BRITISH SOCIETY FOR CHILDREN'S ORTHOPAEDIC SURGERY

The Management of Acute Bone and Joint Infection in Childhood

A Guide to Good Practice

1. Introduction

1.1 This document sets out a statement of good practice in the management of bone and joint infection in children that has been approved by the Council of the British Orthopaedic Association and by the British Society for Children's Orthopaedic Surgery.

1.2 The document aims to assist doctors in making decisions, under specific clinical circumstances, on the basis of a review of the best available evidence of effective clinical practice. The recommendations given should, in most cases, give predictable results. Appropriate decisions should lead to an improvement in care.

1.3 Two conditions will be considered – acute haematogenous osteomyelitis and acute septic arthritis.

1.4 The best results are achieved in children when the diagnosis is made early and appropriate therapy commenced.

1.5 There are wide variations in the management of these conditions. Whilst local variation may be justified, particularly with respect to the choice of antibiotics, not all can be. This document aims to assess the weight of evidence for various therapies and, on that basis, give recommendations for the treatment of the individual child.

2. Definitions

2.1 Acute haematogenous osteomyelitis has been defined as '*an inflammation of bone caused by pyogenic organisms settling from the blood stream, their presence being proven by culture or their effect on bone, this being demonstrated radiographically*'[2]. The duration of symptoms is less than two weeks[7].

2.2 Acute septic arthritis is the inflammation of a joint caused by pus-forming organisms.

3. The Scope of the Problem

3.1 Prior to the introduction of antibiotics, the mortality and morbidity was high. From 1936-1940 the mortality in one series was 36%[19]. In children under the age of 6 months death was even more common[8]. Since the advent of chemotherapy the emphasis has progressively shifted from survival to limb preservation and finally to the maintenance of normal function and growth of the affected limb or joint.

3.2 The condition is becoming less common. A population-based study has shown a steady fall over a 28 year period[3]. It is now relatively rare, with an annual incidence of 2.9/100,000 child population. Septic arthritis is twice as common as osteomyelitis in infants and early childhood. In later childhood the incidence is the same.

3.3 Whilst the fall in incidence is to be welcomed, it does make the condition less familiar and, as a consequence, it may come less readily to mind as a possibility in a difference diagnosis. It is widely recognised that the earlier the diagnosis is made and effective treatment commenced, the more likely is an excellent outcome. Delay can result in the development of complications and produce permanent impairment.

4. Diagnosis

4.1 Early diagnosis and treatment hold the key to a good result. So long as the condition is considered as a possibility it is unlikely to be missed. Both bone and joint infections are based on clinical suspicion confirmed by physical findings.

4.2 An unwell, pyrexial child with localised tenderness and loss of function has bone or joint infection until proved otherwise and should be treated as such. Typically a young child will refuse to use a limb and an older one will complain of pain. Young children may present with little other than irritability[22]. Neonates may produce a more complex clinical picture. Their immune system is less well developed and the infecting organisms may be less virulent than those found in older children. They may not be pyrexial. The infection, particularly in the premature infant, may be multifocal.

5. Laboratory Investigations

5.1 These are not to be relied upon, particularly in the neonate. It is a clinical diagnosis. That said, the C-reactive protein (CRP) is a more accurate parameter, both of activity and response to treatment, than the eryrthrocyte sedimentation rate (ESR)[18]. It is raised within 6 hours of the onset of infection compared to 48-72 hours for the ESR[16]. The ESR takes 2-4 weeks to return to normal after the elimination of the infection whereas the CRP falls much more quickly[13].

5.2 The white cell count is usually, but not always, raised.

5.3 Blood cultures are positive in about 50% of children with acute septic arthritis or acute haematogenous osteomyelitis[20]. Bacteria are isolated in 80% of arthrotomies and 70% of joint aspirates. With either of these procedures an immediate Gram stain should be done.

5.4 Saline instillation may facilitate joint aspiration but only rarely will it facilitate bacterial culture. It is even less useful in osteomyelitis.

5.5 Synovial fluid analysis normally yields a white cell count of over 50,000, with more than 80% being polymorphs.

6. Ultrasonography and Radiology

6.1 In the acute stage there are no changes on the plain films although soft tissue swelling may be apparent. Skeletal changes are unlikely to be seen before 5-7 days.

6.2 Ultrasound examination will demonstrate subperiosteal swelling due to oedema in the early stages and, later, abscess formation. It is particularly useful in demonstrating the presence of an effusion in the hip joint. For a neonate or a young infant with potentially many joints involved, ultrasound scanning facilitates the detection of an effusion easily and readily at most joints and may be repeated without difficulty.

6.3 Although bone scans may be positive as early as 24-48 hours, they are not particularly useful in the acute condition. Aspiration of a joint will not affect the results of a later bone scan. Bone scanning can prove valuable in an infant where multifocal involvement is suspected or where the infection may be in an unusual anatomical site such as the pelvis. MRI scanning has little part to play in routine assessment.

7. Organisms

7.1 Close liaison with the bacteriology and infectious diseases departments is essential to ascertain the local likelihood of infection by infecting organisms and their probable sensitivities.

7.2. In the neonate, staphylococci, streptococci and gram negative bacilli predominate whereas, in older children, staphylococci and streptococci are most often implicated.

7.3 Previously, Haemophilus had to be considered, particularly in younger children. It can now be discounted in a child who has been vaccinated against it[9].

8. Treatment

8.1 The principles of management are to identify the organism, select the correct antibiotic, deliver it effectively and minimise soft tissue destruction. This means rest for the patient and immobilisation of the affected part. This is achieved by placing the limb or joint in a plaster back slab in its position of function and applying dressings in such a way that the part can be examined on a daily basis. The infected limb or joint may require decompression or debridement and antibiotics should be administered.

8.2 Acute Haematogenous Osteomyelitis. Previously, surgery in the form of exploration of the affected part and cortical drilling was commonly performed. Cole et al.[4] considered that operation was indicated only with evidence of abscess formation. Soft tissue drainage without fenestration was then recommended. Gillespie and Mayo[6] in a retrospective study, and Lamont et al.[12], in a prospective study, found a higher failure rate when surgery had been undertaken. Lamont et al.[12] found no advantage in outcome in surgically versus conservatively treated patients.

8.3 Conclusion: Routine exploration of an osteomyelitic focus is not recommended. Failure to respond to antibiotics or evidence of local abscess formation should be the main indications. If bony changes are present and surgery is undertaken then a specimen should always be sent for histology to exclude a Ewing's sarcoma.

8.4 Should the joint be aspirated or opened? The rationale of both is to remove, as far as is possible, the products of inflammation. Even in the absence of viable micro-organisms these can cause destruction of articular cartilage. In the infant hip, all are agreed that surgical drainage, as a matter of urgency, should be undertaken[16, 21]. More superficial joints can be managed by aspiration, repeated if necessary[10, 18]. There is no place for intra-articular infusion of antibiotics as these can cause damage to the joint surfaces.

8.5 Conclusion: A septic arthritis of the hip in an infant should be drained at open operation. Above the age of one there is no evidence that exploration leads to better results than aspiration.. Aspiration, which may need to be repeated, can be sufficient in other joints. Open operation remains the treatment of choice when urgent decompression is required or other drainage methods have failed[22].

9. Choice of Antibiotic

9.1 Before starting antibiotics, samples for bacteriological examination should have been taken from all possible sites.

9.2 All chemotherapeutic agents should be bactericidal. The choice should initially be made on a best guess basis[2], pending bacteriological confirmation.

9.3 In general, under the age of one year, the most probable organisms are staphylococci, streptococci or gram negative bacilli. Flucloxacillin plus gentamicin would be suitable antibiotics, dependent on local experience. Above that age staphylococci predominate, with a minority of infections caused by streptococci. Then, appropriate initial antibiotics might be flucloxacillin with the addition of penicillin or a cephalosporin. Where a child is not immunized against haemophilus Cefotaxime should be included in the antibiotic regime. Once identification of the organism has been made, then appropriate adjustments to the regime may be required.

9.4 These are general recommendations and local guidelines should be drawn up in consultation with the bacteriological department.

9.5 Conclusion.
The basic drug is flucloxacillin with the addition of gentamicin in the under one year age group and penicillin or a cephalosporin in older children. These may be changed once the infecting organism has been identified. Clindamycin can be used where there is penicillin allergy.

10. Route of Administration

10.1 Antibiotics are initially best delivered intravenously. This ensures reliable and safe absorption in a sick child.

10.2 The duration of parenteral antibiotics is debatable. Traditionally the intravenous route was used for between 2 and 4 weeks[11]. Evidence for such prolonged administration is lacking. In a randomised trial[12] the results of intravenous administration for 3 days and 4 weeks were compared. No difference was found. The conclusion was that, presuming adequate absorption, a short intravenous course, followed by oral administration was as effective as prolonged parenteral therapy. Cole, Dalziel and Leith[5] in a retrospective study found that an early change to oral therapy did not increase the risk of recurrence. Vaughan et al.[17] reached a similar conclusion.

In each case the change of route of administration was made when the child was clinically improving, apyrexial and the CRP was falling.

10.3 Conclusion.

Short-term intravenous antibiotics, both in osteomyelitis and septic arthritis, are as effective as those delivered for a long period[11].

11. Duration of Treatment

11.1 There is a lack of evidence upon which to base any recommendations. Empirically 3 – 6 weeks has been the usual regime but there is little hard data upon which to base this opinion.

12. Conclusion

12.1 Most children with bone and joint infection make an excellent recovery. Residual damage is usually the consequence of late diagnosis or inadequate treatment.

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