BRITISH MEDICAL JOURNAL

LONDON: SATURDAY, SEPTEMBER 28th, 1935

TUBERCULOSIS OF THE KIDNEY IN CHILDHOOD

BY

O. L. ADDISON, F.R.C.S.

EMERITUS SURGEON, WEST LONDON HOSPITAL; CONSULTING SURGEON, HOSPITAL FOR SICK CHILDREN

(With Special Plate)

Tuberculous disease of the kidney, apart from miliary tuberculous, is among the rarer manifestations of the disease in childhood, and comparatively few cases are seen under the age of 10 or 11. No age, however, is exempt, and advanced examples may sometimes be found even in infancy (Fig. 1 on Plate).

Frequency of Condition

Miliary tuberculous of the kidneys is a frequent finding at necropsies on children dying of meningitis or of general tuberculosis. In 1934, out of fourteen of such necropsies at the Hospital for Sick Children, Great Ormond Street, nine showed miliary tubercles in the kidneys. In only one instance were the tubercles at all numerous; in most cases one, or two, of a few pin-head tubercles were found on the surface of the kidney, and in one case a small area of necrosis was present.

The frequency of tuberculous disease of the kidney has been under-estimated in the past, and there is no doubt that, in association with other active haematogenous lesions—for example, spine, hip, etc.—renal tuberculosis is not very uncommon. In the early stages, which may persist for some years, there are no urinary symptoms whatever, and the pyuria is so slight, and often so intermittent, that it escapes notice unless very careful and repeated microscopical examinations of the urine are made.

Harris,¹ at the Hospital for Sick Children, Toronto, found that nine out of sixty-seven children (13.8 per cent.) with bone tuberculosis had tubercle bacilli in the urine. These children had no renal or urinary symptoms other than a mild degree of pyuria, frequently intermittent in character. The discovery was due solely to a routine injection of urine every two months into guinea-pigs. The youngest patient was 3½ years. Before this routine examination of the urine was instituted only one case had been found among 392 patients. In this instance the diagnosis was made on the symptoms and confirmed by microscopical examination.

During the last year I have seen ten cases of tubercle of the kidney in children, and seven of these had other active lesions, usually of the spine or hip; one was a case of lupus. The youngest child was 4 years old. In only four of these cases was any increased frequency of micturition noticed. In several cases microscopic pyuria had been present for a year or two with or without a very slight haematuria at times.

As showing how slowly some of these cases develop, one may be mentioned where there had been intermittent haematuria for seven years, one kidney was a little enlarged, and there was some general inflammation of the bladder, but even in this case no ulceration was seen.

It seems quite clear from this evidence that if a systematic search were made regularly in all children

with surgical tuberculosis many more cases of tubercle of the kidney would be discovered.

Pathology

It has been stated that a tuberculous bacilluria—that is, a filtration of tubercle bacilli—may occur without a renal lesion and would account for these symptomless cases, but the presence of a pyuria, even if microscopic, may be taken as proof of a renal lesion. Experimental evidence also is against the filtration theory:

Helmholz² showed that organisms are not found in the urine without renal lesions; and Medlar³ showed that after the intravenous injection of tubercle bacilli into animals, tubercle bacilli were only found in the urine when demonstrable lesions were present in the kidneys, the lesions often being microscopic in size. He also showed⁴ that of thirty patients dying of pulmonary tubercle twenty-two had renal lesions, but none had symptoms before death. The lesions were all small, often microscopic in size, and required serial sections of the kidney (as many as 100,000 being cut) to demonstrate them. Many foci were surrounded by a zone of fibrous tissue and were in various stages of obliteration by fibrosis. He also found that in every case the lesions were bilateral.

Recently Band⁵ investigated 174 cases of extra-urinary tuberculosis for tuberculous bacilluria. In no case were there any symptoms or signs, or any cystoscopic or pyelographic evidence of urinary lesions. In twenty-five (or 14.4 per cent.) of these cases tubercle bacilli were isolated from the urine by animal inoculation. Pus cells were present in excess in every positive urine. The kidneys of five patients in whom tuberculous bacilluria had been present were obtained at necropsy. No naked-eye evidence of tuberculous infection was found, but on microscopical examination of serial sections (1,500 to 2,000 sections being cut from each half kidney) bilateral tuberculous lesions were found in each of the five cases.

According to Young⁶ "the original infection is practically always confined to one kidney. When the opposite kidney is involved it is usually late, leaving a period of months or years during which nephrectomy of the affected side will have a curative effect." It is difficult to accept this opinion in view of the fact that renal tuberculosis is haematogenous in origin. In every one of the cases examined microscopically by Medlar,⁴ and also in every case in the series by Band,⁵ both kidneys were involved.

Young considers the most usual site of the lesion to be in the pelvis or pyramidal portion of the kidney, and occasionally in the cortex. This certainly seems to be true on the naked-eye appearances seen in actively advancing lesions. Destruction always seems to be more advanced in the medullary than in the cortical zone

(Fig. 2 on Plate), but in the cases examined microscopically by Medlar and by Band the lesions were mainly cortical in distribution. In Band's cases no tubercles were noted in the papillary regions. They arose usually in a glomerulus or in a capillary between tubules close to a glomerulus. These early foci, if progressing, ulcerate through to the tubules. Band says:

"The collecting tubules converge at the apex of the pyramid, which is thus liable to infection (a) by direct spread from foci in the cortico-medullary zone, and (b) by tubular extension."

Usually wedge-shaped abscesses form in the medulla with their apices in the pyramids (Fig. 3 on Plate), but at times ulceration and destruction seem to spread outwards from the pelvis and calices (Fig. 4 on Plate).

Various types have been described—for example, fibrous, fibro-cavernous, and ulcerative—but there is no essential difference between them. They are all produced by the same pathological processes, modified by situation, rate of progress, and attempts at repair. Sooner or later the ureter becomes involved, either by direct ulceration spreading from the pelvis or more often from the passage of tuberculous urine. Tubercles form in the mucous membrane of the ureter, break down, and coalesce, forming ulcers, which may rapidly extend for the whole length of the tube.

The ureter may become much enlarged, the mucous membrane destroyed, and the lumen not infrequently blocked by granulations and fibrous tissues. The bladder becomes involved by the passage of tuberculous urine down the ureter, and the earliest evidence of bladder invasion in the form of redness, tubercles, and small ulcers is always seen round the orifice of the affected ureter. In the later stages the ureteric orifice becomes much ulcerated and retracted, and bladder involvement becomes general.

Symptoms

In the earliest stages of invasion of the kidney there are no symptoms, and the only sign is a very slight pyuria, usually intermittent, and discoverable only on microscopical examination. The tubercle bacillus can be found by the inoculation of guinea-pigs with a considerable quantity of centrifugized urine.

Haematuria is almost invariably the first objective sign, seldom more than slight in amount and frequently present only for twelve or twenty-four hours. The haemorrhage subsequently recurs at intervals associated with an increasing pyuria, and in the later stages of general bladder involvement is usually a constant feature.

The urine is acid, and until the disease is well advanced is seldom contaminated with other organisms. In the later stages *Bacillus coli* and streptococci are usually found. The general health is unaffected at first, and it is not until the urinary symptoms, pyuria, and increased frequency become marked that some loss of weight and general failure of health become evident. A little irregular pyrexia, the temperature rising to 100°, is often present in the more active stages, but frequently the temperature remains normal for considerable periods. In the later stages, where the kidney is disorganized, an irregular temperature, reaching 102° at night, is usual. A sudden febrile attack with a temperature of 103° or more is not unusual where there is a *B. coli* infection. Pain is never a marked feature in an uncomplicated case, though some aching may be present if the disease is very active. Where there is a *B. coli* infection with acute febrile attacks severe renal pain is usual during the attacks. The pain may be referred to the abdomen. On examination the kidney is usually not enlarged, but when practically completely disorganized may be moderately increased in size and become a little tender.

Increased frequency of micturition, difficult to be certain about in a child until it becomes very marked, does not occur until the bladder is involved. When the bladder is infected increased frequency of micturition is always present, at first more noticeable during the day. As the bladder becomes more inflamed and ulcerated the frequency increases until complete incontinence is established.

The most striking feature of the whole clinical picture is the complete absence of pain on micturition, either during or at the end of the act, even when, as frequently happens, the bladder capacity is reduced to an ounce or less. If pain does occur in an occasional instance it is due to an active *B. coli* or streptococcal infection.

Diagnosis

The diagnosis is made on the discovery of the tubercle bacillus, and in every case of unexplained chronic or intermittent pyuria a careful search must be made. The bacillus is difficult to find in an early case, and often is only intermittently present. Examination on several occasions may be necessary before the search is successful. A twenty-four-hour specimen of urine should be collected, and centrifugized for microscopical examination, and if this fails to show the bacillus the residue must be injected into a guinea-pig before tubercle can be excluded.

Even in an advanced stage of the disease the signs and symptoms are merely those of chronic cystitis—that is, pyuria, and increased frequency or enuresis. X-ray examination may show increased density of the kidney, or even calcareous areas, when disorganization has occurred, and an intravenous pyelogram will show irregularity of the pelvis and destruction of calices. Owing to the difficulty of getting a good picture by the intravenous method it may be worth while to use the ureteric method in certain cases where it is desirable to find out how much the kidney is affected. The ureteric method has been condemned as being apt to spread the disease further, but I do not think this is a really serious danger, except in an early case. Cystoscopy is always necessary.

At first the bladder may appear perfectly healthy, or a little redness and swelling may be seen round one ureter. Later a few tubercles and one or two small ulcers appear round the affected ureter, followed by inflammation of the trigone and the further spread of tubercles and ulceration on the base of the bladder. Ultimately the inflammation becomes general, and oedema and ulceration increase to such an extent that it is often impossible to find the ureteric orifices.

Course of the Disease and Prognosis

In the early stages, before there are obvious clinical signs such as constant pyuria and increased frequency of micturition, the disease progresses slowly, and may last many months or even years (Harris¹) before general involvement of the kidney takes place. It is quite certain that, contrary to the generally accepted view that a tuberculous lesion of the kidney is always progressive, a large proportion of these early infections become cured. Medlar⁴ and Band⁵ found bilateral invasion of the kidneys in every case they were able to examine microscopically. This is to be expected in a haematogenous infection, and yet when advanced cases come under observation in a large number of them the infection is unilateral.

Harris¹ found three apparent cures among his cases in children and several others in adults. Band⁵ found among his twenty-five patients (adults) with tuberculous bacilluria that seven were free from pus and tubercle bacilli at the end of three years. I have seen three cases in recent years of children with tuberculous pyuria whose urine subsequently became free from pus cells and tubercle bacilli. When the disease is well advanced it is unlikely to become arrested, though attempts at repair are not

infrequent, as shown by localized areas of fibrosis and calcification. Occasionally complete calcification of the kidney and ureter may occur (Fig. 5 on Plate).

Treatment

In the early stages of infection—that is, before the urinary symptoms have become obvious—the child should be treated in a sanatorium, preferably at first in bed. A cystoscopic examination may be made to see whether there is any evidence of early spread to the bladder, and the ureters may be catheterized to see whether one or both kidneys are infected. A ureteric pyelogram is certainly inadvisable in an early case for fear of possibly spreading the disease, and an intravenous pyelogram, though harmless, is not likely to be of value.

The urine must be examined at regular intervals microscopically and an attempt made, from the number of organisms and pus cells present, to estimate whether the disease is progressing. When the disease is advanced and unassociated with other active lesions nephrectomy should be done provided that no tubercle bacilli are found on ureteric catheterization of the other kidney and that renal function is good. Even if the second kidney is infected, but pyelography shows that the lesion is small and the function is found to be satisfactory, I think a nephrectomy may be well worth while. I have seen the most remarkable improvement in health after operation in such a case, possibly sufficient to enable the slightly damaged kidney to heal. Certainly life may be prolonged, and in any case without operation the end is inevitable.

If it is impossible to pass ureteric catheters owing to the inflammation of the bladder, it may be possible on clinical and pyelographic evidence to decide that one kidney is disorganized, while the other is normal, or nearly so.

When tuberculosis of the kidney is associated with other active tuberculous foci, such as spinal caries or other bone lesions, before operation is undertaken the general condition of the child must be carefully considered, and whether the renal or the bone lesion is the more active and important—not by any means always an easy question to decide.

On the whole the outlook after nephrectomy is pretty good, and it is surprising how rapidly a tuberculous bladder may recover and tubercle bacilli vanish from the urine once the damaged kidney is removed. In five of my own cases where a kidney was removed, the youngest being 9 years old, three recovered rapidly and the urine was free from tubercle bacilli in two or three months. Two of the successes were advanced cases, one with a good deal of bladder involvement.

F., aged 9 years, admitted with pyuria and occasional haematuria. Frequency of micturition, hourly, no pain. General condition fair, right kidney easily felt.

Cystoscopy.—Bladder held three ounces. Base much inflamed, numerous tubercles, especially round right ureter; ureteric bar much swollen and several small ulcers present. Left ureteric orifice retracted and oedematous. Catheter passed easily on left side, but only three inches on right.

Urine cleared rapidly after nephrectomy and general condition improved greatly. Five months later Fr $\frac{D}{N} \frac{6}{3}$; no tubercle bacilli found on inoculation of guinea-pig. One year later, bladder normal on cystoscopy. Guinea-pig test negative.

The other two cases improved very greatly in health; one of these I heard had relapsed six years later, and the other is too recent to say more than that there has been a very great improvement in health. The boy is putting on weight rapidly, and five months after operation the bladder capacity has increased from about one ounce to four ounces, and he can now hold his urine as long as four hours, whereas before operation his frequency was about half to three-quarters of an hour.

Summary

1. Tubercle of the kidney occurs at any age from infancy onwards.
2. It is haematogenous in origin, and is primarily bilateral in every instance.
3. In the early stages is without symptoms and can only be discovered by microscopical examination and inoculation of a guinea-pig.
4. It may not develop or give any signs or symptoms for many months or even years.
5. Many of these early infections become cured.
6. It is comparatively common in association with bone and joint tuberculosis.

REFERENCES

- ¹ Harris, R. I.: *Brit. Journ. Surg.*, xvi, No. 63, 464.
- ² Helmholtz, H. F., and Millikin, F.: *Amer. Journ. Dis. Child.*, xxix, 497, 506, 641, 645.
- ³ Medlar, E. M., and Sasano, K. T.: *Amer. Rev. of Tuberculosis*, x, 370; *Wisconsin Med. Journ.*, xxv, 59.
- ⁴ Medlar, E. M.: *Amer. Journ. Path.*, 1926, ii, 401.
- ⁵ Band, David: *Edinburgh Med. Journ.*, 1935, New Series IVth, xlii.
- ⁶ Young, H.: *Practice of Urology*, 1926, i, 280.

SURGERY OF THE PANCREAS*

BY

HAROLD UPCOTT, F.R.C.S.

HONORARY SURGEON, HULL ROYAL INFIRMARY

The more acute forms of pancreatitis have long been admitted to the domain of urgent surgery, but it is becoming clear that the disease has many degrees of lesser severity for which it may be wise to modify our treatment. Recently also the pancreas—like those other glands of supreme importance to health, the parathyroid and adrenal—has come within the range of surgery of the hormones, and it is desirable that we should survey the limits of our art in this field. Wounds of the pancreas I will not consider, since they are usually overshadowed by injury to the surrounding parts, but the surgeon need not despair even if the organ is completely divided, as patients have recovered after suture of such injuries. Crushes and contusions of the pancreas will be referred to only in their connexion with pseudo-cysts.

Acute Pancreatitis

Numerous experiments have been devised in the attempt to explain the pathology of this dramatic disease, and, though many of the results are conflicting, certain facts emerge: (1) acute oedema of the pancreas follows the injection of bile into the pancreatic duct; (2) if the injection is combined with damage to the acinar cells, as by injection under pressure or by some other means, the ferments are activated and acute necrosis occurs. This is more likely to follow if the experiment is performed soon after the animal has had a meal, when the gland cells, under the influence of secretin, are active in the production of trypsinogen.

The terminal bile and pancreatic ducts are so disposed in man that, in a certain proportion of cases—according to differing estimates from 20 to 60 per cent.—an obstruction of the common orifice will allow the entry of bile into the pancreatic duct. This obstruction may be due to the impaction of a biliary calculus in the ampulla, or, as suggested by Archibald, to spasm of the sphincter of Oddi. Direct infection may also be carried by round-worms entering the duct.

Since the biliary tract is diseased in a large proportion of cases of acute pancreatitis we have here a widely

* Read in opening a discussion in the Section of Surgery at the Annual Meeting of the British Medical Association, Melbourne, 1935.

O. L. ADDISON: TUBERCULOSIS OF THE KIDNEY IN CHILDHOOD

FIG. 1.—Dr. Thursfield's case. F., aged 1 year. Left kidney and bladder. The bladder has been everted. Large caseous mass in pelvis and medulla. Some dilatation of pelvis from blocking of ureter. Ulcer one inch in diameter on anterior wall of bladder.

FIG. 2.—F., aged 9. Kidney split sagittally. Irregular abscesses in the medullary zone, some extending into the pelvis. Cortex relatively unaffected except at the poles.

FIG. 3.—F., aged 11. Kidney split sagittally. Radiating wedge-shaped abscesses occupy greater part of the kidney. Invasion of pelvis and ureter.

FIG. 4.—M., aged 15. Advanced renal tuberculosis. Kidney split sagittally, to show involvement of pelvis and ureter, and the renal parenchyma mainly in its medullary zone. At its lower pole a cavitation occurs to within 1.5 mm. of the fibrous capsule.

FIG. 5.—Dr. Poynton's case. M., aged 10½. Healed tuberculous disease of hip-joint. Right kidney occupied by calcareous mass extending whole length of dilated ureter. Irregular density of left kidney indicates tuberculous involvement. A small calcareous area is seen in lower pole.