that it is a very efficient means of rendering the intestine a less suitable culture medium for most pathogenic bacteria.

Finely powdered or granulated charcoal absorbs gas in the intestines and is the best remedy I know for intestinal flatulence. It also makes the foulest stools almost odourless. It seems reasonable to suppose that it may also absorb some of the haemolysin and neurotoxin produced in Addison's anaemia. I therefore give a large tablespoonful of charcoal first thing in the morning and last thing at night.

As it is very probable that the haemolytic streptococcus, which can be isolated from the duodenal contents obtained through an Einhorn tube, is responsible for the toxæmia which causes Addison's anaemia, I advise the administration of an autogenous vaccine prepared from the patient's own duodenal haemolytic streptococcus, or, failing this, from a dental or tonsillar streptococcus. It should be given over a long period in doses so regulated as not to give rise to any general reaction.

The important part played by the spleen in the haemolysis of Addison's anaemia was proved by Hunter, who demonstrated the large amount of free iron it contained in fatal cases, and showed that splenectomy increased the power of animals to resist poisoning with such haemolytic toxins as toluylendiamine. Hijmans van den Bergh confirmed this by finding that blood removed from the splenic vein during splenectomy or after death in Addison's anaemia contained more bilirubin than the blood in the general circulation. It would therefore seem natural that splenectomy should be useful in Addison's anaemia, as it undoubtedly results in the removal of one of the sites of blood destruction. The results obtained in Addison's anaemia by splenectomy have not, however, in the past been sufficiently good to warrant the general adoption of the operation as a method of treatment. I believe that this is due to splenectomy having been tried independently of other methods of treatment. When employed in addition to the other treatment I have described it may prove to be of great value. Two patients of mine, who had shown no improvement for several weeks, and whose haemoglobin percentage would rise to 20 or just above after each transfusion, only to drop again to 15 a few days later, had their spleens removed by Mr. R. P. Rowlands and Mr. L. Bromley respectively. Though they had been delirious and extremely prostrate, they at once felt better after the operation, and the condition of their blood rapidly improved, so that both were able to leave hospital a few weeks later in definite remissions. All who had seen them during the weeks before the operations agreed that this improvement must almost certainly have been due to the splenectomy.

Symptomatic Treatment.

If the production of haemolytic toxins is arrested the blood shows spontaneous improvement. This may be greatly accelerated by symptomatic treatment. I need not say much about the treatment of the anaemia by arsenic, first introduced by Byrom Bramwell⁴⁹ in 1877, as it must be familiar to all of you. It should always be tried; in the majority of cases Fowler's solution given by mouth proves quite satisfactory, but occasionally some preparation which can be injected into the muscles or direct into the blood proves more efficacious.

Direct transfusion of blood was tried by Thomas Bryant in a case of Addison's anaemia at Guy's Hospital in 1879. I am convinced of the great value of this method of treatment, which generally requires repetition, often on several occasions. Experience shows that in many cases it not only adds a quantity of healthy blood plasma with normal red corpuscles to that already circulating, and in this way produces an immediate rise of 5 to 10 per cent. of haemoglobin, but it also frequently initiates a steady rise in the percentage, when this has been stationary or actually falling.

It might have been supposed that the cessation of toxæmia would not lead to any improvement in the nervous symptoms corresponding to that of the anaemia, although the progress of the spinal degeneration would be arrested. But I have seen considerable improvement result, not only in the sensory symptoms, but also in the ataxic paraplegia, quite apart from the result of treatment by re-education and exercises. This is probably due to the fact that the nervous tissue may be thrown out of action as a result of the toxæmia, but be still capable of recovering, if no more toxins are produced,

this being comparable with what occurs in various acute infective conditions involving the central nervous system. The degree of improvement which may occur depends therefore upon the amount of actual destruction of nervous tissue which is already present.

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TREATMENT OF TUBERCULOSIS OF THE URINARY TRACT.*

BY

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THE present century has witnessed a complete revolution in our ideas of the pathology and consequently of the treatment of genito-urinary tuberculosis. There are few of those present at this meeting who have not witnessed the use of a Volkmann's curette in the attempt to ameliorate a bladder lesion, an error indicative of the faulty pathological teaching of fifteen years ago. Progress in our conceptions of the disease is well shown by the attitude adopted at the congresses of urology held respectively in 1908 and 1913. At the former of these meetings the new teaching was in its infancy and on trial. It was accepted tentatively. The same subject was again set for discussion in 1913, and the general principles which guide us to-day were then established and accepted practically unreservedly.

The predominance of symptoms of cystitis, which is such a marked feature in this disease, was responsible for the view held previously—that the bladder was the organ primarily affected, and that the kidney became secondarily infected. This led to surgical energy being directed to the bladder instead of the kidney. Now we know that the kidney is primarily at fault, that almost invariably the disease is unilateral in its early stages, and that the bladder is affected secondarily. We know also that the other kidney will become affected in a very large proportion of cases, at a later date, and that if we remove the primarily involved organ the prognosis of the disease will be good, both as regards the bladder, which will heal, and as regards the other kidney, which is not very likely to become secondarily infected.

* Part of a paper read before the Manchester Surgical Society on March 16th, 1923.

These elementary statements foreshadow the broad lines on which treatment must proceed in this disease. The indications are, for the present, well established and generally accepted. In the absence of contraindication, either in the opposite kidney or systemically, nephrectomy must be carried out without delay in every case; the surgical world is still awaiting the report of a single authenticated case in which Nature itself has accomplished an undoubted cure. The discussion of treatment, therefore, resolves itself into one of detail.

The form of anaesthesia to be employed at the operation requires consideration from two aspects: (1) the effect on the remaining kidney, and (2) the possibility of lighting up foci of latent tuberculosis in the lung. The former of these requires little discussion, that anaesthetic which irritates the kidney least being selected. As regards the second, it should be remembered that Kelynak found that the *post-mortem* records show that 80 per cent. of the subjects of renal tuberculosis had also pulmonary tuberculosis, an observation which indicates the desirability of the careful choice of an anaesthetic. During the last eighteen months I have had the advantage at the Salford Royal Hospital of gas and oxygen for these cases, and I believe that this is the most suitable form of anaesthesia yet evolved for this particular disease. In one case where I undertook the cystoscopic examination for another surgeon, and then passed the patient on to him for operation, I heard at a later time that he had died of pneumonia, and though I do not know that this was a tuberculous condition, the possibility should be borne in mind.

The method of treatment of the ureter was greatly discussed about a decade ago, and even yet remains an occasional subject of debate. By the majority of urologists it is considered that where the bladder will heal the ureter will also heal and become converted into a fibrous cord, and that the amount of tuberculous material discharged from the ureter into the bladder is insufficient adversely to affect that organ. Braasch states that "Ureterectomy did not seem to affect the after-course materially. In fourteen cases in whom ureterectomy was done with the nephrectomy, the sinus persisted fully as long as in the others." Caulk says: "It is useless to try to remove the entire ureter since it heals with the bladder after the removal of the kidney, and that if one tries to remove the ureter, the most important part has to be left, that is the intramural part, and most men feel that such removal is unnecessary."

My own practice is to remove as much as can conveniently be taken away from an ordinarily generous loin incision, and I use the cautery in its division. Usually the portions of the ureter which are most affected are found to be the upper and lower segments, as in the case of the vas deferens. The middle section is generally but little involved, so that if the surgeon gets down as far as the beginning of the uninvolved area healing will be just as rapid as if an extra few inches were removed. An exception should be made in ureters which are occluded at some point in their course. If such a ureter be left the portion above the obstruction, being unable to drain itself into the bladder, must necessarily drain towards the loin incision, and the result will probably be a sinus in the flank.

Ureteric obstruction is an important factor in renal tuberculosis; it complicates the diagnosis by removing from the urine pus and tubercle bacilli, and by saving the bladder from infection; cystoscopic indications, therefore, are absent. It is said to occur in about 10 per cent. of cases. From the operative point of view it has also a considerable significance, because it predisposes to periureteral and perinephric sclerosis and adhesion, so that it is just in that particular case where one most desires to remove the ureter that the operation on the kidney is most difficult, and it will become a question in each case, after a difficult nephrectomy, whether it is desirable to prolong the operation for the purpose of removing the ureter. In the cases where I have met it I have not thought it discreet to do so, especially as I have found the ureter, particularly in one case, bound down and presenting considerable obstacles for removal.

It should be remembered that in the first few years of the new treatment of renal tuberculosis removal of the ureter was favoured, but was quickly given up as unnecessary and the cause of a higher operative mortality. Kelly,

who described an operation for removal of the kidney and ureter, together with a portion of the bladder wall surrounding the ureteric orifice, now states that this larger operation is rarely necessary. Alessandri, Kapsammer, Israel, and many others at one time recommended it, but have given it up. Schlagintweit in several cases cut the ureter and allowed it to retract into the wound. No ill effects followed. Taddei has demonstrated by animal experiments that the ureter closes more quickly when not ligated. When ligated hollow spaces form in its walls, resembling true cysts; when left untied there was no reflux of urine into the wound, and the ureter atrophied more quickly. He therefore advised against ligation.

In one case of my own, where the sinus remained for eighteen months following operation, I judged that it originated from the ureter. I attacked the lower end of the ureter by a muscle-splitting incision in the iliac fossa, with the intention of removing it down to the bladder. It proved to be a thin fibrous cord, and the sinus was due to involvement of the perirenal tissues as will be discussed later.

Sinus formation is one of two sequelae which require consideration. In addition to the case just mentioned, I have met it in three cases: in one the sinus persisted for eight weeks and then closed, in a second it persisted for ten weeks, and in a third case the wound reopened after it had been healed for about a month, and persisted for about another month.

Pardoe has shown that many wounds which are left undrained are liable to break down at a late period, even after the patient has left hospital; as infection is slow to discover itself, it may escape observation if the cases are not followed in the out-patient department. Cabot and Crabtree state that in their cases primary closure resulted in 75 per cent. breakdown, the usual period being three to five weeks after the patient had left hospital. I always, therefore, make a habit of draining the wound, even where a clean removal of the organ has been accomplished.

Infection may originate from the stump of the ureter, yet, with the exception of those cases where the ureter is occluded, I believe that this is only a minor part of the truth, and that a more important source of trouble is the perinephric fat, which is in direct communication, not only with the subcapsular lymphatics, but also with those of the renal parenchyma; tuberculous foci are usually to be found in the fat itself. It is easy to trace the route of these infections in a section of any portion of a tuberculous kidney. Lines of infection, indicated by tubercles and round cells, radiate outward in streaks from the infected pelvic mucosa to the capsule. In the capsule a network of tuberculous infection radiates to every portion of the gland. These lymphatics in turn are in direct communication with those in the perirenal fat, and tubercles may generally be demonstrated therein, even in portions which appear quite healthy to the naked eye. (Kidd, Kuester, Kelly, etc.)

The possibility of infection of the wound from such a source is obvious. Several observers have recently laid stress on the importance of the removal of this fat at operation; more rapid healing of the wound is said to be achieved. In my opinion this is a more frequent cause of trouble than the stump of the ureter, and I always make an attempt to remove the fat after the nephrectomy. In doing so great care should be taken not to injure the adjacent peritoneum and thus risk its contamination.

The presence of these microscopic radiating lines of undeveloped and apparently abortive disease would suffice to account for the failure of attempts made in the early days to resect the obviously affected portions of the organ. The network in the capsule and fat is also held responsible for the relatively bad prognosis of those cases where tubercle has attacked a fused or horseshoe kidney, the process having spread by way of the capsule or fat to the adjacent organ.

The second sequel requiring mention is the persistence of bladder symptoms for some time following nephrectomy. I have followed many of my cases and examined them occasionally with the cystoscope. The improvement of the bladder appears to depend on the condition of the organ at the time of operation; in the earliest cases bladder symptoms disappear immediately after operation, whilst in

the latest cases, where sepsis and deep ulceration have been present, strangury, urgency, etc., will generally diminish considerably, but will rarely completely disappear; an intermediate course is followed by the average case.

It has been said that bladder symptoms take as long to disappear after nephrectomy as they have persisted before it. It may be useful to keep this very rough generalization in mind. The permanent diminution in the capacity of the most severely affected bladders renders some frequency of micturition inevitable.

In addition to the usual vaccine, tuberculin, and hygienic therapy of the post-operative tuberculous bladder, I may call attention to a method introduced by the French school. At the French Congress of Urology in 1923 Heitz Boyer reported three cases of bladder tubercle in which he had used "l'étincelage"—that is, sparking—and since then several papers, notably one by Parisi and another by Raynaud, have appeared, giving the results and indications for this form of treatment. Heitz Boyer considers that the indications are limited, for when symptoms of vesical trouble persist for a long time after operation, much the most usual reason is secondary infection. In a few cases, however, we find another cause in tuberculous ulceration without any marked surrounding cystitis. In three cases he destroyed such areas by what practically amounts to high frequency, taking in at the same time an area of surrounding tissue about 1 cm. in extent. After a period of reaction and sphacelation the membrane detached itself, and fresh epithelialization was complete in about one month. Parisi, when reporting twenty-one cases from Marion's Clinic, gave these localized patches of ulceration as the chief indication for the employment of this form of treatment, though he remarks that good results are also to be obtained in secondary infections, especially when not too diffuse in distribution, and he attributes the improvement in these latter to the fact that the high frequency current has well recognized antiseptic properties. The method involves the system of following up, by cystoscopy, all cases which have been submitted to nephrectomy and in which there is a rebellious cystitis—a routine which often discovers lesions insignificant out of all proportion to the extent of the symptoms which they are producing.

Bilateral Renal Tuberculosis.

This condition presents a different problem. It is natural that the surgeon, who can now do so much for unilateral disease, should be ambitious to ameliorate the lot of the unfortunate sufferer who has progressed so far as to have his remaining organ affected. The chief treatment for this complication should be good prophylaxis, and is therefore educational. The patients should be seen and diagnosed at a time prior to the infection of the second organ.

Once, however, the bilateral disease has been acquired two surgical measures may be considered—nephrectomy or nephrotomy of the more diseased kidney; but I believe the wisest course in the vast majority of cases is not to operate. Even with modern methods of examination it is very difficult to be sure how far the disease in the opposite kidney has progressed, and it is to be remembered that these modern methods are the responsible factors in the enormous drop which the mortality from nephrectomy in renal tuberculosis shows. This operative mortality (Thomson-Walker) has shrunk from 90 per cent. in 1885 and 38.4 per cent. in 1893, to 7.18 per cent. in 1910, whilst the Mayo Clinic now records a primary death rate of 2.9 per cent. In itself this is a vindication of the selection of unilateral cases only, the large proportion of this reduction being clearly due to the rejection of those cases in which the disease was bilateral. Yet one or two clinics have in recent years been attempting the removal of the more advanced organ in carefully selected early cases. The Mayo Clinic reports five cases in whom the diagnosis of bilaterality was made and substantiated at operation, and in whom the more diseased kidney was removed. All were reported dead within a year. The Washington Clinic states that "they have done this several times, but have always met with disappointment. Tuberculosis has always progressed in the other kidney, and the bladder symptoms have never improved."

These writers represent with fairness the opinion of the majority of surgeons working in this field. "Noli me

tangere" may be said to be their watchword. I personally subscribe to this attitude, believing that ultimately only discredit may be brought on surgery by the use of operative measures in bilateral renal tuberculosis; yet the opposite view is held by a minority of reputable urologists, who consider that in properly selected cases nephrectomy will be beneficial. Wagner, from the Zuckerkandl Clinic in Vienna, believes that "the lesions of the other kidney evolve more slowly, and that the operation concedes greater length of life to the patient. Occasionally," he says, "healing may occur in the second organ." Desnos and Minet claim to have seen improvement of symptoms and general amelioration of the disease. In two cases they have noted a survival of from two to four years. Similar observations are credited to Rochet and Thevenot, Perrichon and Casper.

Curiously enough these clinical views receive support from such experimental work as has been done on this condition. Two writers, Uffreduzzi and Forni, working separately on bilateral renal tuberculosis induced experimentally in animals, have reached similar conclusions regarding the effect of the removal of one organ on the opposite kidney. They found that after nephrectomy active hyperaemia occurs in the remaining kidney, and this results in greater resistance to the tuberculous invasion. When the kidneys of these nephrectomized animals were compared with those of control animals, it was found that the lesions were more strictly localized in the former, and showed less tendency to cavity formation and a greater tendency to connective tissue production and sclerosis. There was usually an arrest in the extension of the tuberculous process, with the appearance of fibrous tissue, and the animals in general lived longer than control animals, whilst clinical cure was occasionally obtained.

These results may point to the line of surgical progress for the future, but at present the more cautious policy will probably meet with the greater reward.

A CASE OF PYO-PERICARDIUM.

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The following record is of interest, exemplifying the difficulties of diagnosis in similar cases.

A male child, aged 2½ years, was admitted to the Manchester Northern Hospital on March 23rd, 1923.

History.

The parents stated that he had been perfectly well until three months before, when he was admitted into another hospital for the radical cure of a right inguinal hernia. He was discharged, however, at the end of ten days owing to an outbreak of measles in the ward, no operation having been performed as he had developed a troublesome cough. Since that date the child had been going downhill, being feverish at nights, with loss of power in the limbs, and a persistent cough. The appetite remained good and the bowels regular.

Examination on Admission.

The child appeared to be somewhat ill, with outstanding pallor. There was a high degree of anaemia and some cyanosis of lips and ears, but his general condition and nutrition were otherwise excellent.

Circulatory System.—The child showed signs of orthopnoea and was most comfortable when well propped up and leaning towards the left side. A troublesome dyspnoea became marked whenever the chest was examined. There was no bulging over the precordium; the apex beat was diffuse and weaker than normal, no thrill of friction fremitus being present. The cardiac impulse was displaced to the left, not coinciding with the left lower border of cardiac dullness, which showed no definite increase. The heart sounds were pure although possibly slightly muffled. There were no bruits. The radial pulse was consistently rapid and of low tension. Venous pulsation was markedly present in the jugular veins. Examination of the blood showed no abnormal cells present, but a leucocytosis, the total white corpuscles count being 13,438, giving 9,688 leucocytes and 3,750 lymphocytes.

Respiratory System.—The child had a persistent cough with a brassy note which was paroxysmal in type and devastating in its severity; it somewhat resembled the late cough in pertussis. Inspection of the chest showed both sides moving equally. On percussion no dullness was detected at the bases, but there was a loss of resonance at the centre of the right lower lobe. In this