EMERGENCIES IN GENERAL PRACTICE**ACUTE OSTEOMYELITIS**

BY

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Acute haematogenous osteomyelitis has lost its terror since the introduction of modern antibiotic drugs and chemotherapy. Large series of cases are now reported in which there is not a single death. Early diagnosis, however, remains of outstanding importance, because chronic osteomyelitis, resulting from the failure to institute treatment early, is still a serious problem. In many ways the very success of penicillin for the acute infection brings with it the danger of hasty and imprecise early diagnosis. In recent years most reports have concentrated on problems of treatment, and insufficient attention has been drawn to the difficulties connected with early diagnosis. In this article an attempt is made to redress the balance by emphasizing the early diagnosis and the differential diagnosis.

Pathology and Clinical Features

Acute haematogenous osteomyelitis is a generalized septicaemia associated with a focus of bacterial infection in the medulla of one of the bones. It may occur at any age from birth onwards, though it is commonest between the ages of 10 and 14 years, boys being more commonly affected. There is often a history of preceding minor sepsis of the skin such as a boil, impetigo, or an infected scratch; or the condition may complicate pneumonia, an upper respiratory infection, or any of the acute exanthemata. Trauma is generally believed to be at least a localizing and possibly a precipitating factor.

Staphylococcus aureus is the responsible organism in about 70% of cases. Exceptionally, pneumococci or one of the salmonella group may be isolated. Streptococcal infection is exceedingly rare. Any bone in the skeleton may be affected. The lower end of the femur and upper end of the tibia are the most usual sites, the humerus the next most common. Infection may localize in the pelvic bones or the spine, and—for reasons discussed below—may then cause particular difficulty in diagnosis.

The onset of the disease is sudden. Within a few hours the child's temperature is high (103–105° F.—39.4–40.6° C.), the pulse rate correspondingly rapid, the tongue dry and coated. The affected limb is held immobile, and the increasingly severe pain is intensified by the slightest handling of the limb. In a typical case—for example, when the lesion is localized below or above the knee-joint—the overlying skin feels hot to the touch early in the course of the disease; later, swelling of soft tissues around the site of the bone infection may become obvious. A sympathetic effusion (synovitis) may develop in the joint nearest the lesion by the end of the first day. The evidence of local bone infection diminishes proportionately to the depth at which the affected bone is situated. Thus classical signs are early and obvious in an infection of the upper end of the tibia at its subcutaneous surface, but less obvious in the deeply situated upper femoral shaft. Each site of infection has, too, its special diagnostic problems. Acute infection of the ilium may easily be taken for an acute appendicitis if only the front is palpated, whereas osteomyelitis of a vertebra may mimic acute meningitis or poliomyelitis. No single sign is adequate; the clinical history and picture need to be considered as a whole.

Generally speaking, there are two clinical types of the disease—one in which local signs predominate and one in

which the systemic septicaemia is the outstanding feature. Which type will predominate in any individual case will depend mainly on three factors; the virulence of the infecting organism, the site of the bone lesion, and the age of the patient. There are no specific laboratory investigations, so the key to early diagnosis lies in a careful history and clinical examination. And since effective treatment depends predominantly upon early diagnosis, the possibility of acute osteomyelitis must always be kept in mind.

Haematology and Radiology

The erythrocyte sedimentation rate is as high as one would expect, readings of up to 50 mm. in the hour being not uncommon. The white blood cell count is that of a typical septicaemia—a high count with a pronounced polymorphonuclear leucocytosis. A positive blood culture is obtained in about 50% of cases provided that no specific treatment has been started before taking the sample.

It cannot be too strongly emphasized that a typical early case of acute osteomyelitis shows no abnormal radiological changes. The earliest abnormality is a soft-tissue shadow of an abscess surrounding the bone, but long before this appears the diagnosis should have been made and treatment begun. Radiographic changes of the bone itself do not develop under a week after onset, except in neonatal infection, which is dealt with separately below.

Neonatal Osteomyelitis

Although a newborn child may develop a fairly typical attack of osteomyelitis, it characteristically takes a different clinical course. The infant shows singularly little systemic disturbance in spite of advanced local disease, and attention may first be drawn to the infection by silent swelling and loss of function of one limb. The phalanges are not uncommonly affected, whereas this is rare in older children. In neonatal infections radiographic changes occur rapidly and are usually evident by the time the diagnosis is first made.

Differential Diagnosis of Osteomyelitis

Acute Rheumatism.—It is important to differentiate osteomyelitis from acute rheumatism, and this may be difficult. In both diseases the onset is sudden, and the predominant clinical signs may be limited to a single swollen joint. Pyrexia, raised sedimentation rate, and leucocytosis will be similar in each case. To increase the difficulty, a patient with acute osteomyelitis may have a functional systolic murmur at the apex which will mimic the signs of early involvement of the mitral valve in acute rheumatism. Although every feature of the history, symptomatology, and clinical signs will need to be considered, a scrupulous local examination is the best single guide to the differential diagnosis. The sympathetic synovitis of a neighbouring joint in acute osteomyelitis is rarely so severe that the joint cannot be moved by gentle passive manipulation. Although one dare not await developments, it is worth noting that multiple foci develop commonly in rheumatism and rarely in osteomyelitis, and that a negative blood culture is the rule in acute rheumatism. The therapeutic-diagnostic test of administering full doses of salicylates for 24 hours, which was formerly standard practice in a case of doubt, has now been abandoned. It is better to treat energetically any doubtful case as suffering from osteomyelitis until proved otherwise. A child suffering from osteomyelitis may come

to serious harm if salicylates are used in the valuable first 24 hours, whereas a child with acute rheumatism is unlikely to suffer seriously if he is deprived of salicylates for the same period.

Trauma.—It is not surprising that a readily offered history of minor trauma can put one off the correct diagnosis. This is obviously more likely to occur in those cases in which the local signs and symptoms predominate over the evidence of general infection. "Johnny has a painful leg—I think he must have bumped it . . ." is only too often the opening sentence with which one is confronted in such a case. Unless the possibility of osteomyelitis is kept in mind, it is unlikely that the child's temperature will be taken, and the correct diagnosis may be delayed for one or two valuable days.

Acute Anterior Poliomyelitis.—Older textbooks seldom include poliomyelitis in the differential diagnosis of acute osteomyelitis. In more recent publications it is beginning to find a place, but still often at the bottom of the list and in small print. Experience during the epidemic season of poliomyelitis in the past few years, however, indicates that the difficulties of distinguishing between the two conditions are very real. In one large London fever hospital some three or four children suffering from acute osteomyelitis are admitted during epidemic periods with a provisional diagnosis of acute poliomyelitis. The clinical picture of these cases runs a very similar course: an ill child, with pain and loss of function of a limb. Although the differential diagnosis may be very difficult in any particular case, it is usually possible to arrive at a correct conclusion if all the clinical features are taken into account. If the focus of infection is deeply sited in the upper end of the femur, in the pelvis, or in some part of the spine the localizing signs will be diffuse and imprecise. In a typical case of anterior poliomyelitis the onset is less abrupt, the temperature less elevated, and the polymorphonuclear leucocytosis less pronounced than in acute osteomyelitis. Intense pain is seldom confined completely to one limb and is spread throughout the main muscle mass, whereas in osteomyelitis the tenderness is maximal on direct percussion of the bone. There is fortunately a subcutaneous area of bone readily palpable somewhere on every limb, so that the tenderness of the subcutaneous surface of the tibia, condyles and greater trochanter of the femur, or iliac crest can usually be distinguished from the tenderness of calf, quadriceps, hamstrings, or gluteal muscles. An accurate differential diagnosis at the bedside demands, above all, a quiet co-operative child. Any but the gentlest handling will greatly increase the difficulties.

Scurvy and Haemophilia.—Rarely, subperiosteal or intra-articular haemorrhage due to scurvy or haemophilia may mimic osteomyelitis. The history and general manifestations will help in making the diagnosis.

Syphilitic Periostitis.—Acute syphilitic periostitis presents from time to time as the first sign of the disease in an apparently previously healthy child. The signs and symptoms closely mimic a mild case of acute osteomyelitis. The commonest site of infection is the anterior aspect of the upper one-third of the tibia, where a visible and palpable swelling will be found. In contrast to acute osteomyelitis, x-ray changes will be evident at the clinical onset of the disease. The infection is a manifestation of congenital syphilis and the Wassermann reaction will be strongly positive.

Treatment

As soon as the diagnosis of acute osteomyelitis has been made, a blood sample should be taken for culture and energetic antibiotic treatment instituted. If the child is to be transferred to hospital as an urgent case—and usually this is undoubtedly desirable—it is probably better to defer antibiotic therapy until those responsible for his definitive treatment have had an opportunity of examining and assessing him. Once treatment has been started, however, it should aim at a massive attack on the septicaemia. Half-

hearted antibiotic therapy is worse than useless, for it not only masks the signs and symptoms and gives a false sense of security in the early phase of the disease, but it may also lead to the development of resistant organisms. In spite of the known prevalence of penicillin-resistant strains of *Staphylococcus aureus*, most evidence suggests that the organism responsible for the disease in Britain is still fortunately sensitive to penicillin. Unless there are special grounds for suspecting resistant strains, penicillin is still the drug of first choice. Doses as large as from one to three million units daily should be used, and during the first few days it should be given by injection of the crystalline solution in divided doses at about four- to six-hourly intervals. Attention must be paid to the fluid intake, and the affected limb should be comfortably splinted in a way which permits its ready inspection at frequent intervals.

There is some dispute about the timing and nature of operative treatment. A reasonable estimate of informed current opinion is that about 70% of cases diagnosed within 24 hours of onset and energetically treated by penicillin will probably resolve completely without surgical drainage. The remainder will need some form of drainage either by aspiration or incision of the subperiosteal abscess or, occasionally, by direct drainage of a medullary abscess by drilling the bone. The older the child, the more likely is drainage of the bone to be necessary. The object of surgical drainage is not so much to deal with the infection as to limit the damage caused to the bone by the cutting off of its blood supply by an abscess under tension.

Although the extensive operations of earlier years are no longer necessary, the deliberate evacuation of an intra-medullary or subperiosteal abscess is of fundamental importance in appropriate cases. Trueta has suggested as a useful clinical guide that all cases with persisting tenderness 24 hours after the start of treatment should be operated upon.

Whether operation has been necessary or not, the antibiotic therapy must be continued long after the local signs have disappeared and the temperature and pulse rates have returned to normal. The duration of antibiotic therapy will depend on the age of the patient, the stage of disease at which treatment was begun, and in some measure on the site of the infection. In several series of published cases the average duration of penicillin therapy was 30 days. The E.S.R. often remains raised for several weeks after all abnormal clinical signs have disappeared, and its return to normal levels is a useful guide to when penicillin should be stopped.

Prognosis

Modern chemotherapy has practically eliminated the danger of death from acute osteomyelitis. One is now concerned with the morbidity rather than mortality. Delay in initiating treatment, or in the timing of drainage if indicated, carries the danger of avascular necrosis of bone, chronic abscess formation within the bone (Brodie's abscess), and the possibility of periodic reactivation of the infection throughout life. In this connexion the significance of abnormal x-ray patterns, which become evident several days or even weeks after properly administered early treatment, has not yet been fully worked out. It is worth noting, however, that marked alteration of bony architecture does not necessarily indicate chronicity of the infection. Taken by itself, such a change in the radiological picture is not necessarily of bad prognostic significance; on the contrary it is often a sign of healing in a badly damaged bone.

Some three out of every four cases of acute osteomyelitis diagnosed early and treated energetically may be expected to resolve completely without leaving either pathological or surgical blemish. If timely steps are taken to evacuate an abscess under tension and so prevent avascular necrosis of bone, the vast majority of all affected children should be permanently and effectively cured of the general infection and all its local manifestations.