shaft difficult. Cases of non-union of bone after plating radius and ulna are known to us. It is usually possible to obtain the history and serial skiagrams. This serious complication appears to be due to fixation of the plate to the shaft although the fractured ends are not in apposition, to loosely fitting screws, to the introduction of sepsis, or to splinting of an inadequate type or for too short a period. In some cases more than one of these factors has been present.

All the cases reported in Group V are known to have full function. The case under treatment for 112 weeks is interesting in showing difficulties which may be encountered.

A girl aged 8 had a transverse fracture at the junction of the middle and lower thirds of the radius and ulna, with overlap of the bones. At the time of the primary reduction, which was satisfactory, it was noted that she had blue sclerotics. She had not broken any other bones. Just before she was due for discharge she fell down and re-fractured the limb, producing a similar fracture. It was again reduced satisfactorily. Shortly after the child left hospital the mother thought the plaster was dirty, so she immersed the whole limb in water. When this plaster was removed the arm was tense and the child developed the signs of an ischaemic paralysis. She was under treatment for many months for this, and union of the bone was delayed. While still under treatment she broke it again, but the setting was not satisfactory and an open reduction was carried out. That was in 1936, and the child now has a normal arm.

The patient under treatment for one year was a man of 36 who had the radius and ulna plated. The records suggest that he wished to attend hospital until litigation was settled. Apart from these two cases the average period of treatment is 50 per cent. longer than when treatment is by closed reduction.

Complications

Swelling of the forearm is a frequent sequel to reduction and application of plaster-of-Paris. This should be treated by incising the plaster up the middle of the front of the forearm, and not by enlarging the opening for the fingers and thumb. If the patient is not relieved the incision should extend the whole length of the plaster. The plaster should be prised open, and later can be fixed together by elastoplast. *Re-fracture* occurred in this series in ten children; of these, three had re-fractures twice and one three times. It is difficult to determine how many of these sustained a subsequent injury sufficient to break a normal bone. When some years ago it was first noticed that re-fractures were occurring, the length of fixation was increased; but study of the records does not suggest that this eliminated the complication, to which attention was drawn by me (Buxton, 1926). *Volkman's ischaemic contracture* (Garber, 1939) occurs in a small number of cases treated either in plaster casts or splints. It may be accompanied by median nerve paralysis. Its recognition should be followed by removal of splinting and elevation of the limb. If pain persists and voluntary movement is still greatly restricted, operation is indicated within a few hours. *Median nerve paralysis* without contracture was seen in one case in the series. Delayed operation restored function. Ulnar nerve injury has not been observed. *Synostosis* of radius and ulna is recorded as a not uncommon sequel to infected fractures of radius and ulna, but must be rare in closed fractures. *Decalcification* of the forearm bones and carpus may follow closed fractures in children and adults, but is less common than around the ankle. It appears that imperfectly reduced fractures are more liable to this complication than those which have been perfectly aligned.

Conclusion

In the treatment of forearm fractures two principles must form the basis of treatment: the correction of displacement of the bones and the fixation of the limb for a sufficient length of time to prevent the risk of displacement. The patient has seldom to be in bed, for even after operation he can be up in a few days. The shoulder and fingers should be moved by the patient himself from the beginning of the treatment. The superior and inferior radio-ulnar joint must be in perfect anatomical position after setting a forearm fracture.

Summary

The progress of nearly 400 fractures treated in one hospital has been studied. These are considered in five groups.

Stress is laid on recognition and treatment of dislocation or subluxation of the superior or inferior radio-ulnar joint with fracture of a single forearm bone (fracture of upper half of ulna and forward dislocation of upper end of radius, and fracture of lower third of radius with dislocation of inferior radio-ulnar joint).

Volkman's ischaemic contracture is recorded.

REFERENCES

- Buxton, St. J. D. (1926). *Proc. roy. Soc. Med.*, **19**, Sect. of Orth., 17.
Garber, J. N. (1939). *J. Bone Jt. Surg.*, **21**, 154.

CLINICAL SIGNIFICANCE OF TUBERCLE BACILLI IN THE URINE

BY

C. E. DUKES, M.Sc., M.D., D.P.H.

Pathologist to St. Peter's Hospital for Stone and St. Mark's Hospital, London

The term "urinary tuberculosis" is used to describe a clinical condition characterized by tuberculous lesions in the urinary tract, by the presence of urinary symptoms, and by the excretion of pus and tubercle bacilli in the urine. The term "tuberculous bacilluria" is employed to cover an occult or subclinical tuberculous infection associated with the excretion of tubercle bacilli in the urine but unaccompanied by any urinary symptoms. Tubercle bacilli are to be found in the urine in both these conditions, but it is important to decide whether the case is one of established urinary tuberculosis or of simple bacilluria. The object of this paper is to compare the results of urine tests in these two conditions.

Tuberculous Bacilluria

Tuberculous lesions of the urinary organs, whatever be their location, are almost invariably the consequence of a blood-stream infection from an active tuberculous lesion in some other organ in the body. All the evidence goes to show that the kidney is the first part of the urinary tract to be affected and that the renal lesion is at first bilateral. Tubercle bacilli brought to the kidney by the blood stream give rise to minor tuberculous lesions unaccompanied by signs or symptoms. Most of these are undetected and heal spontaneously without causing any discoverable injury. So long as these minor lesions persist, tubercle bacilli may be excreted in the urine in small numbers. Conversely, whenever tubercle bacilli are found in the urine it may be assumed that pathological lesions exist in the kidney, though a particularly thorough examination

may be necessary to discover them. A perfectly healthy kidney cannot excrete tubercle bacilli.

This type of occult or subclinical tuberculous infection of the kidney, accompanied by tuberculous bacilluria, may occur in any form of tuberculosis, but it is specially likely to be found in forms of tuberculosis spread by the blood stream, such as disease of bones and joints. Harris (1930) proved the existence of tuberculous bacilluria in sixteen out of forty-three adults and nine out of sixty-seven children with tuberculous bone lesions. Band (1935) also found tubercle bacilli in the urine of twenty-five out of 174 patients with extra-urinary tuberculosis. He watched these patients for several years, but only two subsequently developed renal tuberculosis. Tuberculous bacilluria is not so common in pulmonary tuberculosis, and Menton (1932) found only one case in seventy-six patients examined. However, the proportion of positive findings must depend on the frequency with which tests are carried out. Mack (1937) found fifteen cases of tuberculous bacilluria in twenty cases of extra-urinary tuberculosis, but some of his cases were examined several times. One patient was examined on fourteen occasions, but only four tests were positive.

The suspicion may arise that a tuberculous bacilluria is simply the first sign of clinical renal tuberculosis, which may manifest itself with the usual signs and symptoms at a later date. This is not necessarily the case. Many patients suffering from tuberculous lesions in other organs of the body than the urinary tract, but exhibiting tuberculous bacilluria, have been kept under observation for several years, yet no urinary symptoms have developed. In fact, further tests have shown that the kidneys have ceased to excrete tubercle bacilli, and it may be assumed that the minor lesions in the kidney have healed. We are now in a position to group together the features which characterize the excretion of tubercle bacilli in tuberculous bacilluria. They are as follows:

(1) Only a few tubercle bacilli are excreted in the urine, and it is very rare for them to be discovered in stained films of the centrifuged deposit. Guinea-pig inoculation is nearly always necessary for the demonstration of tuberculous bacilluria. (2) The excretion of tubercle bacilli is intermittent, so that the test may be positive on one occasion and negative on another. (3) The urine is clear in appearance and does not as a rule contain pus or blood, but at the time when tubercle bacilli are being excreted microscopic examination will reveal an excess of leucocytes in the urine. (4) In cases of tuberculous bacilluria the excretion of tubercle bacilli may cease when the patient's general health improves.

Urinary Tuberculosis

As already stated, there is abundant evidence that the minor tuberculous lesions of the kidney responsible for tuberculous bacilluria may heal spontaneously; on the other hand, a small proportion progress and give rise to clinical urinary tuberculosis. No hard-and-fast line can be drawn between tuberculous bacilluria and clinical urinary tuberculosis, but in general it may be said that clinical urinary tuberculosis is accompanied by symptoms, by constant abnormalities in the urine and pathological changes in the kidney, demonstrable by radiology and by renal function tests. Since in most cases the patient only comes for medical examination when urinary symptoms have developed it follows that tuberculous disease of the urinary organs is rarely discovered in the preclinical phase. Now, the symptoms of urinary tuberculosis are not directly due to disease of the kidney but are caused chiefly by the passage down the ureter of irritating

material and by the extension of the disease to the ureter and bladder. In fact, most cases of urinary tuberculosis are not diagnosed until the tuberculous lesion in the kidney has broken down and discharged its contents into the renal pelvis and infected the ureter and bladder. The disease is now at such an advanced stage that it may require to be treated by nephrectomy if only one kidney is affected.

Surgeons have often declared that nephrectomy is the only treatment for unilateral tuberculous disease of the kidney, because the disease cannot heal by natural means. This statement should be qualified by saying that natural cure is unlikely in any case of urinary tuberculosis discovered by a surgeon, for the simple reason that the surgeon has discovered it too late. In the earlier pre-clinical stage the disease might well have been arrested and cured by medical treatment. Up to the present the only patients who have had the good luck to have their renal tuberculosis discovered in the pre-clinical or occult stage have been those who happened to be selected for inclusion in a research or who enjoyed the services of an exceptionally thorough clinical pathologist. A much larger number of cases might be discovered and be given timely medical treatment if urine tests were carried out as a routine in extrarenal tuberculosis, especially in disease of bones and joints which are obviously haematogenous in origin. Regular examination of the urine with inoculation into guinea-pigs might thus reveal cases of tuberculous bacilluria in the pre-clinical stage. Surely it is as important to watch over incipient tuberculosis of the urinary organs as it is to carry out repeated examination of the chest or of the rate of blood sedimentation.

Comparison of Urinary Conditions

We may now compare the condition of the urine in clinical urinary tuberculosis with the state of affairs in tuberculous bacilluria. The chief points of distinction are as follows:

1. In clinical urinary tuberculosis the urine contains large numbers of tubercle bacilli, and they can generally be found in stained films of the centrifuged deposit. Cultures and guinea-pig tests are rarely necessary for the diagnosis of clinical urinary tuberculosis. It is better to repeat the microscopic examination two or three times and to make films from the deposit of a twenty-four-hour specimen of urine. When these tests have been negative, and I have proceeded to cultures and guinea-pig tests in order to allay the importunity of a surgeon, I have nearly always found the cultures and guinea-pig tests also to be negative. It often happens that something else is discovered during the six to eight weeks required for animal inoculation tests, and by the time the little guinea-pig has ploughed its lonely furrow the interest in his behaviour has considerably declined.

2. The excretion of tubercle bacilli is constant, and acid-fast bacilli can be found in films almost each time the urine is examined. I have proved this by repeating urine tests frequently, and in most cases of urinary tuberculosis it has been possible to find tubercle bacilli each day the urine was examined. In six cases of urinary tuberculosis in which acid-fast bacilli were relatively scanty I collected each specimen of urine the patient passed over a period of twenty-four hours (usually fifteen to twenty samples) and examined each one with the object of finding out at what time of the day or night tubercle bacilli were excreted in largest numbers. As a rule tubercle bacilli were most easily found in the urine passed first thing in the morning. This was not due to any influence of the hour, but simply to the fact that these samples were the most concentrated and contained the largest quantity of pus.

3. In urinary tuberculosis the urine always contains a few pus cells, and often the pyuria is sufficient to cause a definite

turbidity. I have never found tubercle bacilli in films of urine which did not contain a very few pus cells or a few red blood corpuscles. If a very dilute and watery urine is sent for examination and no pus or blood or bacteria are found in the films the best plan is to arrange to examine a more concentrated specimen or the deposit from a twenty-four-hour sample.

4. In urinary tuberculosis the excretion of tubercle bacilli will continue as long as the tuberculous lesion can discharge freely into the urinary tract. Whenever tubercle bacilli are found easily in films from the centrifuged deposit of the urine one can be sure that there is an open tuberculous lesion of the urinary tract, and if acid-fast bacteria are found in urine collected from one kidney it is certain that there is a tuberculous lesion of the kidney discharging into the renal pelvis. I reached this conclusion as the result of dissection of sixty tuberculous kidneys removed by nephrectomy before I knew of the work of Medlar (1932), Lieberthal and von Huth (1932), and Kjaer (1937). In each of these sixty cases I had examined the urine before operation, and in some had found tubercle bacilli in films, whereas in others the diagnosis had been based on guinea-pig tests, on cultures, or by other means. Whenever tubercle bacilli had been found in films the subsequent dissection of the kidney revealed an open tuberculous lesion. The smallest focus was a small tuberculous ulcer situated on the apex of a renal papilla. Next in size were small caseating lesions communicating with one of the calices. Tubercle bacilli were present in largest numbers in the ulcerating type of tuberculous lesion with extensive cavities. The films were generally negative in closed tuberculous lesions associated with calcification. In one case with double renal pelvis and double ureter I found pus and tubercle bacilli in the urine from the upper ureter, but the urine from the lower ureter contained no pus, and no tubercle bacilli were seen in films. On examining the kidney after it had been removed by nephrectomy I found an open tuberculous cavity communicating with the upper renal pelvis, whereas the tuberculous lesion of the lower pole was "closed" and had no direct communication with the lower renal pelvis.

Summary

Tuberculous bacilluria is the result of an occult or subclinical tuberculous infection of the kidney, and may occur in many different forms of extrarenal tuberculosis, especially in disease of bones and joints. Tubercle bacilli are present in the urine in small numbers only and are rarely found by microscopical examination. Guinea-pig tests are necessary to demonstrate tuberculous bacilluria. The excretion of tubercle bacilli is intermittent. The urine is generally clear in appearance, though containing an excess of leucocytes. The excretion of tubercle bacilli may cease when the patient's general health improves.

In clinical urinary tuberculosis the urine contains large numbers of pus cells, and these can generally be found in stained films. Guinea-pig tests and cultures are rarely necessary. The excretion of tubercle bacilli is constant, and will continue as long as an open tuberculous lesion can discharge freely into the urinary tract. In clinical urinary tuberculosis the urine always contains a few pus cells, and often the pyuria is sufficient to cause a definite turbidity. These points enable a distinction to be made between results of laboratory tests in tuberculous bacilluria and in clinical urinary tuberculosis.

REFERENCES

- Band, D. (1935). *Edinb. Med. J.*, **42**, 162.
Harris, R. I. (1930). *Amer. J. Surg.*, **10**, 514.
Kjaer, T. (1937). *Proc. Mayo Clin.*, **12**, 525.
Lieberthal, F., and von Huth, T. (1932). *Surg. Gynec. Obstet.*, **55**, 440.
Mack, W. S. (1937). *Edinb. Med. J.*, **44**, 253.
Medlar, E. M. (1932). *Urol. cutan. Rev.*, **36**, 71.
Menton, J. (1932). *British Medical Journal*, **2**, 965.

A PSYCHOLOGICAL ASPECT OF THE REARMAMENT PROGRAMME

BY

S. BARTON HALL, M.D., D.P.M.

Honorary Psychiatrist, Liverpool Royal Infirmary

It is forty-six years since Sir William Mather, at the Salford Engineering Works, found that reduction of weekly working hours from fifty-three to forty-eight resulted in an actual increase in total output. During the present century, and before the war of 1914-18, there gradually accumulated evidence which further illustrated the positive relation which modification of working week bore to increase of output. These findings were confirmed by the Health of Munition Workers Committee (1917 and 1918). Knight, writing in 1928, summarized his comments as follows:

(i) Every reduction in the working day leads to a decrease in accidents, spoiled work, sickness, and absence. (ii) The reduction of working hours from twelve to ten leads to an increase in hourly and daily output. (iii) The reduction of working hours from ten to eight leads to a further increase in hourly and daily output, except in operations whose speed depends mainly on the speed of machinery. (iv) The reduction of working hours below eight, though increasing hourly output, does not usually lead to an increase in daily output.

To some engaged in medical, and particularly in psychiatric, practice it is becoming apparent that these lessons, even if they have been learnt, are not being adequately applied at the present time, and the aim of this communication is to enlist the help of the profession in drawing attention to the problem before its effects begin to make themselves felt not only upon the health of individuals concerned but upon the vigour with which the nation can continue to prosecute its cause.

Statement of the Problem

Among cases of psychoneurosis investigated at a psychiatric out-patient clinic, and in which occupational factors are prominent, there has lately come to be included a type of breakdown that can be ascribed to a situation having fairly well-defined features. The clinical characteristics, though of less striking interest than the features of the situation from which they derive, have exhaustion in some form as their common basis, and they may be grouped as follows:

(a) Relative failure referred to cognitive function in its finer aspects, such as attention and its associated processes of application, concentration, recent memory, maintenance of train of thought, and ability for expression. (b) Diminution of instinctive "drives" as displayed by some failure of emotional life, volitional and conative trends such as ability for interest, affection, capacity for "looking forward," general resilience and spontaneity—the "personality" of the patient in the sense used by Mayer-Gross (1938).

The features of the underlying situation found to be common to all cases were: (i) Skilled nature of occupation. (ii) High degree of individual, or collective (foreman), responsibility. (iii) Atmosphere of "rush" and pressure reinforced by knowledge that work was connected directly or indirectly with the nation's emergency and rearmament programme. (iv) Continuous "overtime" work, with resulting extension of working week consider-