INTRODUCTION

THREE decades ago in the pre-antibiotic era, infection of a major joint carried an appreciable mortality and the end result of the joint was usually disastrous. Treatment consisted of rest and drainage, either by aspiration or formal surgical exploration. Since the introduction of antibiotics the results have improved dramatically. At first antibiotics were given systemically then later supplemented by intra-articular injection. However problems in treatment still remain. Local methods of irrigation, warning of the danger of intra-articular antibiotics and indications for surgical drainage are points still under discussion. There remains the need for constant surveillance of aetiological agents and their sensitivity in order to give optimal antibiotic cover. These points prompted a survey of acute septic arthritis as an aid to further consideration of the disease and its treatment in the acute phase.

MATERIAL AND METHODS

The records of two Belfast Hospitals* were searched for all cases of primary joint infection presenting between 1960 and 1974. Only cases of proven acute haematogenous septic arthritis were included in the survey. Cases diagnosed on clinical grounds alone, without the finding of pus or specific radiological bone changes were discarded. Those cases in which there was doubt as to whether the primary lesion was adjacent acute osteomyelitis or where there was insufficient information recorded were excluded. Seventy-six cases were considered, only twenty-nine fulfilled the criteria and were analysed in detail. The average follow-up after discharge from hospital was two years.

RESULTS

The age distribution is shown in Table I. There were five patients under two months old at the time of presentation. There was a 2:1 male preponderance, there being nineteen males and ten females. Only five patients had a history of

| Age (years) | 0–1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-------------|-----|---|---|---|---|---|---|---|---|----|----|----|----|
| Number of Patients | 5 | 7 | 4 | 7 | 0 | 0 | 2 | 3 | 0 | 1 | 2 | 1 |

* The Royal Belfast Hospital for Sick Children and The Ulster Hospital, Dundonald.
trauma which could be considered relevant. The sites of infection are given in Table II. One patient had simultaneous infection in a shoulder and hip joint,

### Table II

*Site distribution of acute septic arthritis*

| Site       | Number of Cases |
|------------|-----------------|
| Shoulder   | 1               |
| Elbow      | 3               |
| Hip        | 10              |
| Knee       | 13              |
| Ankle      | 1               |

another bilateral hip infection. There was a preference for lesions on the left side, twenty patients had a joint involved on the left side, nine patients had a joint involved on the right side. The time between onset of symptoms and diagnosis was in nearly all cases less than five days, and half of the patients presented within forty eight hours of onset. Only one patient had a normal temperature on admission, pyrexia ranged from 37.3°C to 40.0°C. In all but two patients the temperature had returned steadily to normal limits within four days. One of these two patients who failed to settle had continuing bone and joint infection, the other wound abscess which was subsequently drained with no evidence of deep infection.

Twenty patients were toxaemic on admission. The average haemaglobin on admission was 11.5g./dl blood. The white blood cell count was elevated in eleven of the twenty-six recorded and all had settled within one week. The erythrocyte sedimentation rate was elevated on admission in eighteen of the twenty-six recorded and all had returned to normal limits within five weeks. There was no recurrent illness which seemed to predispose to acute septic arthritis.

Pus was cultured from twenty-seven patients, in only ten were organisms isolated. Blood cultures were carried out on twenty patients, only two of which were positive. A total of eleven organisms were isolated and their sensitivity determined. Table III.) The antibiotics used in treatment varied but the majority of patients

### Table III

*Organism and antibiotic resistance*

| Organism                  | Number of cases | Antibiotic resistance          | Number of cases |
|---------------------------|-----------------|--------------------------------|-----------------|
| **STAPHYLOCOCCUS AUREUS** | 6               | sensitive                      | 3               |
| **COLIFORM SPP.**         | 3               | penicillin and ampicillin      | 3               |
|                           |                 | penicillin, cloxacinlin,       |                 |
|                           |                 | fusidic acid.                  |                 |
| **HAEMOPHILUS INFLUENZAE**| 1               | penicillin and sulphonamides.  | 1               |
| **PNEUMOCOCCUS**          | 1               | sensitive                      | 1               |
were treated with a combination of ampicillin and cloxacillin. The only poor result was treated with tetracyclines for one week and then changed to benzylpenicillin. Only seven patients were recorded as having instillation of antibiotic initially, all were given intra-articular benzylpenicillin and very few had repeated instillations. However the regime adopted at this time entailed repeated intra-articular instillations and this low number may only reflect the failure to record this type of treatment. The average length of antibiotic treatment was five and one half weeks.

Open surgical drainage was carried out in four hips, one knee and one elbow. All were reported as containing thick pus and coagulum despite previous needle aspiration. There was one patient who developed a wound abscess which necessitated drainage. In no case was surgery considered to have caused harm.

There was only one case out of the twenty-nine in which there was a failure of treatment. This one month old child was seen in the Casualty Department with an abscess at the base of the right middle finger. Pre-auricular lymphadenitis was also noted. The abscess was drained and the child sent home. Two days later at review, the child's temperature was 38°C and further swelling was noticed in the left groin. The child was admitted to a medical ward where it was found to be ill-looking with a greyish pallor. Both hips were irritable and there was an inflamed fluctuant swelling in the left groin. Blood cultures were taken, the child was commenced on tetracyclines and a surgical opinion sought. Later that day the hip joints were formally explored and thick pus drained from both. Culture revealed a *Staphylococcus aureus* sensitive to all common antibiotics. Radiographs revealed reactive bony changes at the upper end of both femurs and both pubic rami. (Fig. 1). At eight days the temperature had not settled, tetracyclines were stopped and benzylpenicillin substituted. This was continued for

![Fig. 1. Radiograph revealing bilateral septic arthritis with bone changes in pelvic bones and both femurs.](image)

three months. One year after when the child was beginning to walk radiographs showed gross destruction and dislocation of both hips. Fours years later, there was
still no evidence of continuing bone infection but both hip joints were still grossly disorganised. (Fig. 2).

![Fig. 2. Radiograph five years later showing grossly disorganised hip joints.](image)

Five patients showed continued radiological changes in an adjacent epiphysis after adequate treatment. In none of the cases was this associated with any functional deficit despite constant follow-up examinations. A radiographic example shown. (Fig. 3). Although the numbers are small all patients with radiological epiphyseal changes were under the age of one year.

![Fig. 3. Radiograph of a defect in the right capital epiphysis after a two year period. There was no functional deficit or evidence of continuing bone infection.](image)
Late orthopaedic complications consisted of the patient already described with bilateral dislocation of hip and one patient with radiological evidence of epiphyseal damage of one hip and subsequent shortening of the leg. There were no cases of joint ankylosis.

**DISCUSSION**

In this series the most striking finding was the very low incidence of a precise bacteriological diagnosis. There was a very poor isolation rate for pus culture and only two blood cultures were positive. It is well known that pus is inhibitory to bacteria but other published series have a much higher diagnostic rate (Lidgren and Lindberg, 1973; Nelson, 1972; Ruedy, 1973.) Bacteriological specimens must not have been adequate. Under the age of two years this disease is caused by a great variety of agents and precise aetiological diagnosis is imperative so that adequate antibiotic cover can be given as soon as possible. Direct gram stains should be carried out to differentiate between gram positive cocci and gram negative rods. Pus specimens should be sent for both aerobic and anaerobic culture remembering that *Haemophilus influenza* requires enriched media and sophisticated bacteriological techniques (Wall and Hunt, 1968). A pus culture which is negative should alert one to the possibility of Bacteroides. This group has a mean isolation time of 6.5 days and should be incubated for at least three weeks (Ament, 1967). Thus antibiotic treatment must be on a "best guess" footing until bacteriology is established. Coliforms may be resistant to ampicillin and either gentamycin or kanamycin may be substituted. Over the age of two years there is a great increase in isolation of *Staphylococcus aureus* and there is now no reason why a β-lactamase resistant penicillin cannot be used as a first choice drug.

Antibiotic therapy alone is quite insufficient. Application of the surgical principle of drainage of pus is essential to minimise the articular damage, to decrease intra-articular pressure and to increase antibiotic effectiveness. In our series needle aspiration was found to be effective in all but the hip joint, However, in any joint, if doubt exists as to the efficiency of drainage it is better to formally explore the joint than to leave it full of pus. The anatomy of the hip joint makes it quite different from all the other commonly involved joints. Aspiration is difficult and adequate drainage of thick pus is difficult by needle aspiration. The added diagnostic difficulty of differentiation from acute osteomyelitis of the femoral neck means that formal surgical exploration of the hip should be very carefully considered (Gillespie, 1973; Goldenberg et al 1967).

The frequency of intra-articular instillation of antibiotics was very difficult to assess in this series. Clawson and Dunn (1967) recommend intra-articular injection, but effective concentrations of antibiotics have been shown to be present in an infected joint during systemic chemotherapy (Parker and Schmid, 1971). Series are reported where good clinical results are obtained without intra-articular injection (Russell and Ansell, 1972; Ruedy, 1973 and Nelson, 1972). However warning has been given of a chemically induced synovitis following intra-articular therapy (Argen et al 1966). It would appear that, if an infected joint is adequately drained
either by needle aspiration or surgery, systemic antibiotics provide adequate levels in the joint space and that injection of antibiotics into the joint may expose the cartilage to further risk of damage. This problem demands further investigation.

There is always the danger of pathological dislocation especially in the hip joint and splintage is mandatory. The Forrester-Brown splint is particularly useful in preventing this complication in the hip joint.

Radiological changes in the absence of infection persisting after the acute episode may include epiphyseal lysis. This does not appear to effect the short term prognosis for the joint, because if followed radiologically the epiphysis will reappear. Long term follow-up will be essential to assess the true damage to the joints involved.

We must always be alert to the diagnosis and remember that more than one joint can be involved at any one time. Adequate treatment means early precise bacteriological diagnosis, adequate drainage of the joint, if necessary a formal exploration, and bacteriocidal antibiotics in effective dosage. Adequate splintage is mandatory to prevent dislocation. The result of failure to appreciate these factors is still orthopaedic disaster.

**Summary**

Twenty-nine cases of proven acute haematogenous septic arthritis are reviewed. The clinical features are described and results are discussed. The need for a precise bacteriological diagnosis is discussed and recommendation is given for antibiotic cover. Needle aspiration was found adequate for all joints, however surgical drainage may be considered necessary especially for the hip joint. Splintage is mandatory to prevent dislocation and epiphyseal damage.

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