ACUTE OSTEOMYELITIS IN CHILDREN*

BY

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It might be thought that the subject of osteomyelitis in children has become rather hackneyed of late, but there can be no doubt that the disease to-day differs in some respects from that of thirty years ago. In the first place, acute osteomyelitis in children is a disappearing disease, and this is borne out by figures that I have been able to obtain from different hospitals in the United Kingdom.

Hospital	No. of Cases 1900-10	No. of Cases 1920-30
Edinburgh Royal Infirmary	404	208
King's College Hospital	92	33
Westminster Hospital	70	36
London Hospital	100	121
Belgrave Hospital for Children	72	16
Evelina Hospital for Children	63	63
Victoria Hospital for Children	31	54
Queen's Hospital for Children	15	89

It will be seen that in some hospitals the number of cases is much reduced, while in others it has grown; the increase in some cases is due to the fact that the number of beds was increased during the years 1920-30 in the hospitals in question, and therefore the increase is more apparent than real. In others more cases are admitted than formerly, because they are not sent on to various rate-aided institutions.

The gradual disappearance of acute osteomyelitis is due to the fact that the general health of children is much better. Tonsils and adenoids are removed at an early age, and this in itself allows better aeration of the lungs, does away with septic infection of the throat, and prevents many complications occurring after infectious fevers. Debilitating and deficiency diseases of infancy are treated very effectively. Slum clearance in the British Isles is going ahead, and tenement houses with adequate washing facilities are now found in most of our big cities. The streets are cleaner and the drainage system satisfactory. There is also a tendency for these acute cases to be sent to hospital much earlier than in former years, and so early cases are seen to-day, while it was generally the late ones that were seen thirty years ago. These are the real factors in preventing the common occurrence of acute osteomyelitis in children when it is considered that the condition is a septicaemia, due in the vast majority of cases to the staphylococcus, the organism getting into the blood stream either from a septic infection on the skin, such as a boil, or from a septic tonsil, or in other cases as an enteritis.

In all probability trauma plays no important part in the causation of acute osteomyelitis, but textbooks have always stressed it as a causation for many years, and therefore it is still recorded as an initial cause. If trauma were an exciting cause there would be evidence in some cases at least of injury of the skin or soft parts, but this is always lacking. Again, in cases of fracture of the long bones, due to direct trauma in children, osteomyelitis does not ensue, and in many cases of compound fracture where excision of the wound edges is carried out good union of the fracture takes place without any sign of osteomyelitis. No doubt, in many instances, the reason

why a history of injury is obtained is the fact that acute osteomyelitis is sudden in onset, causing sharp pain near the growing end of the bone; this pain may cause the child to cry out, and in some cases to actually fall down, when the disease is affecting one of the bones of the lower extremity.

In children osteomyelitis commences on the diaphyseal side of the epiphyseal plate, and 50 per cent. of the cases occur in the femur and tibia. This frequency in the bones which take part in the formation of the knee-joint is due to the fact that more rapid growth of bone takes place there than in any other situation. The following list shows the site of infection in 100 consecutive cases in children.

*Bones Affected by Acute Osteomyelitis in Children under 12 in
100 Consecutive Cases at King's College Hospital and
the Belgrave Hospital for Children*

Bone	No. of Cases	Bone	No. of Cases
Femur	30	Fibula	3
Tibia	23	Carpus	3
Humerus	16	Clavicle	2
Ulna	10	Scapula	2
Tarsus	5	Pelvis	2
Radius	4		

Fraser, in reviewing 200 cases, found that the femur and tibia accounted for 59 per cent. The blood vessels to the growing end of a bone are numerous, because not only does the nutrient artery supply the metaphysis, but vessels from the periosteum, epiphysis, and juxta-epiphyseal region all take part in bringing blood to this area. This blood supply, however, at the actual margin of the metaphysis is in a series of tortuous loops, which are narrow and inelastic, and are in reality end-arteries. This interesting anatomical arrangement favours the occurrence of embolism, which would in itself cause a devascularization of an area of bone in the immediate neighbourhood of the metaphysis. This is the most probable way in which acute osteomyelitis starts in children.

The small area of infection, having started in the vascular marrow of the metaphysis, is in reality a considerable distance from the medullary cavity of the bone, and therefore, in the early stages of the disease, it is not necessary to open the medullary cavity in the treatment of the condition.

The course of the disease is governed by the virulence of the organism and the power of resistance of the patient. When pus formation takes place this may tract to the surface and travel under the periosteum, and cause that membrane to be stripped up for a certain distance. If, however, the infection is more severe, the medullary cavity is involved early and the infection may spread the whole length of the cavity and the whole diaphysis may be killed and become a sequestrum. All grades between these two conditions may be met with, so that each case requires to be treated on its merits. In those cases where the capsule of the joint covers the metaphysis the joint is directly infected; this always takes place where the neck of the femur is involved. In other cases the delicate lymphatics which run from the bone to the capsule of the joint may be the medium whereby the joint itself becomes infected; while in rarer cases still the epiphyseal plate of cartilage may be perforated and the joint thereby infected.

The actual pathological picture of acute osteomyelitis is similar to that of any other acute infection, but with the added factor of bone involvement. It is this factor which invariably makes the symptoms so acute and severe, because the infection is imprisoned in a dense bony capsule. If drainage is not established at an early

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date there is a great possibility of destruction of the thin-walled vessels in the bone, and infection will then reach the general circulation. It might be thought that a blood count would be an indication of the virulence of the infection and of the patient's power of resistance, but this is not borne out by practical experience, for the average leucocyte count in my cases was 18,000 to 20,000, with a polymorphonuclear percentage of 80. This in itself does not help very much, but may explain why intravenous antiseptics, such as mercurochrome, do not seem to have any influence on the disease.

It is quite conceivable that in some cases the patient's powers of resistance do overcome the infection, and the area becomes walled off, and an isolated or Brodie's abscess is formed. Such an abscess will be pushed further and further away from the growing end of the bone, so that eventually it comes to lie at a considerable distance from the epiphyseal line. Sometimes an actual sequestrum can be seen in the centre of the abscess cavity in good skiagrams. Unfortunately x-ray examination is generally of little use in the early stages of acute osteomyelitis in children, and if the surgeon waits until there is something definite in the x-ray picture he will wait too long, and valuable lives will be lost.

TREATMENT

The treatment of acute osteomyelitis must be definite and thorough, but no dogmatic statements can be made as to the treatment in every case, for each must be treated on its merits. Every case, however, requires immediate drainage, and no time should be lost in establishing this; any delay may cause extension of the primary focus and the medullary cavity may become infected, which adds to the gravity of the case. As there is a tendency to-day for the disease to assume a milder form, so there is a definite tendency for the treatment to be more conservative. To my mind the medullary cavity is not involved in early stages, and should not be opened up as a routine in every case. In early cases a simple trephining of the diaphysis just above the epiphyseal plate often is all that is required; efficient drainage is established—and that, after all, is the keynote of treatment. If after the small portion of bone has been removed the surrounding bone does not appear healthy and no bleeding takes place, then further exploration must of necessity be carried out, and the medullary cavity opened up, even to the whole of its extent if living bone is not discovered. In some cases a wedge of diaphysis can be removed after the trephine has exposed the affected bone and the focus of infection thereby completely eradicated; this is, of course, the ideal treatment in early cases.

In well-established cases the medullary canal requires to be opened up and one-third of its circumference removed. This gives adequate and efficient drainage; if more of the circumferential bone is removed a weak bone is left and fracture may take place.

As to whether multiple drill holes made down to the focus of infection can in themselves act as drainage to the area, it seems most probable that if they were efficient at first there would be a great tendency for granulations to fill up the holes and for pus to become "pocketed" beneath them, necessitating another operation. I have seen this required in several cases so treated.

With regard to the pros and cons of diaphysectomy, in the treatment of acute osteomyelitis I am firmly convinced that if the case is a late one and the whole of the diaphysis is involved diaphysectomy is the only method to be adopted, followed later by a bone graft. Such cases, however, are rare, and should be getting fewer

every year. The late results of these cases are not encouraging if they are followed over a series of years. Partial diaphysectomy, though advocated by Rankin of Glasgow and others, does not seem justifiable, and the guttering of the bone gives, in my opinion, better results, because sequestrum formation will always take place and the recuperative powers of the bone and periosteum in children are phenomenal.

The after-treatment of these cases may be said to be as controversial as the treatment itself, and many new forms of treatment have been instituted of recent years. Winnett Orr has established the fact that such cases can be treated with iodine and then mopped dry, and the gutter in the bone filled with sterile vaselined gauze. The limb is then fixed in plaster-of-Paris so that the joint above and below the bone involved is immobilized. Healing will take place under the plaster, but the odour in these cases prevents them from being nursed in the wards, and therefore this treatment can only be carried out where there is liberal balcony accommodation. Antiseptic gauze will answer the purpose quite well, and dressings can be carried out every other day; it is essential that fixation on a skeleton splint with plaster should always be established, as this ensures rest of the inflamed bone and so lessens the patient's pain. Constitutional treatment, which is all-important in these cases, cannot do any good if the little patient is in constant pain.

The use of maggots in the treatment of osteomyelitis, although used with success in America, does not seem to have many advocates in this country, and sensitive children would be very distressed to have crawling maggots placed in their wounds.

CONCLUSIONS

In conclusion it may be said that:

1. Osteomyelitis in children is a disappearing disease.
2. The disease is not so fulminating as formerly, and that is due to the fact that the general health of the children is better.
3. Trauma plays little or no part in the causation of the condition.
4. Early drainage is the essential treatment.

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