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TUBERCULOUS DISEASE OF THE KIDNEY

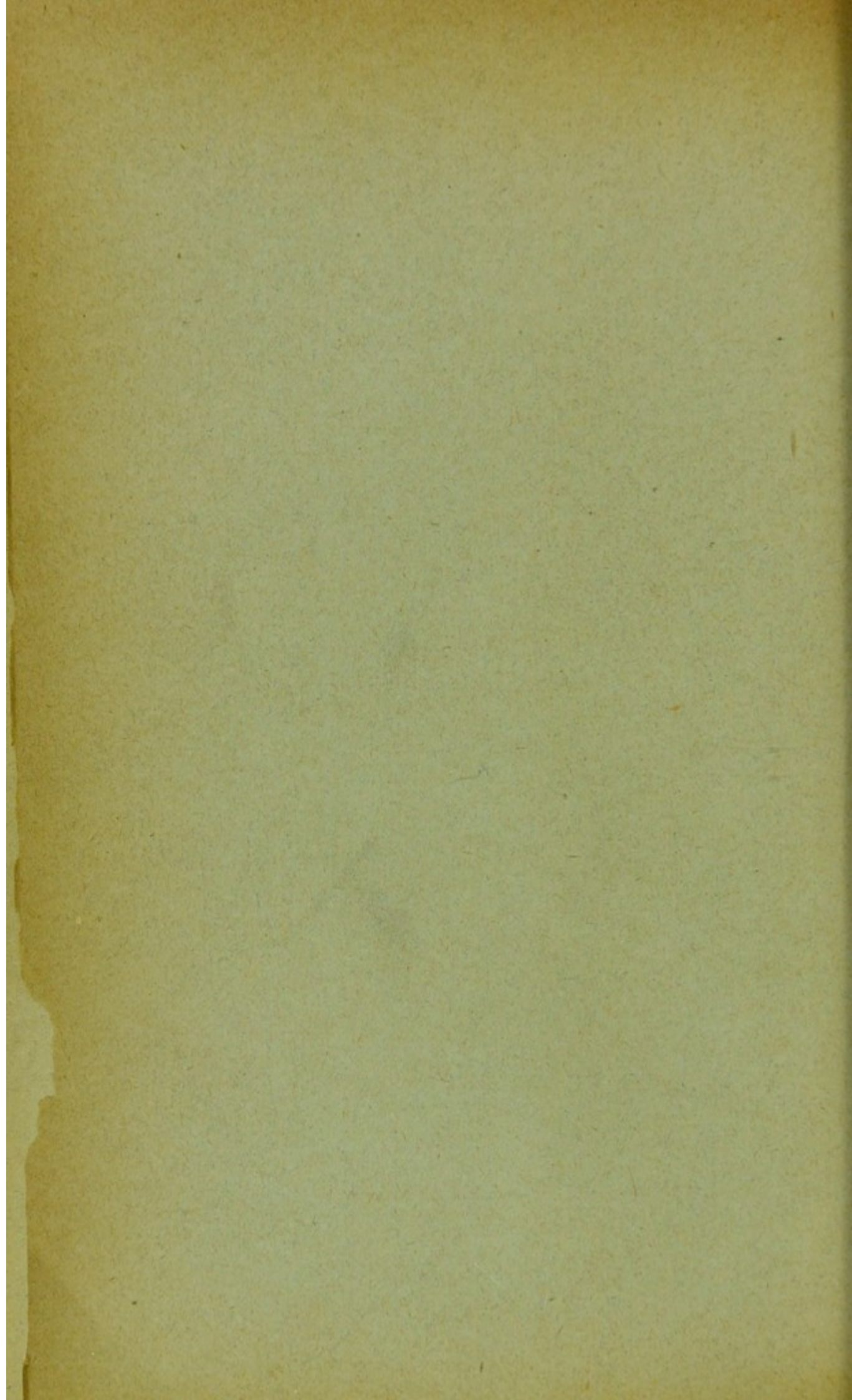
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TREATMENT

BY

DAVID NEWMAN, M.D. GLASG.

SURGEON TO THE ROYAL INFIRMARY, GLASGOW.

Reprinted from THE LANCET, February 24, March 3 and 10, 1900.



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TUBERCULOUS DISEASE OF THE KIDNEY: ITS ETIOLOGY, PATHO- LOGY, AND SURGICAL TREAT- MENT.

TUBERCULOUS lesions of the kidney present themselves to the surgeon in many phases. In some instances when first seen by him the disease is so advanced that little can be attempted to stay its progress or to mitigate the suffering of the patient, while in other cases the malady is still limited in extent and much may be done by early surgical intervention. Even a few years ago renal tuberculosis was looked upon as almost a certainly fatal malady, but now that new and more exact methods can be employed in detecting the disease in the early stage the surgeon is not uncommonly placed in a position to advise and to carry out operative measures with considerable hope of success.

Various attempts have been made to classify diseases of the kidney into "surgical" and "medical," but it must be admitted that any such grouping is not only arbitrary and unscientific but productive of much misunderstanding and harm. An endeavour to follow such a classification has been attempted by M. Du Pasquier and M. Brissand, who adopt even now the nomenclature in use prior to the development of renal surgery. The old term "surgical kidney" was given to all secondary purulent lesions of the organ resulting from primary septic foci in the lower urinary passages—that is to say, the word "surgical" was employed to denote that the renal lesion was secondary to a malady requiring the surgeon's aid. It pointed to the etiology of the renal lesion rather than to the circumstances of how the disease required to be treated. In illustration of this it may be observed that the French writers just referred to designate as "medical" those cases of tuberculous nephritis in which the virus has been carried to the kidney by the blood, whereas those in which infective material has extended upwards from the lower urinary tract they regard as "surgical." This classification is imperfect and unsatisfactory from all points of view. Indeed, the very cases which are included under their classification as being "medical" are those most suited

for surgical treatment. Take, for example, cases of caseous nephritis where the kidney has been invaded through the blood and the virus has given rise to a localised renal tuberculosis unassociated with active disease in other organs. Those cases while included by the writers above referred to as "medical" are the very ones which give the most satisfactory results to the surgeon.

To have an intelligent view of the present position of surgery to tuberculous disease of the kidney it is necessary to study very carefully the various modes of infection and the different phases of the morbid process. From a clinical standpoint tuberculous disease may be said to manifest itself in three distinct forms—namely, (1) acute miliary tuberculosis; (2) local tuberculosis or renal phthisis; and (3) chronic tuberculous or caseous nephritis. All these varieties are due to the presence of tubercle bacilli and to an infective process resulting therefrom, but the channels through which the virus reaches the kidney and the methods by which local infection takes place vary considerably.

The etiology of tuberculous lesions of the kidney has been carefully worked out and the different avenues of infection have been ascertained. Two conditions are necessary to the establishment of tuberculous disease in the kidney—the presence of a suitable nidus there and the conveyance of specific organisms to the part. Probably on account of its abundant blood-supply the healthy kidney tissue, although more vulnerable than other parts of the urinary tract, has a remarkable power of destroying organisms introduced into its substance or of eliminating them from the system. To discuss how this is brought about is beyond the scope of the present inquiry, but an important clinical fact must be here referred to—namely, that tubercle bacilli carried by the blood from distant parts may be eliminated without any morbid change in structure being produced in evidence of their sojourn in the kidney. For example, they may be found in the urine of persons suffering from tuberculous disease of bone, of the lungs, or of other organs. Their presence, therefore, in the urine is not pathognomonic of tuberculous disease of the urinary tract. Although the observation of these organisms furnish positive proof that the patient is tuberculous the precise seat of the lesion remains to be determined. In cases where the kidney eliminates these bacilli without itself becoming involved in the tuberculous process it must be assumed as an explanation either that the quantity carried to the organ at a given time is too small or that the virulence of the microbes is insufficient to overcome the normal preventive power of the renal tissue and to produce the specific pathological effect. The natural power of the renal tissue in destroying micro-organisms may be rendered less powerful by abnormalities such as malformations of the organ or by disease. Hence we find that Bright's disease, cystic degeneration, amyloid degeneration, or congenital malformations and displacements all tend to make the kidney more liable to septic and tuberculous

diseases, and, as in other organs so also in the kidney, injury or hæmorrhage may be an exciting cause of tuberculosis.

In order that tubercle bacilli may grow and multiply in the kidney it is necessary that they be conveyed by the blood stream to a part where there is a favourable soil for their growth and where they are not liable to be washed away by the current of blood or the flow of urine. Hence tuberculous foci are more likely to originate in the parenchyma of the organ than in the urinary passages. It is now quite recognised that the presence of the bacillus is the most important etiological factor in the disease, but at the same time other influences are at work in determining the establishment of the malady in the kidney. Acute febrile diseases, such as enteric fever, measles, scarlet fever, pneumonia, &c., and injuries produced by blows and falls are the most important predisposing causes. Sometimes the injury may not be severe enough to cause hæmaturia, but patients so frequently blame a fall or a blow that the surgeon cannot overlook insignificant traumata as possible causes. Suppose that tuberculous bacilli are present in the blood when a blow is sustained by the kidney, then the effusion of blood, with thrombosis of capillaries and the injury to the tissues, provide the conditions required. The following cases are illustrations of renal *phthisis ab hæmoptoe*.

CASE 1. *History of a fall of 26 feet; severe pain in the left renal region; hæmaturia and effusion of blood around the left kidney; apparent complete recovery from the injury; and two and a half years afterwards the patient suffering from advanced tuberculous disease of the left kidney.*—A man, aged 30 years, was admitted to the Glasgow Royal Infirmary on May 11th, 1893. While working on the deck of a steamer he had accidentally fallen into the hold, a distance of 26 feet. He was rendered unconscious and when admitted to the hospital was suffering from severe shock. Besides other injuries he complained of severe pain in the left lumbar region and the first urine passed after admission contained a considerable quantity of blood. On examination a distinct fulness and increased resistance was made out in the left flank and over this area the percussion was dull. The patient made a slow but steady recovery and he was detained in hospital until August 17th on account of the other injuries, the kidney condition having apparently been recovered from within a fortnight. The hæmaturia disappeared ten days after admission.

The patient was again seen on Nov. 27th, 1895, two and a half years after the accident, by Dr. D. McKellar Dewar, who recommended him to come into hospital, but this he refused to do, preferring to be under the care of his private medical attendant, with whom I saw him in consultation. He said that he had remained well and had been able to

follow his occupation until the end of May, 1895, when he complained for the first time of a recurrence of the pain in the left lumbar region, and although on palpation a distinct dullness could be made out no fluctuation was detected. The urine was free from any deposit, blood, or albumin, but tubercle bacilli were not looked for. In November the urine contained an abundant muco-purulent deposit, six specimens of which were examined for tubercle bacilli, and in two of these bacilli were found. From May to November the patient's general health rapidly deteriorated, his appetite was impaired, and he lost 16 lb. in weight. The evening temperature was elevated irregularly and he complained of night sweats but there was no vesical irritation. By the end of December a distinct fluid accumulation was discovered in the left kidney and the patient was advised to have a nephrotomy performed, when the kidney was found to be occupied by a typical tuberculous pyonephrosis.

CASE 2. History of a blow causing ecchymosis in the right lumbar region; hæmaturia of five days' duration with one recurrence on the eleventh day; severe pain and some swelling in the right renal region; six months after the injury the urine became muco-purulent and bloody; symptoms and physical signs of renal phthisis.—A woman, aged 47 years, was admitted to the Glasgow Royal Infirmary on August 2nd, 1895. On inquiry it appeared that in January the patient had fallen from "house steps" a distance of eight feet and on falling struck her "right side" against the back of a chair. The blow was received on the right lumbar region and caused considerable ecchymosis between the lower ribs and the crest of the ilium. On recovering from the immediate shock of the injury she suffered severe deep pain in the region of the kidney and the urine first passed after the accident contained blood. The hæmaturia continued for five days after the injury and recurred once only on the eleventh day. There was some swelling in the region of the kidney but how long it lasted the patient did not know. Since the fall the "side" had always felt weak, but the pain was not severe till seven weeks previously to admission. About the same time she observed the urine to be dark in colour and to contain blood together with a white deposit. On admission the patient complained of a swelling in the right lumbar region. She had always been rather spare in body and lacking in colour, but she said that of late she had fallen off considerably. A month prior to admission she experienced pain in the lumbar region whenever she moved about and at the same time the urine presented the abnormal appearance above mentioned. On examination the whole space between the liver and the crest of the ilium was dull and fluctuant and presented the characteristic features of a large pyonephrosis, but there were no sudden discharges of purulent urine at any time. The specific gravity of the urine was 1012, it was strongly

alkaline, and contained a considerable quantity of pus, some blood, and crystals of oxalate of lime; tubercle bacilli were numerous. On August 17th the kidney was incised, when a large quantity of pus, urine, and tuberculous débris was evacuated and a large cavity was scraped out with a Volkmann's spoon. Later in the history of the case the lungs became involved, there being dulness and abundant moist râles at the bases of both lungs behind, but at the apices there was no evidence of consolidation.

In both of the foregoing cases it was clearly shown by the history that the patients enjoyed perfect health until the occasion of the injury, and it may be safely presumed that the traumatism was the only cause of the hæmorrhage. In cases where slight indirect violence has been followed by the appearance of blood for the first time the question may be legitimately raised as to the presence of pre-existing disease, which may not up to the time of the accident have shown itself by hæmaturia, but in these cases the blows were severe and direct and of themselves sufficient to injure the kidney. The most reasonable explanation seems to be that the injury reduced the resisting power of the organ by the effusion of blood into its substance and that tubercle bacilli in the effused blood, or subsequently conveyed to the neighbourhood of the effusion, took root and multiplied, formed a centre of infection, and thus produced what may be called a renal *phthisis ab hæmoptoe*.

Again, septic inflammatory lesions of the pelvis or of the renal substance predispose to tuberculous disease.

CASE 3. *Acute tonsillitis and abscess, followed by what at first appeared to be a purulent embolic nephritis, but which ultimately became tuberculous.*—A man, aged 41 years, consulted me first in November, 1895, complaining of an acute inflammation of the right tonsil which culminated in the formation of an abscess. Three days after the abscess in the tonsil was opened and the temperature had returned to normal it suddenly rose again, and in the evening the thermometer registered 104·2° F., without any recurrence of the throat affection. The patient, however, complained of considerable discomfort and a dull aching pain in the right lumbar region, and he had during the afternoon several severe rigors. The urine was at first increased in amount, excretion rising during the first three days after the onset of the renal pain to an average of 80 ounces in 24 hours. It was acid, its specific gravity was 1008, a considerable amount of mucus was deposited on standing, and it contained a moderate amount of albumin (0·3 per cent.) and some blood, but no pus. On the fourth day the patient had six rigors and for the first time pus appeared in the urine. The quantity was large at first and deposited rapidly from the urine in which it escaped. The urine had no unpleasant odour; the reaction was acid. The patient did not complain of any

vesical irritation. The urine was examined on six occasions for tubercle bacilli, but none was found. Pus continued to be present in the urine for over two months, but during that time it gradually diminished in amount and at the end of February, 1896, the patient resumed his occupation and was lost sight of till July, 1898. Then he complained of marked vesical irritation, passing urine over 60 times in the 24 hours. The urine had all the characters of a tuberculous pyelitis. No operation was allowed, but when the kidney was removed post mortem it was found to contain numerous tuberculous centres.

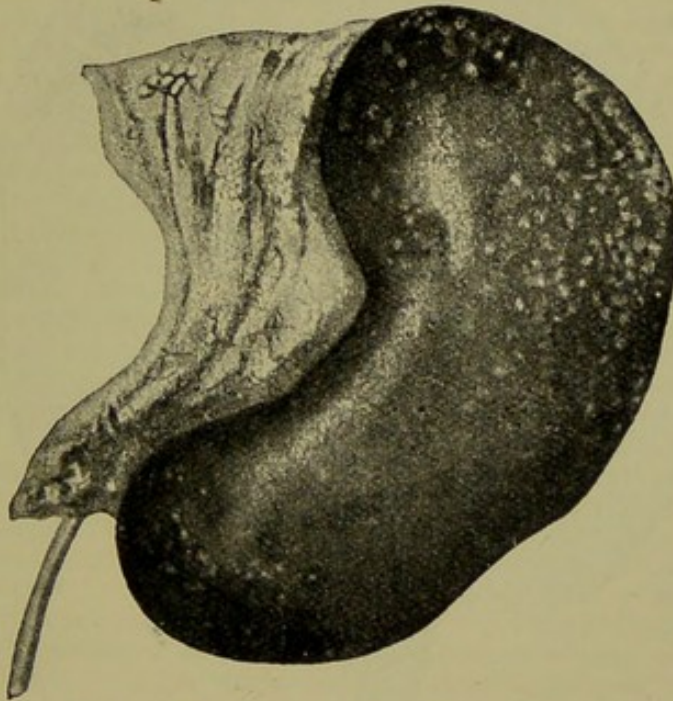
In this case the mode of onset and the early history of the disease points to the formation of an abscess in the parenchyma of the kidney, rupturing into the pelvis and there setting up a chronic pyelitis, which at a later stage became tuberculous.

It may be well now to consider the methods of attack or the channels along which the microbes of tubercle may travel. The kidney may be invaded in four different ways:—
1. By the blood stream. (*a*) The tuberculous particles may be so small as to be stopped only in the ultimate capillaries, where they give rise to numerous miliary deposits (in such instances the blood stream becomes contaminated while passing through tissues or organs foreign to the urinary apparatus); or (*b*) tuberculosis may arise from infective emboli passing into a branch of the renal artery, the tuberculous virus becoming disseminated over the area of its distribution. 2. By invasion along the lymphatics of the kidney from foci in the lower urinary tract. 3. By contagion along the lumina of the excretory ducts. 4. By spreading to the kidney from continuity with other organs. It must, however, be borne in mind that while primary infection is conveyed to the kidney by one of these channels the infective process becomes more complicated as the disease advances; indeed, the mode of extension comes to involve a combination of the processes just mentioned.

The kidneys communicate with the outer world by means of the lower urinary tract, and in some instances the blood supplying these parts may become contaminated by the tuberculous virus, but probably in the great majority of cases the blood becomes infected when passing through the vessels of the respiratory organs, the alimentary canal, or the mucous or cutaneous surfaces. Having entered the circulation the bacilli may be carried into the renal artery and may be eliminated from the kidney without any serious harm resulting. Durand Fardel has demonstrated the presence of tubercle bacilli within and around the glomeruli without their giving rise to any structural changes in the kidney recognisable by the microscope, and on several occasions I have seen tubercle bacilli in the cortex of the kidney in subjects of rapidly fatal pulmonary phthisis, while in the same cases during life I have failed to detect the specific organisms in the urine.

Infection by the blood stream.—(a) Obstruction of the capillaries. In acute miliary tuberculosis of the kidney the virus is conveyed by the blood-vessels and is widely disseminated, so that such cases seldom come under the cognisance of the surgeon. It may, however, be interesting to follow the changes in this acute process where the tuberculous nodules are small in size and all in about the same stage of development. The tuberculous virus being conveyed to the kidney by the blood-vessels the favourite seat of the disease is in the cortex, where the little miliary growths appear as small, semi-translucent, greyish streaks surrounded by a darker zone of deeply injected renal tissue. These

FIG. 1.



External appearance of a tuberculous kidney.

miliary nodules are frequently arranged in rows or they form linear streaks (see Fig. 2) following the direction of the vasa interlobularia and present an appearance which closely resembles minute hæmorrhagic infarctions. In Fig. 1 the fibrous capsule is seen to be stripped off the cortex of the kidney and the deeply injected parenchyma is exposed, showing the numerous miliary tubercles as clear white pearly specks embedded in a chocolate-coloured background. In the illustration they are shown to be distributed irregularly, but in many instances of acute general tuberculosis the tubercles are arranged in groups or irregular circles, following more exactly the arrangement of the

vascular supply. Fig. 2 shows the section of a kidney in its long axes, the pelvis being laid open. The cortex is invaded by a great number of miliary tubercles forming clots and streaks. In some parts the tuberculous masses have joined together and have softened. The mucous membrane of the pelvis and calices is much thickened and at the lower end of the section two cavities have formed which are filled with tuberculous débris. (After Rayer.) The regular arrangement is seen

FIG. 2.



Section of a tuberculous kidney.

in a few cases, but in some of those which have come under my observation the tubercles have been distributed without any very evident relationship to the arterial supply, while in other instances the infective process has appeared as if limited to an area supplied by a single branch of the renal artery. Borrel in his investigation into the etiology of renal tuberculosis found it necessary, in order to produce the disease, to inject infective matter into the aorta of animals, as when it was introduced into the veins even pure cultures of tubercle bacilli

failed to pass through the lungs. As regards etiology he concludes that there are two forms of tuberculous disease, primary renal tuberculosis, where the virus is by some means introduced into the arterial current and in which the tuberculosis rapidly follows the inoculation, and secondary renal tuberculosis, which after inoculation takes two or three weeks to develop. The invasion taking place through the lymphatics leads to the formation of a caseous nodule and the production of caseous nephritis. Borrel calls this "granular tuberculosis of the kidney." There is no precise localisation, the tuberculous material occupying any portion of the parenchyma of the organ. In both forms of the disease the tubercle is clearly a connective tissue formation, the renal epithelium taking little or no part in the structure of the new growth. The same view is held by Virchow and Metchnikoff.

A considerable amount of labour has been devoted to the study of the origin of the various elements which come to form the miliary tubercle. In miliary tuberculosis the small tubercles consist of altered portions of the kidney connective tissue appearing in small circumscribed areas infiltrated by leucocytes which are at first clear in colour and tolerably well defined. The irritative action of the bacilli induces these early tissue changes. The connective tissue cells become swollen and undergo mitotic division, and because of their large size they have been called "epithelioid cells." At the periphery lymphocytes appear and they gradually increase in number. The toxic action of the bacilli is first seen in the centre of the focus where the "epithelioid cells" become hyaline and their outline indistinct. Ultimately the cells become fused into a homogeneous mass which subsequently degenerates, or the "epithelioid cells" may by proliferation of their nuclei without segmentation of their protoplasm come to form the so-called "giant cell" which was at one time considered to be characteristic of tubercle. At the same time the epithelium of the tubules undergoes fatty metamorphosis, the tubules become compressed by the abundant connective tissue formation around them, and the infiltrated leucocytes and epithelium swell up and undergo caseous necrosis, so that ultimately, should time permit, the whole infected area becomes disorganised. This degenerative change begins at the centre of the tubercle and extends towards the periphery, where the micro-organisms are most abundant. The degenerative changes are probably partly due to thrombosis of the capillaries as a consequence of the action of the toxin upon their walls, but the necrosis and caseation are doubtless also the direct result of the bacillary products. In some parts these little tuberculous masses coalesce and unitedly form patches of considerable size, which in the first instance are usually situated at the union of the cortex and medulla; but on account of the remarkable tendency which tuberculous inflammation has to spread they may ultimately involve a considerable portion of

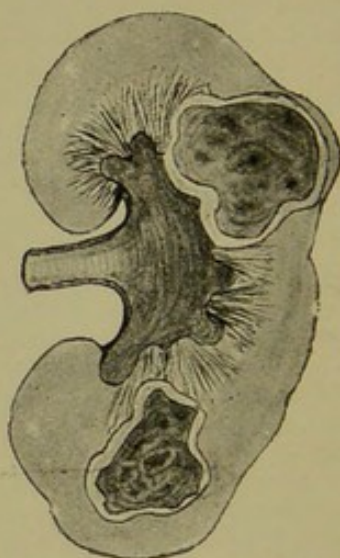
the kidney. In such masses blood-vessels larger than capillaries become occluded by thrombi and as a consequence further necrosis ensues. In this form of renal tuberculosis the disease is generally at first confined to the parenchyma of the kidney and does not immediately extend to the lower urinary tract.

Miliary renal tuberculosis is always associated with tuberculous disease in other parts and is a disease which attacks children more frequently than adults. It may be preceded by tuberculous formations in any part of the body, but the most common precursor is phthisis pulmonalis. Next in order of frequency comes tuberculous meningitis, while in some instances lymphatic glands, joints, or bones have been found to contain the primary focus, and only in a few cases the prostate gland or the bladder have been named as the site of origin of the disease.

FIG. 3.



FIG. 4.



The discovery of the presence of renal miliary tuberculosis is frequently made for the first time after the death of the patient, and as the lesion does not give rise to any distinctive symptoms the disease is one which is to be inferred from the general circumstances of the case rather than definitely diagnosed; besides, it is one for which nothing can be done surgically.

(b) Tuberculous embolism of the arteries. There is another method by which the kidney may be infected. In place of conveying individual bacilli or small groups of bacilli the blood stream may carry an infected thrombus to the kidney,

the artery in which it becomes impacted is closed, and the tuberculous virus is more or less disseminated over the area supplied by the blood-vessels. Hence we find considerable wedge-shaped areas of tuberculous disease in the kidney with little or no evidence of involvement of the pelvis or ureter. These masses may, however, break down and lead to a widely disseminated lesion, or, as is not uncommonly the case, tuberculous material may caseate or even become encysted (Fig. 4). (Fig. 3 shows the longitudinal section of a kidney in which tuberculous disease is seen in different stages. In the peripheral portion of the cortex and extending towards the medulla there are numerous tuberculous infarctions in some of which caseation has taken place, while in others cavities have formed. In the medullary area there are five large cavities, all of which contained caseous matter and tuberculous debris, but none of them communicated with the pelvis, and the urinary tract was free from disease. Fig. 4 shows the section of a kidney containing two distinct isolated foci of tuberculous disease limited to the medulla and cortex of the organ, the pelvis being free from disease.)

The encysted form of the disease is of great importance to the surgeon, being in many instances amenable to operative treatment. Generally the disease is unilateral and involves only a portion of the kidney substance, although it may have more than one focus. While caseous nephritis arises in most instances as a consequence of tuberculous thrombosis it may be mentioned that in a few cases the renal lesion may be the result of an extension of the tuberculous process from the pelvis of the kidney to the parenchyma through the lymphatics or along the lumina of the uriniferous tubules.

CASE 4. *Tuberculosis limited to the right kidney; compensatory hypertrophy of the left kidney; tubercle bacillus; pus and albumin in the urine from the right kidney only; nephrectomy; cure.*—A man, aged 22 years, consulted me in July, 1897. At that time he complained of pain in the right lumbar region almost constantly present, but never very severe. On inquiring into the history of the case it appeared that the first departure from health was noticed three years previously. At that time he complained of frequent micturition, requiring to rise six or eight times during the night. The urine was copious, pale in colour, of low specific gravity, and contained no deposit. Polyuria and frequent micturition were the only symptoms during the first six months; at that time, however, pain was complained of and in the urine the patient noticed on one or two occasions a small quantity of blood. He never passed gravel or stone. Six months previously (February, 1897) he had noticed a white deposit which, according to his description, appeared to be pus; at the same time pain developed in the right lumbar region, occasionally accompanied by nausea and sickness. The appetite gradually became impaired and the patient was much troubled with sleeplessness and he gradually lost

weight. When first examined he weighed 10 st.; he was 5 ft. 10 in. in height, thin, anæmic, and seemed highly nervous and anxious as to his condition. The thoracic organs were normal, but there was slight enlargement of the liver and spleen. Both kidneys were distinctly felt on palpation and were found to be enlarged; the right was irregular in form, the lower extremity being rounded while the upper was more pointed, giving to the organ somewhat the form of a pear; the left kidney was uniformly enlarged. The urine was pale in colour; its specific gravity was 1008; it was cloudy, and on standing threw down a moderate deposit of mucus and pus; it contained no crystalline deposit; there was a small trace of albumin but no blood. On four examinations out of six tubercle bacilli were found. Examination of the bladder with the cystoscope showed it to be free from disease, with the exception that the orifice of the right ureter protruded and the mucous membrane covering it was deeply injected. Catheterisation of the ureters showed that all of the pus, the albumin, and the tubercle bacilli came from the right kidney; that from the left kidney was normal with the exception of being low in specific gravity. The conclusion came to was that the right kidney was the seat of tuberculous disease while the left had undergone compensatory hypertrophy. The right kidney was excised and was found to contain two considerable tuberculous foci, but the pelvis was not involved in the disease (Fig. 4). The patient made a good recovery and reported himself well in January, 1899.

In the early stage the lesion is limited to the substance of the kidney, the virus being conveyed in the blood stream only, but in the later developments the advancing tuberculous process comes gradually to be carried forward through other channels, unless a conservative inflammatory action closes the lymphatics and prevents extension. If the caseous material breaks down rapid destruction of the organ may result, so that in one specimen renal tuberculosis in all its stages may be seen. The order of infection can, however, be generally determined by careful observation.

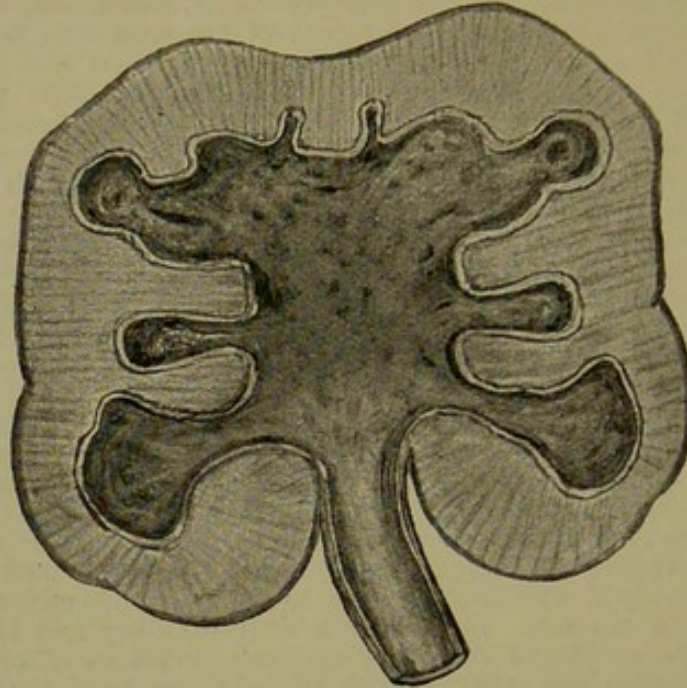
In tuberculous pyonephritis infection may take place in various ways. The primary focus may be in the kidney substance, and in such cases the parenchyma may be greatly destroyed before the pelvis is seriously involved and the walls of the ureter thickened sufficiently to cause much or any obstruction to the escape of urine. While the organ may be enlarged by the caseous deposits which have come to occupy its substance the increase in bulk is seldom due to a retention of urine or of tuberculous débris in the pelvis. The ureter is patent and the degenerated tuberculous material is allowed to escape into the bladder to be discharged with the urine. So long as this freedom exists there is no pyonephrosis, but if the ureter becomes blocked by tuberculous thickening of its walls, by impaction of

masses of *débris*, by cicatricial stenosis, or by twisting of the ureter, the secretion is then dammed back and then sudden and rapid changes take place in the morbid condition and in the clinical aspect of the case. The secretion of the kidney and the tuberculous *débris*, which is probably up till the present free from sepsis, is now very liable to contamination by pyogenic organisms, and within a few hours the whole clinical features of the case may become completely altered. It is easy to understand how large collections of fluid, tuberculous *débris* mixed with urine, should become contaminated by pyogenic organisms and large renal abscesses or pyonephrosis result. On the other hand, it is undoubted that they may remain aseptic for long periods.

Primary tuberculosis of the pelvis of the kidney is less common than secondary infection of that part. The principal seat of the disease is at the apices of the papillæ, in the calices, or in the pelvis, and from hence, partly by the blood stream and partly by the lymphatic channels, the material virus is carried within the substance of the kidney. The primary focus becomes occupied first by miliary tubercles and subsequently by caseous masses. In the course of a few weeks or months these masses form an irregular softened area, which by progressive peripheral infiltration spreads inwards. At the same time by infection through the blood-vessels and lymphatics, now, and to the naked eye, apparently independent nodules develop in the tissue around, while in the more remote parts of the kidney and in the mucous membrane of the pelvis fresh eruptions of opaque white nodules appear. In recent cases these diminish in size and number the more distant they are from the primary focus, but when the disease is of long standing the individual nodules cannot be distinguished. The constructive process which has just been described is rapidly followed by a destructive one. The tuberculous nodules, having attained a certain size, undergo caseous necrosis, break down, and when in the pelvis of the kidney they become replaced by a tuberculous ulcerating surface, or if within the renal parenchyma they are transformed into irregularly globular cavities. These as they enlarge become elongated and assume a pyriform shape and approaching the cavity of the renal pelvis rupture into it. As the destructive process extends from within outwards greater and greater portions of the renal substance become involved, until finally the whole of the medulla and a large portion of the cortex may be destroyed. This leads to the formation of a large cavity (Fig. 5). But besides the encroachment on the renal tissue by tuberculous disease dilatation and sacculation of the organ may be caused by a blocking of the ureter, ultimately producing a tuberculous pyonephrosis which sometimes, when the other kidney is free from disease, destroys all vestige of urine-secreting tissue. Should only one organ be involved the kidney may, by a drying-up of the contents of the pyonephrosis, become converted into a

shrivelled, putty-like mass (Fig. 7). In old cases calcification may occur and a hard mass may form which is liable to be mistaken for a calculus.

FIG 5.



Specimen of a tuberculous single kidney. The pelvis and calices are greatly dilated and the mucous surface is ulcerated and thickened. The parenchyma of the organ is not diminished in amount but rather increased from compensatory hypertrophy.

CASE 5. *Bilateral renal tuberculosis without involvement of the urinary tract; the right kidney completely destroyed and caseous; the left kidney enlarged and occupied by tuberculous pyonephrosis; tuberculous disease of the sacrum, nephrotomy; death 18 days after from suppression of urine.*—A woman, aged 33 years, was admitted into the Glasgow Royal Infirmary on March 9th, 1899. She consulted me in private six weeks previously to admission, when she was advised to come into the ward as early as possible. She was a well-nourished woman, but she complained of symptoms of dyspepsia and of occasional attacks of severe pain in the region of the left kidney, generally limited to the lumbar region but occasionally extending down the thighs. The patient also complained of frequent micturition and discomfort in the bladder, which, however, subsided immediately the bladder was emptied. There was no history of hæmaturia, but the patient observed on many occasions a whitish deposit which

from her description was evidently pus. When the patient was first seen a complete and systematic examination was made, and I concluded that she was suffering from a large pyonephrosis of the left kidney. The right kidney could be felt and it appeared to be normal in size and in situation, and the patient stated that as far as she was aware it had not caused her any trouble. The urine had a specific gravity of 1016 with an acid reaction; it contained a trace of albumin, a few red blood corpuscles, and pus was deposited on standing equal to about 2 per cent.; no crystalline deposit was thrown down, no tubercle bacilli were discovered, and there was no sugar. The heart, the lungs, and the liver and spleen were normal. The left kidney was so enlarged as to occupy the whole space between the costal margins and the crest of the ilium, and it extended as far forward as to within one and a half inches of the nipple line. The swelling was dull on percussion and slightly fluctuant and the organ was distinctly tender on palpation. The patient was advised to come into the Royal Infirmary at once, but this she failed to do until six weeks later. Complete suppression of urine occurred on March 8th, associated with rigors, elevation of temperature, and profuse sweating. The symptoms were so urgent that the patient was sent in on the evening of the 9th, and on the following morning it was found necessary to perform nephrotomy, when one and a half pints of pus and urine were evacuated. The patient stated that she had suffered from pain in the left side for 15 years, but that it had been specially severe during the past three years. After the operation the left kidney continued to discharge a considerable quantity of urine which for the first three days was mixed with pus, but after that time the pus diminished considerably; no urine, however, passed from the urethra, and on passing a catheter the bladder was found to be empty, the inference being that no urine was being secreted by the right kidney. During the first 15 days urine in considerable quantity drained away from the left kidney, but on March 25th it was observed that although the drainage-tube was still communicating with the cavity in the kidney almost no urine escaped. The patient complained of an increased amount of pain, sickness, and diarrhoea. Diuretics produced no effect and she died three days after from suppression of urine.

Post mortem the left kidney was found to be fully three times the normal size and a large cavity was discovered occupying the pelvis and parenchyma of the organ, but on making allowance for the displacement of the substance of the kidney by disease the secreting tissue remaining appeared to be much in excess of what is found in the normal kidney, probably due to a compensatory hypertrophy (Fig. 6). The right kidney was simply a multilocular cyst of about the size of a normal kidney. There was no vestige of renal tissue left and the loculi contained soft, white caseous material

FIG. 6.

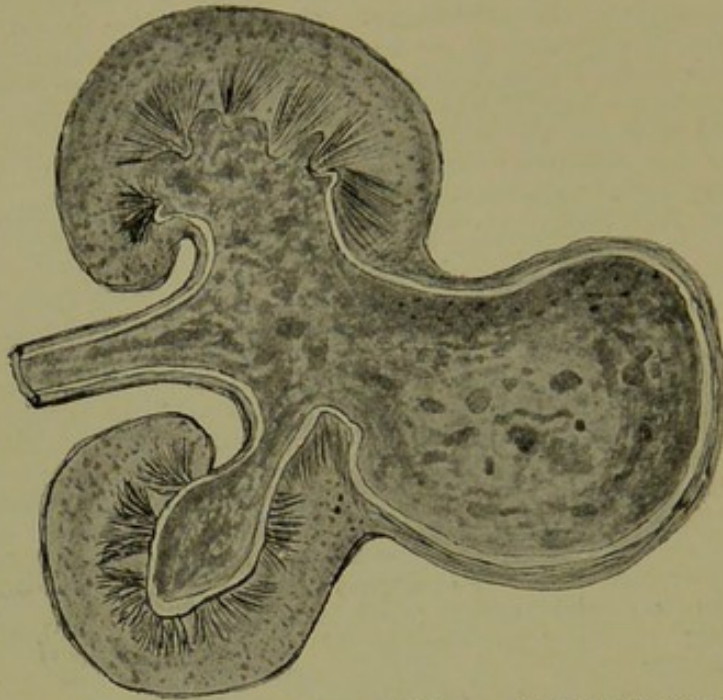


Fig. 6 shows a section of the left kidney. The pelvis and the middle third of the organ are occupied by a large tuberculous pyonephrosis and a large sac protrudes considerably beyond the outer border. The upper and lower thirds of the kidney are not much involved in the disease. (Royal Infirmary Museum, Series VII., No. M 19.)

FIG. 7.

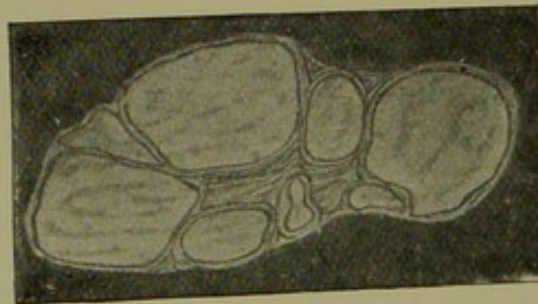


Fig. 7.—The whole kidney has been destroyed; the capsule and a few fibrous septa alone remain to represent the organ which has been replaced by caseous masses. (Royal Infirmary Museum, Series VII., No. M 20.)

(Fig. 7). A careful examination was made of the ureters and the bladder and they were found to be free from disease. A caseous mass was found over the front of the sacrum and there was caries of both sacro-iliac synchondroses.

Judging from the morbid appearances and the history of the case it is evident that the right kidney was destroyed at a very early date without causing the patient much suffering. She could not remember having had aching in the right renal region, although on the left side she had during a period of 15 years more or less intense pain, sometimes amounting to anguish. At the same time there must have been a very sudden and complete blocking of the right ureter, as there was no evidence of the kidney being distended or of the infection having spread downwards. Coincident with or following the destructive process in the right kidney the left kidney underwent a compensatory hypertrophy, but at a later period infected matter must have been conveyed to it by the blood, probably in the form of a tuberculous embolism. The tuberculous disease in the left kidney was not very destructive although of old standing.

Associated with tuberculous disease of the kidney there are usually more or less specific inflammatory changes in the mucous membrane of the pelvis, the ureter, and the bladder. The lesions in these parts generally follow the disease of the kidney. The affection of the conducting and collecting portions of the urinary tract is brought about in the following way. If the primary focus be situated in the medulla of the kidney the disease spreads into the renal substance and the tuberculous material breaks down and discharges by bursting into the pelvis and infects the mucous membrane secondarily. Or, if the pelvis is primarily involved the debris flowing into the bladder in its course infects that viscus.

Infection by invasion along the lymphatics of the kidney from foci in the lower urinary tract.—Ascending renal tuberculosis is by no means an uncommon malady. By injecting the ureter of living animals or by studying the course of events of the disease in the human subject we can easily follow the course of events. The experiment performed by Albarran throws considerable light upon this subject. By injecting the ureter with pure cultures of tubercle bacilli and ligaturing it below the point of puncture he was able to study the process by which infection proceeded along the duct and the morbid lesions associated therewith. The infection extends upwards from the bladder to the kidney. The bladder is usually contracted, its muscular coat is hypertrophied, and the mucous membrane is indurated. In the ureters and the bladder the tuberculous process begins by the formation of tubercles in the mucous membrane, and these breaking down form in a typical manner the so-called lenticular

ulcers (Fig. 8) which are characterised by a flat base covered by caseous matter and sharp rugged borders within which little miliary nodules are situated. The ulcers are at first circular, usually superficial; their edges are slightly raised and are surrounded by a pale anæmic zone set in a deeply hyperæmic mucous membrane. In the bladder these ulcers frequently coalesce, forming larger ones of variously irregular forms. Their favourite seat is—probably on account of the mode of infection—the trigone and fundus of the viscus. In this form of the disease the kidney may be rapidly destroyed by hydronephrosis and the swelling may attain an enormous size through dilatation of the kidney by its fluid contents, and at the same time the surface of the distended pelvis and the renal parenchyma may become occupied by tuberculous foci. The infection of the kidney through the pelvis has been already described. In ascending

FIG. 8.



Tuberculous ulceration of the ureter.

renal tuberculosis the course of events is so different from that which is seen in the descending variety of the disease that clinically they can be distinguished easily from one another. The former is characterised by the early obstruction of the escape of urine from the pelvis, hence the most prominent features of the disease are symptoms and signs indicative of hydronephrosis or pyonephrosis. But the contents of the dilated pelvis differ in tuberculous disease from that observed in a purely septic lesion. They may be purulent but not necessarily so; indeed, they may be quite aseptic and may consist of broken-down renal tissue and tuberculous débris, or they may present the appearance of very soft, putty-like material. The renal sac in such instances is usually unilocular but it is divided more or less by deep septa which represent all that remains of the calices. These pouches generally correspond with the prominences, while the septa mark the depressions, on the surface of the kidney, and sometimes the latter are so deep

that they give the kidney a distinctly lobulated appearance on its external surface. In some instances the obstruction to the ureter is complete only occasionally, and then the retention causes renal colic, while in the intervals the contents of the kidney escape and appear in the urine. The urine in such cases is usually clear for some days, during which time the subjective symptoms are aggravated; then suddenly the urine becomes turbulent, a sudden escape of tuberculous debris takes place, and for a time the patient is relieved.

Extension by contagion along the lumina of the excretory ducts.—This method of extension is seen in cases of ascending tuberculous lesions and the progress is much the same as that which is observed in the conveyance of septic infection. In some cases the whole route of infection may be traced in the walls or on the surface of the bladder, the ureters, and the pelvis, right into the uriniferous tubules of the pyramids. These tubules are found in many instances to be blocked by colonies of tubercle bacilli alone, but more frequently they are mixed with other organisms. The aggregations of microbes are surrounded by areas of inflamed tissue the exact character of which depends upon the age of the lesion. The foci are limited to the medullary portion of the kidney at first. In the early stage the specific inflammatory changes are slight and consist chiefly of degenerative processes in the epithelium and infiltration of leucocytes around and between the tubules, but gradually as the disease extends from the original centre disintegration of the renal parenchyma occurs and small cavities or abscesses form. The organisms may by plugging the lumina keep back the excretion and dilate the tubules. In this way the vitality of the epithelium and of the basement membrane becomes impaired and ultimately rupture occurs and the contents of the tubule is permitted to escape into the lymphatic spaces. Then the organisms rapidly spread and very soon excite fresh lesions in more distant parts of the organ.

Infection by the extension of the disease from other organs by continuity.—The isolated position of the kidneys protects them from infection by this process. Their deep situation in the lumbar region, far away from external influences, except through the lower urinary tract and the blood-stream, shut off from the abdominal cavity and surrounded by a firm fibrous capsule, make contagion by continuity difficult. But as we find in septic lesion of the kidney so also in tuberculous lesion, it must be recognised that contagion by this means does occur. The extension of tuberculous infection through the capsule is the least common channel of invasion of the renal substance, so that even in cases where the suprarenal bodies are involved in the tuberculous process the corresponding kidney is rarely affected. I have met with only one such case; in that case the kidney became infected by continuity from a tuberculous empyema. The patient was

under the care of Dr. Wood Smith while he was physician in the Glasgow Royal Infirmary. The case was one of chronic phthisis pulmonalis, in which perforation from a cavity in the lung into the pleura occurred at the left base; this led to an empyema between the diaphragm and the base of the left lung extending upwards to as high as the seventh rib. The empyema was known to exist for one month. Ultimately it perforated through the diaphragm and surrounded the left kidney. At the post-mortem examination there were found in the substance of the kidney numerous small tuberculous foci but there was no evidence of extension of the disease to the pelvis, the ureter, or the bladder. The infection evidently spread from the subcapsular lymphatic space to the lymphatics surrounding the capillaries and the uriniferous tubules.

The comparative frequency of tuberculous disease of the kidney may be judged by the following statistics quoted by Roberts: "Embracing both primary and secondary deposits, the latter being, especially in children, by far the most frequent, out of 1317 tuberculous subjects examined in the Pathological Institute of Prague (out of a total of 6000 bodies) tubercle in the kidney was found 74 times, or in the proportion of 5.6 per cent., of tuberculous subjects.¹ Among 315 tuberculous children Rilliet and Barthez found tubercle in the kidneys 49 times, or in the proportion of 15.7 per cent." Dickinson also alludes to the relative frequency of renal tuberculosis in children and in adults, and in a table compiled from the post-mortem records of St. George's Hospital and the Hospital for Sick Children, Great Ormond-street, he shows the frequency of tuberculous formations in the kidney and other organs in 600 post-mortem examinations, the subjects of 300 being under the age of 12 years and those of the other 300 of the age of 12 years and upwards. Of the former group 49, and of the latter group 17, suffered from tubercle in the kidney. These results correspond so closely with those of Rilliet and Barthez that there can be little doubt that renal tuberculosis in one form or another is specially a disease of early life, but whether the renal lesion is a primary or a secondary one is not shown in the statistics just referred to. Dickinson does not distinguish between the two forms, miliary and caseous; for "the miliary," he says, "become caseous as they enlarge, so that although in some cases there may be only one or only the other, yet they are continually intermixed and inseparable, as different results of the same process." From the surgeon's standpoint it must appear, however, very important to distinguish between a disease which involves the whole system and another which primarily attacks an individual organ or part of an organ, even although they are histologically the same pathological process. With the distinction just

¹ Prager Vierteljahrsschrift, Band i., p. 1, 1856.

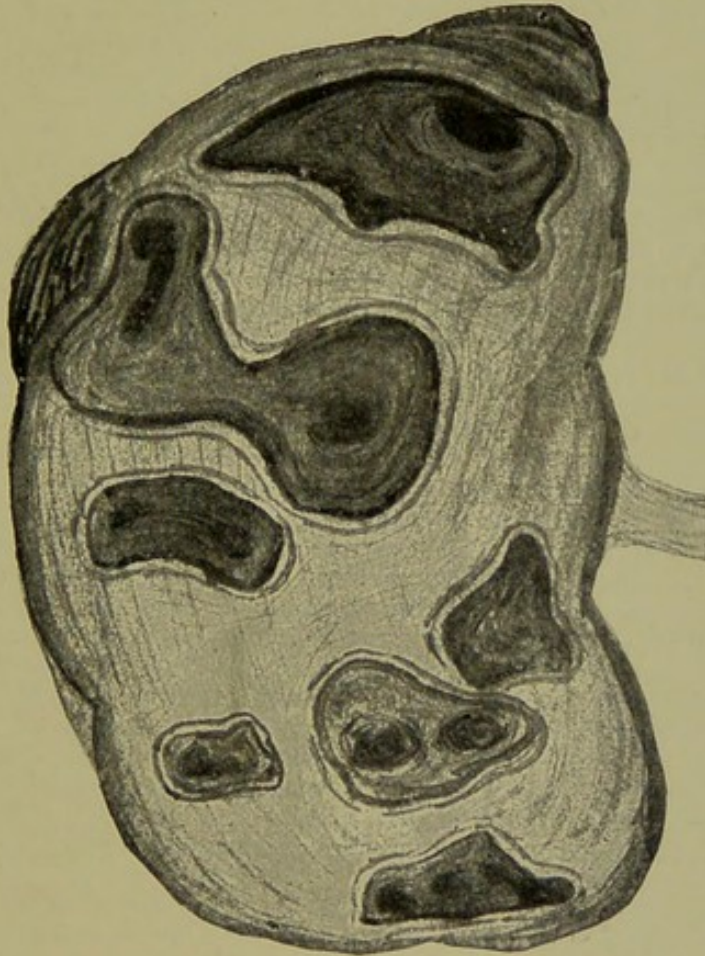
referred to in view Morris shows, by an examination of the records of the Middlesex Hospital, that of the 40 cases of tuberculous kidney met with in 2610 necropsies, 29 were miliary (secondary) and 15 were strumous (primary). Of the 29 cases of miliary tuberculosis 18 were males and 11 were females, and in 28 out of the 29 cases both kidneys were diseased, while in the 15 cases of primary renal tuberculosis (nine males and six females) both kidneys were diseased in eight patients. Another point worthy of note is the different periods of life at which the two forms of disease occur. In the miliary (secondary) tuberculosis 12 cases occurred in persons under 10 years of age, eight in persons between the ages of 10 and 30 years, six in persons over 30 years of age, and three in persons whose ages are not stated. In the scrofulous (primary) tuberculosis no cases occurred in persons under 11 years of age, five occurred in persons between the ages of 11 and 30 years, seven in persons over 30 years of age, and three in persons whose ages are not stated.

Symptomatology.—In all cases of pyuria with the renal symptoms in men a careful examination should be made of the genital organs and of the prostate for tuberculous disease, as very often a clue which is of value in diagnosis may be thus obtained. If the symptoms are associated with rapid emaciation, anæmia, elevated evening temperature, and rapidly progressing marasmus tuberculous disease should be suspected. When the disease is limited to the parenchyma of the kidney the symptoms may be insignificant and ill-defined. When the bladder, ureter, and pelvis are not involved—that is to say, when the infection is purely tuberculous and localised to the kidney—there is seldom much pyrexia. The urine is acid and the quantity of pus is small. There is not generally much pain in the affected organ nor is the kidney much enlarged. The severity of the symptoms varies according to the form of the tuberculosis. In many cases it is a noteworthy fact that marked and advanced disease of the kidney, and even of the pelvis and ureter, may exist for long periods with total absence of symptoms pointing to a lesion in the urinary tract; hence the disease may destroy one kidney and block its ureter without being recognised. The only indications of departure from health may be impairment of the general nutrition, indicated by anæmia and emaciation, so that only late in the history of the case the attention of the physician may be directed to tuberculous disease. But when the mucous membrane of the pelvis or calices becomes involved, or when abscesses of the kidney burst into them, renal pain becomes marked. It is difficult to make any general statement as to the constitutional symptoms of tuberculosis of the urinary tract: their characteristics depend not only upon the extent of the disease and the locality involved but also upon the health or disease of other organs. In many cases emaciation and anæmia are

marked, especially when there is mixed infection and the temperature is high or variable. Instances are met with, however, where tuberculous disease has existed in one kidney for a long period without any perceptible loss in weight or increase in temperature. In instances where the tuberculous lesion is small in size and localised a careful record of the temperature may reveal a slight afternoon rise of half a degree or of a degree. This slight variation in temperature in renal tuberculosis distinguishes it from a septic kidney. In the latter the variations are much greater. The fever arises in each from the action of the microbes and the amount or virulence of toxin produced by them, and consequently the pyrexia is to some extent a gauge of the activity of the morbid process. In the great majority of cases the thermometer is of much assistance, but it must be borne in mind that the pyrexia may depend more upon septic lesions in other parts than upon the aseptic renal malady. The temperature of the patient is generally from two to three or even four degrees higher in the evening than in the morning, or there may be intermittent periods of fever lasting for several consecutive days. Pain in renal tuberculosis depends upon whether the pelvis and ureter are involved in the disease. When the kidney parenchyma alone is implicated severe pain is seldom complained of and the patient only experiences a dull, dragging sensation in the loin. In cases of ascending tuberculous disease, or in advanced cases of primary renal tuberculosis where the pelvis, ureter, and bladder have become implicated, pain is often a distressing symptom. The pain sometimes simulates that of stone in the bladder. Occasionally, however, it is limited to the lumbar region or it may extend down the thighs. Frequent micturition is invariably accompanied by pain, which commences to be severe about the middle of the flow, increases towards the termination, and then subsides almost immediately the bladder is emptied. There is seldom an escape of blood with the last drops of urine and the pain and frequency are as marked during the night as in the day. In these respects the strangury of tuberculous disease differs from that met with in vesical calculus. Vesical irritation, shown by incessant and painful micturition, is a frequent and almost characteristic symptom of tuberculous disease, and this symptom may be present to a marked degree without the bladder being diseased. It is often the first symptom which attracts the patient's attention and makes him seek advice. Strangury is met with in all varieties of the disease, from the earliest to the latest stages, but it is generally most marked in the ascending lesions. It may, however, disappear or become much abated for considerable periods. In many cases swelling in the renal region is not pronounced. Sometimes, however, the kidney attains considerable dimensions and occupies the greater part of one side of the abdomen. Renal swelling sufficiently large to be made out by palpation may be pro-

duced by extensive disease of the cortex alone. (Fig. 9 shows a very good example of enormously enlarged tuberculous kidney, where the increase in bulk was due to infiltration of the parenchyma of the kidney rather than to any great distension of the pelvis or calices. The kidney weighed 28 ounces and contained a large number of irregular-walled cavities lined by greyish-white pultaceous material.) When

FIG. 9.



Enlarged kidney (weighing 28 ounces) due to tuberculous nephritis and the formation of cavities in the renal substance. (Royal Infirmary Museum, Series VII., M 10.)

this is so the swelling is found to be uniform in size when examined from time to time. On the other hand, when the renal swelling is due to obstruction of the urinary tract, giving rise to hydronephrosis or pyonephrosis from time to time, great variation in the size of the kidney may be observed. In about one-fifth of the cases recorded,

and in the majority of those operated upon for strumous disease, the tuberculous pyonephrosis was discovered by palpation during life. Increase in the bulk of the kidney, while it must be regarded as an important sign of disease, is one which when present in connexion with the tuberculous lesion usually indicates that the disease has so far advanced as to cause diminution of the lumen of the ureter or other obstruction to the flow of urine. It is important also to ascertain whether or not the swelling is limited to one side; this may be done by palpation and percussion in some cases, while in others the only reliable mode of testing the extent of the disease is by catheterising the ureters. In tuberculous disease the renal swelling may form the centre from which the pain starts and from it the pain may extend down the line of the ureter to the bladder and testicle, across the abdomen to the opposite kidney, to the spine, down the groin, or along the outside of the thigh.

It is to the diagnosis of tuberculosis in the early stage that we must especially direct attention, seeing that in its later development the aid of the surgeon is of little avail. The urine furnishes important information, and in all cases of suspected tuberculous disease careful analysis and microscopical examination of it should be made previously to the employment of any instrumental examination. One of the first indications of a tuberculous lesion in the kidney is polyuria, due, probably, to hyperæmia of the organs produced by the presence of tubercle bacilli or their toxins. It is a symptom which is very apt to be overlooked, unless when associated with albuminuria. The presence or absence of albumin seems to depend upon whether or not the tuberculous lesion freely communicates with the urinary tract. If the disease is located in the kidney substance all inflammatory products are kept shut off and do not mix with the excretion. At the same time the portion of the kidney not implicated in the disease continues to excrete healthy urine. If, however, there is a free communication between the active diseased area and the urinary tract, serum, blood-corpuscles, and leucocytes escape and give the urine an albuminous reaction.

Hæmaturia is seldom profuse, but it may occur as a premonitory symptom long antecedent to the development of a gross renal lesion. It is by no means uncommon to meet with cases of profuse and frequent hæmoptyses long prior to the development of any recognisable physical signs of pulmonary phthisis; so also in renal tuberculosis hæmaturia may be present as a premonitory symptom of the disease. Those who have had much experience in the post-mortem room must have seen cases of chronic phthisis pulmonalis where shortly before death hæmorrhages have occurred and blood has escaped into the parenchyma of one kidney or into the pelvis and where on minute examination the renal tissue or even the effused blood was found to be occupied by tubercle bacilli, yet on microscopical examination the histological structure of the kidney was little altered and beyond

the blood infiltration presented the same microscopical appearance as its fellow on the opposite side. In such cases numerous tubercle bacilli may be found in the thrombosed vessels of the Malpighian tufts without any inflammatory changes having taken place.

But while hæmoptysis has been looked upon as a valuable danger-signal of phthisis pulmonalis, even when unaccompanied by other physical signs, hæmaturia has not been regarded in the same light, although doubtless in some instances it carried with it the same warning of trouble to come. Hæmaturia is often the first indication of danger that induces the patient to seek advice, and in many instances unless repeated and most minute examinations are made the medical adviser may find it difficult to arrive at a satisfactory explanation of the symptoms. In tuberculous disease the urine presents very marked variations in the different stages of the malady; in the initial phases of the affection the presence of the virus induces a congested condition of the organ, and hæmorrhages occur which are analogous to the early hæmoptysis of pulmonary tuberculosis and are probably due to a local interference with the circulation arising directly from the intimate relationship of the tuberculous deposit with the vascular supply.

CASE 6. *Profuse hæmaturia with slight pain in the left kidney recurring thrice; no other deposit in the urine and no swelling in the lumbar region; apparent recovery for two years followed by a relapse of the symptoms and a swelling in the left lumbar region; muco-purulent deposit in the urine and tubercle bacilli; no vesical irritation.*—A young woman, aged 18 years, consulted me in September, 1893, on account of a profuse hæmaturia which had occurred a fortnight previously. No reason could be assigned for the onset of the bleeding, and it was unaccompanied by any pain over and above a sense of fulness and weight in the left renal region. A careful examination of the urine failed to reveal any abnormal constituents beyond a small trace of blood, but the hæmaturia had practically disappeared at the time I saw the patient. Three months after this first hæmorrhage a second attack, not so profuse or so prolonged as the first, occurred and two months thereafter a third attack, all without any concomitant symptoms. On account of the difficulty in forming a diagnosis an examination of the bladder was made during the last attack and blood was seen issuing from the left ureter in a distinct cloud. It was therefore evident that the hæmorrhage was of renal origin, but as there were no symptoms pointing to the nature of the malady complete rest in bed was enjoined and the patient made what was regarded at the time as a complete recovery. Two years after the first hæmorrhage a fourth hæmorrhage occurred; this was associated with considerable pain in the left lumbar region and a distinct swelling could be made out by palpation. Examination of the urine two weeks after

the hæmorrhage occurred showed it to contain a deposit of muco-purulent material as well as blood corpuscles, and on microscopical examination tubercle bacilli were discovered. Still, there were no symptoms present indicating any irritation of the bladder. The temperature was now elevated for the first time and the patient suffered from night-sweats, but there was no emaciation, loss of appetite, or serious constitutional disturbance.

CASE 7. *Hæmaturia 13 years previously to admission, and again nine years after the first bleeding; large tuberculous pyonephrosis.*—A man, aged 39 years, was admitted to the Glasgow Royal Infirmary on April 28th, 1896, complaining of pain in the region of the right kidney. The patient's first trouble in connexion with the urine dated back 13 years, when he had a slight attack of hæmaturia accompanied by pain over the right kidney, but these symptoms passed off in a few days. The patient had been in the infirmary in February, 1892, suffering from hæmaturia. He first noticed blood regularly present in his urine in November, 1895. He, however, was able to continue at work until the end of January, 1896, when he came into the hospital. At that time the hæmaturia was very considerable. He said that it was only three weeks previously to admission that he noticed anything like severe pain in the right side, and since the pain came on he had not noticed any blood in the urine. On examination a very distinct fulness was found in the right lumbar region. The whole space between the liver and the crest of the ilium was dull on percussion, and on pressure considerable tenderness was produced. The thoracic organs and the other abdominal organs were normal, so also was the bladder. The urine contained a considerable quantity of pus and some blood, and tubercle bacilli were present. The left kidney was healthy. On operation a large tuberculous kidney was discovered on the right side; it was scraped and evacuated.

In early hæmaturia the urine contains blood, but is free from tuberculous deposits such as can be recognised by the naked eye or even by the microscope. Cultivation observations and inoculation experiments may, however, detect the presence of tubercle bacilli.

Late hæmaturia from destructive tuberculous processes in the pelvis and renal parenchyma.—When the kidney parenchyma and the calices become more seriously involved the characteristics of the urine are more distinct, but this is not always the case. The physical characters of the urine are in some instances such that one can with certainty state that the urinary tract is the seat of a tuberculous lesion, while in other cases the excretion may be to no appreciable extent altered from the normal. Before destructive processes commence within the renal pelvis or substance traces of albumin and small quantities of blood may be detected, but when the tuberculous deposit has commenced to break down and

to evacuate into the ureter the quantity of albumin is increased, the urine is liable after a time to become alkaline, and along with greater or less quantities of débris of renal tissue pus appears in considerable quantity. The albuminuria differs from that of Bright's disease in that the urine is not clear, but contains much mucus; it is viscid, cloudy, and opaque, and it does not contain tube-casts. The deposit contains small caseous masses mixed with renal débris, and on standing, although a considerable amount of pus may be precipitated, a certain quantity remains suspended and imparts a cloudy appearance to the fluid.

It is only in rare instances that profuse hæmaturia occurs in renal tuberculosis. Trautenroth² records a case of a woman, aged 24 years, who was the subject of pulmonary tuberculosis in its early stage but who also suffered from profuse hæmorrhage from a tuberculous kidney which necessitated nephrectomy. The pelvis of the kidney was filled with coagulated blood and upon one of the papillæ a considerable ulcer was discovered. The parenchyma of the kidney was the seat of a diffuse tuberculosis. The urine before the operation was found to contain tubercle bacilli. The patient made a good recovery. Routier³ records a somewhat similar case where the right kidney was the seat of a large tuberculous ulceration. Severe hæmorrhage occurred and continued during 17 days associated with renal colic. On making pressure over the right kidney blood was seen to escape from the right ureter by the cystoscope. The kidney was removed and the patient made a good recovery.

CASE 8. *Occasional slight hæmaturia followed by one profuse bleeding in advanced renal phthisis.*—The only case worthy of note where severe hæmaturia occurred in advanced tuberculous disease was that of a man, aged 37 years, who was admitted to the Glasgow Royal Infirmary on June 16th, 1895. The patient was under treatment for a long period for tuberculous disease of the right kidney, and whilst occasional slight hæmaturia was observed from time to time it was not until March, 1897, that a large amount of blood escaped and at that time a very considerable hæmorrhage, amounting as the patient thought "to about a pint of blood and blood-clot," escaped, but as far as is known no recurrence of bleeding of such dimensions occurred. Although tuberculous bacilli are classified as non-pyogenic, and properly so, in many cases of tuberculous disease before mixed infection has occurred large numbers of leucocytes not distinguishable by the microscope from pus may be found. In pure tuberculous disease the urine is acid and sterile from pyogenic microbes. For diagnostic purposes it is therefore necessary to draw off through a sterilised catheter a quantity of urine and to make cultures. The presence of pyogenic

² Centralblatt für Chirurgie, 1896, No. 16.

³ Bulletin et Mémoire de la Société de Chirurgie de Paris, vol. xxi., p. 148.

micro-organisms does not exclude the possibility of the disease being tuberculous, but their absence greatly strengthens the presumption.

As the disease advances the odour of the urine as a rule becomes more and more offensive; the fluid deposits large quantities of mucus and triple phosphates and on examination it is found to be highly albuminous. Occasionally while the urine is pale and of low specific gravity there may be evidence of retention on the diseased side, as shown by increase in the renal swelling, with perhaps indistinct fluctuation and pain, accompanied by general constitutional disturbance, or there may be complete suppression, death being ushered in by uræmic symptoms.

In addition to the diagnostic points already indicated the detection of the tubercle bacillus in the urinary *débris* is of great value. It is when tuberculous lesions begin to break down that tubercle bacilli are most abundant, and sometimes their number is very large. Several examinations are required before it can be concluded from negative results that the case is not tuberculous. It is more difficult to obtain the bacilli from urine than from sputum; they are less numerous in proportion to the medium in which they lie. decomposition destroys them more rapidly, and smegma bacilli are apt to be mistaken for them. The method is as follows. Allow a quantity of urine to stand in a conical glass in a cold place for not more than six hours and from the deposit select a small quantity of *débris* and place it in a glass of $\frac{3}{4}$ per cent. salt solution. It is more rapid and more reliable, however, to obtain separation of bacilli by the employment of the centrifuge. This method should always be resorted to when the numbers are small or when the urine contains much mucus or blood. When large quantities of mucus are present it may be necessary to render the urine slightly alkaline before using the centrifuge. Having placed a small fragment of the *débris* on a clean cover-glass it should be spread out into a thin layer by pressing another cover-glass against it between the finger and thumb. On separating the cover-glasses a thin film of *débris* will be found adhering to each. The glasses must be air-dried, and then the films may be more firmly fixed by drying over a spirit-lamp or in front of a fire. The cover-glasses are then placed in or, still better, floated upon (with the film side downwards) a solution of aniline magenta or a staining fluid of gentian violet. When the film has become sufficiently stained the colour may be abstracted from all structures other than the tubercle bacilli by passing the cover-glass through a 25 per cent. solution of nitric acid. The action of the acid may be arrested by carefully washing the specimen in pure water. When examining the urinary *débris* for tubercle bacilli it is necessary in most cases to prepare at least half a dozen specimens. Should bacilli be present they will be recognised by a magnifying power of

750 diameters as minute rod-shaped bodies, coloured according to the nature of the staining fluid employed. They are from three to seven micro-millimetres long; they may be straight, but are more frequently curved or bent upon themselves at an obtuse angle; they are frequently beaded and they occur in bundles or singly. From the urine the micro-organisms are not easily cultivated, as putrefactive bacteria contaminate the culture and destroy the specific bacilli. Koch, however, states that he has succeeded in cultivating tubercle bacilli from cases of tuberculous pyelitis. In some instances the bacilli in the urine are so few in number that it is difficult or almost impossible to discover them simply by the microscope; in such instances inoculation experiments may help to clear up the diagnosis. Tuberculosis can be communicated artificially to animals in many different ways—in fact, through any of the channels of access to the body: by inhalation, by feeding animals on tuberculous products, or by injection into the serous cavities beneath the skin, or into the anterior chamber of the eye, or into veins. When tuberculous urine is injected subcutaneously into guinea-pigs or into rabbits it produces a typical tuberculosis within 10 or 12 days. The local swelling may break down, caseate, and ulcerate, while the lymphatic glands related to the part become enlarged and firm, and after a time may also caseate and the disease passes on to another group. When injected into the peritoneal cavity tuberculous urine produces an extensive tuberculous infiltration of the omentum and acute tuberculous peritonitis. Normal urine when aseptic becomes absorbed without producing any evil effect or when septic it may produce a suppurative peritonitis. If, however, the experiment is performed with care healthy urine produces a negative result, but if the urine contains tubercle bacilli or their spores acute miliary tuberculosis is developed in the course of a few weeks when the injection is made into the peritoneum, or if the urine is placed underneath the skin a hard tuberculous nodule is formed.

Besides the detection of the tubercle bacillus it is necessary to determine whether the disease is on one or on both sides. I have several times had occasion to examine by ureteral catheterisation cases of tuberculous pyelitis in which it was considered of importance to determine the extent to which the disease had involved one or both kidneys. Catheterisation can only determine the organ to which the tuberculous disease is limited; it cannot indicate the extent of the tuberculous lesion in the affected organ, but to make sure that one kidney is free from disease is a point of importance. The first time I succeeded in doing this was in 1886, when a case was examined and it was clearly shown that the tuberculous lesion was limited to one kidney.

Diagnosis.—The diagnosis of tuberculous disease from other renal lesions is generally easy, but in some instances it is extremely difficult. The most important features which dis-

tinguish the disease have already been referred to, so that little requires to be added. The diseases with which tuberculous lesions are most likely to be confounded are renal tumours, septic pyelitis, and pyonephrosis, and changes in the kidney consequent upon the presence of a calculus. In calculous pyelitis the purulent stage is slowly developed and is usually preceded by occasional attacks of slight hæmaturia. Indeed, in many cases of renal calculus the appearance of blood in the urine is the first circumstance which attracts the attention and alarms the patient. In calculus the urine passes through a stage during which there is an increase in the quantity of mucus, and this stage is succeeded by the appearance of pus, the quantity of which slowly increases. While these changes are taking place, even through a protracted period, it is remarkable how well the general nutrition of the body is maintained. In tuberculous disease, on the other hand, the purulent stage often develops early; the pus is constantly present, but is not generally in large amount. The pyuria is accompanied from the beginning by a degree of emaciation, by a careworn expression, by evening exacerbations of fever, and by rigors, by drenching night-sweats, and an interference with appetite seldom witnessed in calculous pyelitis.

Tuberculous disease is readily distinguished from malignant tumours of the kidney or renal pelvis by the circumstance that in these diseases the urine seldom contains much pus or débris, and if abnormal at all it is from the presence of blood, which when it once appears continues and may be found in large quantities.

The extension of the inflammatory process to the ureter, bladder, and lower urinary tract is strong if not unequivocal evidence of its tuberculous nature. In inflammation arising in the course of calculous pyelitis or pyonephrosis the conducting and collecting portions of the urinary system are seldom seriously implicated, whereas in strumous disease not only are those structures involved, but by a process of infection the generative organs may become invaded also—in the male the vesiculæ seminales, the vas deferens, the epididymis, or the testicle, and in the female the vagina and the ovaries. An examination, therefore, of these parts may assist the diagnosis in doubtful cases.

The diagnosis of the various stages of tuberculous disease is also especially important when operative interference is contemplated. In miliary renal tuberculosis secondary to lesions in other organs there may be only slight disturbance of function, the secondary urinary troubles being marked by the symptoms of the primary lesions. Sometimes, however, incontinence of urine may demand attention and on examination the condition of the urinary organs may be ascertained.

In chronic nephritis and in tuberculous pyelitis the symptoms are generally well marked and differ materially according to the course of events as regulated by the channel along which infection has taken place. As already indicated, in the descending variety the kidney parenchyma is first

involved, and the renal trouble, although it may be primary, is generally secondary to some easily recognised tuberculous lesion elsewhere. There is not usually much increase in the size of the organ to begin with, but sooner or later the lower urinary tract becomes involved in a way and with a degree of certainty not seen in other inflammatory diseases. When a mixed infection has taken place and tuberculous abscesses have formed and ruptured into the pelvis pyuria becomes constant, except when the flow from the ureter is retarded by an obstruction, which, however, is usually temporary. At times, therefore, the urine may be almost clear, while at others it is loaded with pus and tuberculous debris. In the ascending form of tuberculous disease vesical symptoms appear early in the course of the disease and are often associated with evidence of tuberculous lesions in the prostate, &c. The ureter becomes involved before the kidney, hence symptoms arising from obstruction, such as renal colic, transitory pyonephrosis, or increase in the size of the kidney from the dilatation of its pelvis, are observed early in the course of the disease.

Prognosis.—In tuberculosis the prognosis is most unfavourable, and is especially grave when the disease is not limited to one kidney but extends to the ureter, the bladder, or the other kidney. When, however, the lesion is limited to one kidney or to only a part of the organ the outlook is more favourable. When localised the tuberculous material may become discharged, or it may dry up into a firm caseous mass, thereby becoming practically harmless, while the other kidney undergoes a compensatory hypertrophy. It is important to observe that in many cases considerable time elapses between the commencement of the primary tuberculosis and the invasion of other parts. It is by making an early diagnosis and by taking advantage of this interval that the surgeon can hope to save, or to prolong, the life of his patient.

A question now worth consideration is, Can spontaneous cure take place? Or at the best can the progress of the disease be only checked? The more we know about tuberculous disease in all its aspects the greater is the tendency to believe in the possibility of spontaneous cure. As there are individuals whose tissues have the power of resisting the inroad of the virus, so also a person who is already infected may acquire sufficient resisting power to check the progress of the disease. When the tubercle bacilli introduced into the kidney are small in number or weak in virulence the tubercles remain discrete, the bacilli may die in the struggle of the tissues against their growth and propagation, and sometimes the only trace of the contest may be small fibrous nodules embedded in the renal parenchyma. These small scattered nodules might escape observation entirely were it not that in other parts of the organ the tuberculous process has been more extensive and more considerable patches of fibrous tissue have formed containing

more distinct remnants of tuberculous products. Complete disappearance of the tuberculous material and its replacement by fibrous tissue which contains no infective material must be looked upon as the closest approach to a spontaneous cure, at least as far as local development of the disease is concerned.

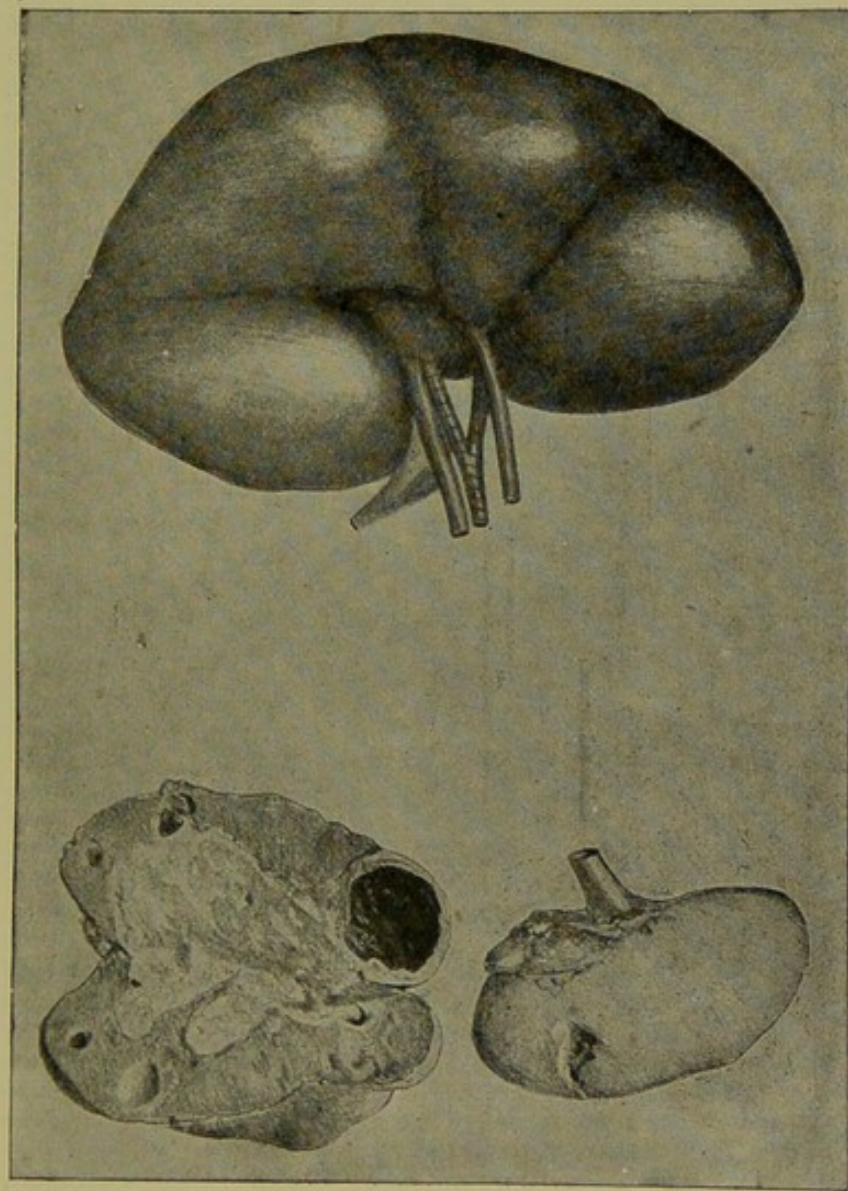
Fig. 10 shows a right kidney atrophied from tuberculous disease, entire and divided in section. It weighed one ounce, was embedded in a mass of adipose tissue, and at its upper extremity was a small cavity with smooth walls of the size of a hazel-nut filled with pultaceous material. Several other smaller cavities existed containing caseous matter. The left kidney was enlarged by compensatory hypertrophy and weighed seven and a half ounces.

Such favourable terminations are observed not only in tuberculous lesions of the kidney but also in those of the bone and joints, the lungs, the brain, &c., where, besides undergoing the changes just indicated, less complete repair may be attained by the tuberculous products undergoing retrogressive changes, such as caseation or calcification, or by becoming encapsuled in a covering of fibrous tissue. While the latter may be looked upon as favourable terminations they cannot be regarded as complete recoveries. They demonstrate, however, that in the struggle going on between the tissues and the invading bacilli the latter have not always all their own way and in the long run may fail to hold the position which they had first established.

Tuberculosis is apparently more virulent in some parts of the urinary tract than in others—for example, the bladder, the prostate, or the epididymis are more resistant than the kidney.

The susceptibility of the different tissues of the body to given diseases varies greatly, in the same manner as some species of animals are more prone to certain infectious maladies than they are to others. Immunity may be possessed by one tissue in man while in another susceptibility may be pronounced. Some diseases affect the lower animals—for example, swine plague—and never occur in man, while, on the other hand, other maladies attack the human subject while the lower animals enjoy immunity. In the guinea-pig even a few tubercle bacilli introduced into the body are certain to produce a localised tuberculosis almost invariably followed by a general dissemination of the disease. Dogs, on the other hand, are more highly resistant and a large number of bacilli must be used to produce any effect, and, as a rule, only when intra-peritoneal or intra-venous injections are employed. The disease remains localised and does not lead to a general tuberculosis. As regards susceptibility to tuberculosis certain human tissues seem to follow the course pursued in the guinea-pig while other structures offer greater resistance, analogous to that of the dog. In some structures the tuberculous process makes rapid headway, in others it remains localised for a long period, becomes quiescent, or even seems to undergo changes towards recovery. The circumstance that the tubercle bacilli

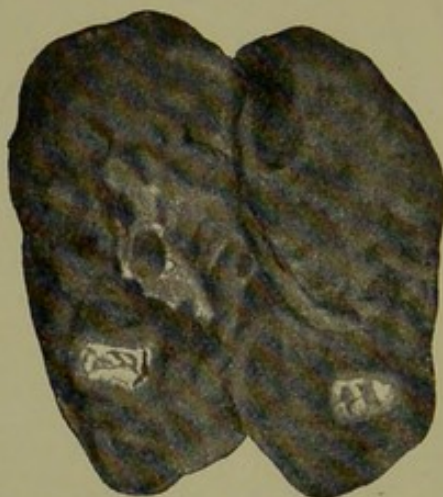
FIG 10.



Kidney atrophied from tuberculous disease.

may pass through the kidney and be found in the urine without producing any pathological effect illustrates the power possessed by the renal parenchyma in some individuals of resisting the injurious action of the organisms. When the lesion is limited to the parenchyma of one kidney and the bacilli are abundant and virulent rapid cell multiplication takes place, the virus speedily induces necrosis, which may extend beyond the tubercle into the vascular tissue around, inducing inflammatory changes which shut off the tubercle from the lymphatics and blood-vessels. In this way the tuberculous process may not extend into the pelvis, and in place of having an opportunity of being discharged may undergo fatty degeneration, caseation, and perhaps even calcification. Sometimes, however, even where caseation has taken place a cure is not effected, as the bacilli or their spores may still remain vigorous and active. So long as this is the case the process of caseation spreads

FIG. 11.



Longitudinal section of a kidney containing a caseous mass which has become encapsuled and inert.

and the tissues become infiltrated with inflammatory products. But as the organisms become less active fibrous tissue develops and the whole inflammatory focus becomes encysted. Very slowly a process of shrinking and absorption takes place. In almost all cases, however, putty-like masses or caseous nodules are left in the centre of the fibrous covering.

The disease becomes quiescent so long as left undisturbed, but if injured in any way it may again become active. Tuberculous foci, even although the great bulk of the mass has become inert as a consequence of degenerative changes, almost always contain tuberculous bacilli or their spores, so that in the event of injury the imprisoned organisms may again become virulent. When a localised tuberculous centre ruptures into the pelvis of the kidney the material may become discharged by escaping externally by a process of

gradual disintegration and breaking down of the tuberculous mass and evacuation of the débris; or the organ may be destroyed by suppuration and ultimately the only remnant left of the tuberculous process may be the fibrous tissue capsules.

While post-mortem examinations upon individuals who have died from other diseases provide us with illustrations of nature's methods of cure they also point out the kind of cases in which surgical intervention may be of some avail. Unilateral primary tuberculosis permits some time to elapse between the onset of the disease and the invasion to more distant parts. This period is in the great majority of cases not very long, but it is the only one in which the surgeon can interpose with advantage. A number of cases have been recorded where surgical treatment has prolonged life very considerably or where the patients have enjoyed good health for several years after the operation. The most favourable cases for operation are those in which, from the very circumstances of the case, the diagnosis is difficult and uncertain. Surgical treatment is, therefore, often not called for until the disease is advanced, or it is even postponed to a time when serious complications have set in. When, however, the physician fully appreciates the advantages of early surgical intervention and endeavours to recognise renal tuberculosis at an early stage better results will be obtained than those hitherto achieved. The medical attendant who makes an early diagnosis in a case of renal tuberculosis renders a service to his patient as valuable as that of the surgeon who at a later date performs a successful nephrotomy or nephrectomy.

Treatment.—As regards treatment tuberculous disease of the kidney may be compared to scrofulous lymphatic glands. The gland becomes infected, it enlarges, and, if not contaminated by pyogenic organisms in regular course, necrosis sets in and the whole structure becomes converted into a caseous mass, enclosed by a capsule through which the disease does not extend to the parts around although it may pass along the lymphatics to the neighbouring glands. When the whole of the lymphatic tissue is destroyed the activity of the tuberculous process becomes exhausted and a putty-like mass remains. The tuberculous glands can be easily recognised at an early stage and enucleated before the capsule has ruptured and an escape of the infective matter takes place into the surrounding parts. At a correspondingly early stage tuberculous disease is not recognisable in the kidney. It is only when the tuberculous material has broken down and the débris escapes with the urine that the true nature of the malady can be ascertained. It is true that the infective material as it escapes is very liable to produce a tuberculosis of the structures with which it comes in contact. On the other hand, the discharge of the caseous matter may be complete, and in that case healing occurs just as may happen in a lymphatic gland by the formation of granulation tissue. It is well

known that where rupture has taken place the healing of a lymphatic gland is much accelerated. The danger of infection is distinctly diminished by laying the gland open and by removing its contents. So also incision, scraping, and a free drainage of the tuberculous cavity in the kidney or of the distended pelvis not only removes tension and subdues pain, but is also of value in checking the local extension of the disease and by retarding general infection.

From an examination of statistics the relative value of nephrotomy and nephrectomy in the treatment of renal tuberculosis can be roughly ascertained, but there are certain points of detail that require to be carefully considered. Take first the statistics of nephrotomies and nephrectomies collected up to 1888.⁴ From an examination of the tables of nephrectomy for tuberculous disease⁵ it will be observed that although the mortality is very high—namely, 36·3 per cent.—a sufficient proportion of the patients have recovered from the operation and enjoyed a prolongation of life to justify the surgeon in extending his sway where medical treatment is unavailing. The following table shows the general results :—

TABLE I—*Nephrectomies for Tuberculous Disease.*

	Males.	Females.	Recoveries.	Deaths.
Lumbar	13	13	16	10 = 38·5%
Abdominal	—	7	5	2 = 28·6%
Totals	13	20	21	12 = 36·3%

Of the 33 cases operated upon in 26 the lumbar operation was performed (13 males with five deaths and 13 females with five deaths), and in seven female cases the abdominal operation was adopted with two deaths. The causes of death in the 12 fatal cases were as follows :—

TABLE II.

	Abdominal.	Lumbar.
Shock and collapse	1	4
Septicæmia	—	1
Uræmia	1	1
Hæmorrhage	—	1
Vomiting	—	1
Cause unknown	—	2
Totals	2	10

⁴ Newman: *Surgical Diseases of the Kidney*, 1888, pp. 300 and 340.

⁵ *Ibid.*, p. 340.

Nephrotomy has been employed in 20 cases with six deaths (three males and three females). In six instances the minor operation of incision was followed by excision, and of these two patients died and the remaining four recovered. The following table shows the general result:—

TABLE III.—*Nephrotomies for Tuberculous Disease.*

—	Males.	Females.	Recoveries.	Deaths.
Lumbar	7	12	13	6 = 32%
Abdominal	1	—	1	—
Totals	8	12	14	6 = 30%

In the fatal cases the causes of death were as follows. Two patients died from amyloid disease, one from shock following the operation, one from exhaustion, another died from an increase in the symptoms of the tuberculous disease, accompanied by epileptiform attacks, and in the sixth case the immediate cause of death is not stated. F. C. Facklam⁶ included the above cases in his statistics published in 1893 and gives the following conclusions:—Nephrotomies: out of 20 cases 12 patients died, giving a mortality of 60 per cent. Nephrectomies: out of 88 cases 25 patients died, giving a mortality of 28·4 per cent. In the "Annals of Surgery," vol. xxvii., 1898, p. 18, Dr. L. Bolton Bangs of New York (referring to Facklam's statistics), in a paper on the Remote Results after Operations for Renal Tuberculosis, remarks: "This percentage should have been better and would have been if the best means of diagnosis had been used. For since 1888, the date from which I have had my cases selected, the means of diagnosis have been improved and made more accurate, especially through the perfection of the cystoscope and catheterisation of the ureters. This fact, together with the fact that in 1888 Newman's work on the 'Surgical Diseases of the Kidney' was published, led me to select the last ten years as an arbitrary period in which to begin my research. It should also be stated that all of Facklam's cases have been carefully excluded. Therefore I believe that the cases which I herewith present have never before been summarised. There have been obtained from the literature 105, and through the courtesy of surgeons to whom a blank form was sent requesting details of their cases 30 cases more, making in all 135 cases. Summary:—Whole number of cases 135. Deaths, one month or less after operation: exhaustion, two cases; extension tuberculosis, two cases; uræmia (42 per cent.), 11 cases; various

⁶ Archiv für Klinische Chirurgie, 1893, vol. xlv., p. 715.

accidents, 12 cases; deaths, total immediate, 27. Operative mortality, 27 out of 135 = $\frac{1}{5}$, or 20 per cent. Remote results: of 19 cases no record; of the remaining 89 cases, died two to three months, six cases; died four to nine months, seven cases—total, 13; immediate deaths, 27; number of deaths within nine months, 40. General mortality after operation, 40 out of 135 = 29.63 per cent. Survived one to eight years, 45 cases, or 33½ per cent. Prognosis good or improvement great in patients alive one to nine months after operation, 31. Total survivors and promising cases, 31 + 45 = 76, or 76 out of 135 = 56.3 per cent. For the details of the state of health of the 35 cases who survived at least one to two years, which are instructive and in the main encouraging, I refer you to the schedule which I submit herewith and ask attention only to those which may be termed cases of prolonged survival. Of these there were ten." Dr. Bangs remarks with reference to his statistics: "The first and undoubted conclusion which they warrant is that the immediate result of the operation for renal tuberculosis in the cases in which they are indicated are brilliant. Many cases which seem to be *in extremis* and liable to speedy death from hectic, hyperpyrexia, pain, &c., have been immediately relieved, their existence made tolerably comfortable, and their lives prolonged. But a clear and positive conclusion as to the remote results has been an exceedingly difficult one to reach. Still, I think the opinion, based upon such statistics as I have been able to get, is warranted that operation affords better remote results than hygiene." In many of the cases the patients recovered from the operation and lived for a few months, but in how many instances a cure in the proper sense of the term was effected it is more difficult to ascertain. While there is no reason to deny that in the kidney tuberculous disease may remain local and be completely removed by operation, the circumstance that the natural tendency of tuberculous disease is to attack simultaneously several organs, or one organ after another, renders the prospect of ultimate recovery less hopeful in this disease than in other suppurative lesions, notwithstanding that the immediate mortality from the incision is not much higher than in some of the non-tuberculous suppurative affections.

Nephrotomy may be practised in the first instance if the disease is limited to a small area or has formed only one cavity which can be easily drained. In such a case hope may be entertained that no further operation may be required. But should this favourable prospect not be realised and should the wound continue to discharge, then excision of the kidney must be resorted to, otherwise the prolonged suppuration may produce amyloid infiltration of organs, including the other kidney. This danger, together with the possibility of the tuberculous disease extending to other parts, may give rise to reasonable doubt as to the wisdom of leaving the tuberculous material to separate by suppuration alone.

Various methods are adopted to facilitate the discharge of tuberculous débris. It has been proposed to empty and cleanse tuberculous pyelitis by catheterisation of the pelvis of the kidney and by washing it out with aseptic solutions. I have only employed this method of treatment on one occasion and cannot recommend it. The case was one of unilateral tuberculous pyelitis in a female. A ureteral catheter was introduced, at first every second day and afterwards daily, and the pelvis was washed out with over a pint of sterilised boric solution. For six weeks the patient stood the treatment well, but although the quantity of débris in the urine was considerably diminished no distinct improvement in the symptoms occurred and subsequently a nephrotomy was performed and the tuberculous matter was scraped out with a Volkmann's spoon. The finger should be introduced through the wound at the time of the operation and the pelvis of the kidney should be freely explored, and any caseous matter should be removed either by scraping or by the application of the cautery.

Partial excision of the kidney has been recommended in the treatment of tuberculous disease, but probably is not so suitable an operation for that malady as for lesions, such as perinephric tumours and other localised growths in the cortex of the kidney which are strictly localised or only involve a small portion of the organ.

Nephrectomy should be performed as a primary operation when the disease extends over a large area and where there is little hope of success by incision and drainage, also in cases of strumous disease where nephrotomy has previously been performed but in which a sinus and discharge persist. Where there is no reasonable prospect of saving useful renal tissue or attaining comparatively rapid spontaneous evacuation nothing can be gained and much may be lost by delay; therefore, if the general health of the patient be such as to permit nephrectomy being performed it should be resorted to at the earliest possible date—indeed, whenever it has been shown that the disease is limited to one side.

In many instances the advanced condition of the tuberculous lesion prohibits all operation, but when the nature of the case is discovered early and the disease is limited to one side an incision should be made and the condition of matters explored. If the disease can be removed without excising the whole organ so much the better, but if on examination several centres are discovered, or if the disease is extensive, the kidney should be excised at once. Undoubtedly primary nephrectomy is the favourite operation and the one most likely to effect a permanent cure. Although drainage alone, or even with thoroughly scraping out the tuberculous lesions, gives relief, it is often only short-lived and the ultimate result proves unfavourable. In those cases in which operative interference is considered inadvisable the treatment must be symptomatic. The general constitutional treatment of renal phthisis belongs properly to the domain of the physician rather than to that of the surgeon, who can practically do

nothing in the way of soothing local symptoms by instrumentation. On account of the great tendency of the urine to become alkaline and to decompose, washing out the bladder is in most instances contra-indicated. The internal use of boric acid, salol, or benzoate of ammonia frequently gives considerable relief to vesical irritation; the administration of antipyrin combined with extract of hyoscyamus has a similar effect. Strangury may be alleviated by the administration of preparations of opium per rectum or by the employment of warm sitz baths, and when the urine has become alkaline calomel administered by the mouth has also a very beneficial effect. Strict attention must be given to all hygienic details, to the careful regulation of diet, and if possible recourse should be had to a dry and elevated health resort.

Glasgow.

