter, it may be a stricture or kink of the wall, or it may be something pressing upon the ureter from outside, such as an abnormal vessel,¹ fibrous band, or tumour.

Here I am chiefly concerned with a valvular condition² of the upper end of the ureter which is often overlooked until the kidney has become seriously damaged or even destroyed by long-continued obstruction, with or without added septic infection. I have had reluctantly to remove many such kidneys which could have been saved by timely operation.

After nephrectomy there is always the fear that the remaining kidney may become fatally obstructed, for the anatomical abnormality is sometimes bilateral. Hence the importance of drawing attention to this condition so that the obstructed kidney can be saved, and not have to be removed.

Etiology.

There is very often a congenital narrowing at the upper end of the ureter where it joins the renal pelvis; and sometimes there is a valvular fold of mucous membrane there, or the ureteral orifice is not at the lower end of the infundibulum of the pelvis, but on one or other side of the pelvis. The ureter then runs for some distance along one wall of the pelvis, and is usually adherent to it. Any distension of the pelvis in these circumstances is likely to obstruct the ureteral orifice in a valvular manner; this increases the distension and dilatation of the pelvis. A similar state of obstruction is well known in the large arteries and in the oesophagus. In the former a sacular aneurysm may obstruct the distal part of the artery; in

the latter a full oesophageal pouch frequently obstructs the distal part of the gullet.

In the course of time, attacks of obstruction marked by renal pain become more frequent, the pelvis gradually dilates, and inflammatory adhesions take place around the pelvis, and these tend to increase the obstruction. In one case of pyonephrosis I found the upper ureter folded into three complete kinks by such adhesions; the kidney was pyonephrotic, and so thin that it could not be saved. Mobility of the affected kidney certainly adds to the obstruction, and great descent of the kidney may be an important cause of kinking of the ureter, but mobility is also a result of repeated distension of the kidney.

Symptoms.

There is a history of repeated attacks of pain in the loin behind and in front. These attacks sometimes begin during childhood or adolescence, but more often during early adult life. The pain rarely extends downwards to the groin or thigh, and there is rarely any dysuria or abnormal urine. These points distinguish this condition from stone, but not from obstruction of the ureter by abnormal blood vessels. Gradually the attacks become more severe and more frequent, and before long a renal swelling may become noticeable during the attacks. The appendix is frequently removed in mistake and without benefit, and I have known fruitless operations undertaken for supposed cholecystitis or for ileal kink. In the course of time a typical hydronephrotic swelling may be found during the attacks, and pyonephrosis sometimes develops, with or without pathological urine.

Diagnosis.

Some of the pitfalls have been mentioned. We have to distinguish this renal affection from those of the other abdominal viscera by exercising care and caution, and making complete examinations. The location of pain and tenderness in front and behind the kidney is very important. Cholecystography is often invaluable in excluding disease of the biliary tract. We have then to distinguish this from other renal conditions, especially from other kinds of obstruction of the ureter, such as stone and abnormal renal blood vessels.

The entire absence of blood, pus, or albumin is against stone, and so is a negative good radiogram, although this can never be quite conclusive. Ureteral catheterization and pyelography, and possibly uroselectan, should generally establish the diagnosis long before the hydronephrosis becomes visible or palpable. Finally, these repeated attacks call for operation, which serves completely to establish the refinements of diagnosis, and to cure the condition by simple operative measures.

Operation.

The kidney is explored through the usual time-honoured and excellent oblique incision in the loin below the last rib. The kidney is carefully separated and delivered, and turned forward so that the renal pelvis and ureter

can be minutely examined from behind. Any abnormal renal vessel or band of fibrous tissue obstructing the ureter is tied and divided. If none of these, or stone, is found, and yet the ureter is of normal size and the pelvis is dilated or distended, the diagnosis of valve ureter is established, and the condition is treated either by enlarging the opening, as shown in Fig. 1, or after Fenger's method

FIG. 1.—Valve ureter; ureteroplasty. The incision made to overcome the valve and stricture is shown. A continuous suture of fine catgut is inserted as demonstrated in the figure.

¹ *The Operations of Surgery*, vol. ii, p. 582.

² The late Sir Henry Morris described this abnormality in his standard work *Surgical Diseases of the Kidney and Ureter*, vol. ii, p. 423.

(Fig. 3), or by making an anastomosis between the lower pole of the pelvis and the ureter at the same level (Fig. 2), fine catgut being used throughout.

Division of the ureter, with implantation of it into the lowest part of the infundibulum, is neither so easy nor so infallible as the methods recommended above.

FIG. 2.—Large hydronephrosis due to valve ureter. The opening of the ureter is high up. The incisions for an anastomosis between the lower part of the pelvis and the ureter are shown.

In the course of years I have operated on many cases of stricture, with or without valvulation of the upper end of the ureter, with excellent results, except in the late cases where the kidney has become spoilt and had to be removed in order to save life and relieve symptoms.

The following examples illustrate the difficulties of diagnosis and the results of treatment some years after operation.

CASE I.—Hydronephrosis due to Valve Ureter Mistaken for Cholecystitis; Ureteroplasty; Recovery.

A spinster, aged 39, had had attacks of pain twenty years previously in the right hypochondrium, alternating with attacks of appendicitis. Appendicectomy was performed by Sir H. T. Butlin during an interval in 1903. After the operation the attacks of pain in the right hypochondrium often recurred, with sickness; they were thought to be due to floating kidney. She felt very seedy with the attacks, and they recurred about once a week up to October, 1922. Between October and February she was free from them, but felt tired and unwell. For the last five weeks she had had an attack about once a week. She had no fever, and the urine was normal. She saw various doctors in the country and in London, who thought the gall-bladder was the cause of the trouble (? gall-stones). Dr. A. H. Spicer brought the patient to see me. He had on several occasions felt a swelling in the gall-bladder region, but the patient was not tender there when I saw her. On repeated questioning she said she never had any trouble with micturition. I agreed with the diagnosis of obstructive cholecystitis, and advised exploration. An acute attack, with pain and swelling in the right flank, developed the night before the operation.

Operation.—March 22nd, 1923. Dr. Spicer assisted. A Kocker incision was made. The gall-bladder was normal, the liver low, and the duodenum normal. There was a large hydronephrosis adherent to the under surface of the liver. The abdomen was closed, and an incision made behind in the loin. The kidney was mobilized; it was rather thin. The large hydronephrosis was partly emptied with difficulty by massage. Valve ureter and stricture were found, with adhesions to the pelvis. Anastomosis, $1\frac{1}{2}$ inch in diameter, was made between the lower end of the infundibulum and the ureter. Fine catgut was used. The patient has remained well now for seven years.

CASE II.—Hydronephrosis due to "Valve Ureter"; Fenger's Operation and Nephrectomy; Recovery.

A woman, aged 31. For twenty years she had sudden attacks of pain in the right groin, occurring at intervals of from a fortnight to six weeks, but having no relation to the periods. For about ten years the patient had complained of attacks of pain in the right loin extending along the ureter. In 1908 she was admitted into a medical ward for a swelling on the right side diagnosed as tuberculous kidney, but as the swelling suddenly disappeared, hydronephrosis due to a kinked ureter was suggested. Radiography revealed no stone. She was x-rayed at Guy's Hospital six years later with a negative result, and I ordered her a belt, which enabled her to go on pretty well for about two years, and then the pains returned in spite of the kidney belt. Dr. Stratton was fortunate to find her one day when the kidney was greatly enlarged. He therefore sent her to me again with a view to operation. The history of colic was very definite, and an x-ray examination again failed to reveal any stone; therefore a diagnosis of either an abnormal artery kinking the ureter or valve ureter, or a small stone, was made.

Operation.—June 9th, 1916. I found a large hydronephrosis with a moderately good kidney, which seemed worth preserving. The hydronephrosis was due to valvulation at the junction of

the ureter and pelvis. The ureter was quite natural, but the pelvis was larger than a cricket-ball, and there was a very obvious kinking at the junction. I therefore enlarged the opening at the junction after Finney's method of gastro-duodenostomy, using fine catgut in two layers, the superficial one only taking up the fat. There was no leakage of urine through the wound, and blood

FIG. 3.—Pyelo-ureteroplasty, for stricture (Fenger's operation). (a) Stricture and valve incised longitudinally. (b) and (c), Wound sewn up transversely.

appeared in the urine next day. A few days after the operation the patient had a feeling of distension in the old situation. She made a good recovery, but had slight recurrences in 1921 and 1923.

CASE III.—Hydronephrosis due to Valve Formation at the Junction of the Renal Pelvis and Ureter; Anastomosis; Recovery.

A married woman, aged 66, gave a history of severe attacks of pain in the left loin on and off for many years. Sixteen years previously she was an in-patient in the London Hospital for pain in the left flank, which was thought to be due to gastric ulcer. There was no haematemesis. A year later she was seen by the late Dr. J. H. Bryant, who found both her kidneys unduly movable, and ordered an abdominal belt for their support. About eight years ago she had haematuria for several months, and albuminuria for a year afterwards. In the intervals between the attacks of colic she had an aching pain in the left flank. In December, 1921, her doctor found a large cystic bilobular swelling in the abdomen close to the pubis on the left side, and he sent her to see me with a suggested diagnosis of growth of the colon.

When I examined her (December 16th, 1921) the swelling was the size of a foetal head, very freely movable in the abdomen. It could be pressed back into the left loin, but not into the right loin or right iliac fossa. It was bilobular, the upper and left lobe being smaller and flatter than the spherical elastic lower and medial portion. The left kidney could not be felt apart from this swelling. A diagnosis of left hydronephrosis was confidently made. The cause appeared uncertain, and might be due to small stone, an abnormal renal vessel pressing the ureter, or kinking of the upper end of the ureter by the descent of a very movable kidney. X-ray examination revealed no stone, but a negative report in such a case is never conclusive, for urate stones small enough to enter the ureter often do not show on the x-ray plate. While the patient was in Guy's Hospital undergoing investigations the swelling disappeared, and a very large amount of urine was passed.

Operation.—January 12th, 1922. The left kidney was exposed through the usual oblique incision in the left loin. It was extraordinarily movable and low; its cortex was fair in consistency and colour, but thin; its pelvis was empty but greatly dilated, the ureter normal and patent throughout. The junction of the ureter and pelvis was thick and narrow, and placed far above the lower pole of the pelvis, thus forming a valve which became more and more obstructive as the pelvis distended with urine. A long incision was made through the contiguous borders of the pelvis and ureter, dividing the valve. The incision was then sewn in reverse with catgut, after Fenger's method, thus overcoming the obstruction. The patient made a good recovery.

CASE IV.—Hydronephrosis Destroying the Kidney; "Valve Ureter"; Nephrectomy.

A woman, aged 31, who was florid and fat, gave a history of three severe attacks of anaemia. At the present time the blood is almost normal, red corpuscles being 5,000,000 and haemoglobin 80 per cent. There was a very large swelling in the left loin the size of a man's head. It was dull in front, movable from side to side and from above downwards. It seemed to have an anterior hard edge like a spleen, but the hand could be placed above it, between it and the left costal margin, and I thought there was splenic dullness separate from it in the chest behind. Mr. Bellingham Smith had had her admitted to his ward about a year ago, but he thought the swelling had nothing to do with the pelvic viscera. There were no urinary symptoms. The diagnosis lay between splenic tumour, pancreatic cyst, and a very large renal swelling. The woman was so fat that it was difficult to examine her well.

Operation.—April 10th, 1924. A very long left paramedian incision was made, and it was at once found that the swelling was

retroperitoneal, bulging forwards on the mesial aspect of the descending colon; the transverse colon and the splenic flexure were above it. The great omentum was adherent across the front of it to the descending colon. The liver, spleen, and other viscera were normal. A vertical incision was made through the peritoneum on the outer side of the descending colon, and the tumour was shelled out and removed. It contained five pints of clear, watery liquid, and was the cystic remains of the kidney. There was no recognizable renal tissue in it, but the ureter issued from its inner aspect at the lower point of trisection. The condition was one of valve ureter; there was no constriction by any abnormal vessel. The ureter itself was small in size. Three large renal vessels had to be tied and divided. The other kidney was larger than usual, but otherwise normal. The patient made a good recovery.

CASE V.—*Hydronephrosis due to Valve Ureter; Ureteroplasty; Recovery.*

A very stout married woman, aged 64, was admitted to Guy's Hospital on January 24th, 1928. In 1906 hysterectomy for fibroids was performed. Since 1914 she had had numerous attacks of severe pain in the right flank, below the costal margin, passing through to the back, below the last rib. For years these attacks were thought to be due to gall-stones. There was no history of jaundice, or of anything wrong with the urine or urination. In October, 1927, a bad attack developed, with high fever and "a swelling filling up nearly all the right flank, which was evidently a hydronephrosis." The symptoms gradually abated, and the patient was quite well until December 14th, when the signs recurred with severe pain, vomiting, and a large swelling reaching to the middle line, with a temperature of 103° F. This time the urine contained large quantities of pus. With rest, dieting, and large doses of potassium citrate the patient got fairly well, but the swelling did not entirely disappear; it could be felt in the right loin, which was dull behind and resonant in front. X-ray examination did not show any stone in the kidneys or ureters. Pus and only a little urine issued from the right ureter, whereas the left kidney was excreting plenty of normal urine, and the blood urea was normal.

Operation.—The right kidney was explored through the usual oblique incision in the loin. There was a large hydronephrosis containing offensive urine, the kidney was considerably but not hopelessly damaged, the ureter was normal but empty and completely obstructed at its origin high up on the inner wall of the greatly dilated pelvis; it was not constricted by any abnormal renal blood vessel. The obstruction was overcome by slitting up the pelvis and ureter at their union, the incision extending over an inch into each, and being joined with fine catgut in such a manner as to remove the valvular obstruction, after Finney's method of pyloroplasty. The patient made a good recovery.

THE SIGNIFICANCE OF REFLEX ACTION IN COLOUR VISION.*

BY

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WHEN the retina of the left eye has been stimulated by light of any pure spectral hue above a certain intensity it is found that the sensitivity of the right is enhanced for three colour sensations, which are invariably red, green, and violet. The predominant enhancement always occurs for the sensations complementary to the stimulating colour. If the intensity of the stimulus falls below a certain critical intensity, which for white light is about 0.25 metre-candle, the effect upon the right eye is opposite in character, since it inhibits or depresses the sensitivity of all three colour sensations. When the stimulating colour of sufficient intensity is applied to the right eye the measurements on that eye show that the one sensation, red, green, or violet, chiefly involved, if the stimulus is a simple colour, or the two if the colour is compound, as orange, yellow, and blue, are depressed in sensitivity, while the complementary sensations are enhanced.

These experiments, both contralateral and ipsilateral, may be readily explained by assuming the existence in the visual neural apparatus of a sensory reflex action, which may exercise either a facilitating or an inhibiting influence on the retinal sensitivity by which its responsiveness becomes enhanced or depressed. As the basis of the visual theory I am presenting is the existence of such a sensory

reflex, it is desirable to establish it with the greatest possible amount of experimental evidence.

In the sense of hearing, measurements have now been made in my laboratory by J. F. Allen which show that stimulation of one ear by a pure tone either enhances or depresses the sensitivity of the other in a manner similar to the contralateral effects in vision.

In the sense of taste, also, measurements show that stimulation of one side of the tongue by solutions of sugar, salt, acetic acid, and sulphate of quinine, depress and enhance the four gustatory sensations, both ipsilaterally and contralaterally, precisely as in vision. It is found that weak solutions of these substances inhibit gustatory sensitivity, just as feeble light inhibits retinal sensitivity; while in illustration of the facilitating process it is well known that distilled water stimulates the sweet taste after this has become enhanced in sensitivity by stimulation with an acid or a salt solution.

Besides eliciting the sensations of taste, stimulation of the tongue by solutions evokes an enhanced activity of the parotid gland by which the amount of saliva secreted in a given time is much augmented. Inhibitory effects also occur. Measurements show that both ipsilateral and contralateral actions take place with appropriate stimulation.

In the muscles it has been found by measuring the angle of elevation of the arm by post-contraction after stimulation has ceased that stimulation of the left arm affects the right in the same way that stimulation of one eye or ear affects the other, or stimulation of one side of the tongue influences contralaterally the sensations of taste on the other side and the secretory activity of the opposite parotid gland.

No contralateral experiments in the sense of touch were thought of at the time the investigation was made. But it was shown that ipsilateral stimulation of the fingers of one hand enhanced the sensitivity of the index finger in the same manner that stimulation of one part of a retina influenced the sensitivity of an adjoining area, or of one part of the tongue influenced adjacent receptors.

In all these cases it was found possible to express the measurements in a mathematical law, which states that some measure of the response is proportional to the logarithm of the intensity of stimulation. The formula, which is similar to Fechner's celebrated psycho-physical law is $R = k \log I \times c$, where R is the measurement of the sensation, I the intensity of stimulation, and k and c are constants.

The evidence cited has been set forth at length in numerous papers published by the writer and his students. It proves quite conclusively the identity of the actions in all the neural systems to which reference has been made. No exception will probably be taken to the explanation of the phenomena of secretion and muscular contractions by reflex action. It seems reasonable to conclude, therefore, that the identical behaviour of the sensory neural apparatus similarly results from reflex action of a sensory character by which the sensitivity of the receptor end-organs is controlled.

The theory of sensory action to which these investigations lead may be briefly stated as follows. When a suitable stimulus is applied to receptor organs the afferent nervous impulses excite characteristic sensations in the cortical centres, and in addition simultaneously evoke reflex impulses, which are conducted to the receptors, causing either depression or enhancement of their sensitivity. The function of the sensory reflex actions is to control the sensitivity of the receptor end-organs. The alteration of sensitivity occurs in receptors for other sensation qualities within the area stimulated, and extends ipsilaterally to adjacent areas and contralaterally to corresponding areas on the other side of the body. Thus stimulation of an area of the right retina by red light, for example, causes a sensation of red, while the reflex or inductive reaction extends to the green and violet sensations within the area stimulated, and to all three sensations in surrounding areas of the stimulated retina and to the corresponding area of the left retina as well. The inductive action of dim light of all hues is depressing in character, while that of bright colours is enhancing. After the retinal receptors,

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