SEPTIC ARTHRITIS OF THE HIP AND OSTEOMYELITIS OF THE UPPER END OF THE FEMUR IN INFANTS

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This paper is a review of nine children who had a septic arthritis of the hip and who can be accepted as examples of Tom Smith’s disease or acute arthritis of infancy, with one other example of an extensive osteomyelitis of the femur in an infant. A review of the literature suggests that it is not a very common disease and a report of a small personal series may prove useful.

Every study of this subject should start with Thomas Smith’s classical review of septic arthritis of infancy in 1874. His study was not confined to any one joint and included thirteen fatal cases in which he made a careful post-mortem examination of the joints, from which he concluded that the septic arthritis usually resulted from the rupture into the joint of a metaphyseal, or occasionally an epiphyseal, abscess; in other words, that the process usually began as an osteomyelitis. Among his eight surviving patients were three with a persisting dislocation after a septic arthritis of the hip. He was the first to realise that a haematogenous osteomyelitis or arthritis of infancy, when not fatal, recovered rapidly with no persisting sinuses and no late complications—in contrast to the relapsing osteomyelitis which was usually expected in those days in older patients.

CLINICAL MATERIAL

Table I summarises the case histories in this series. The age of onset ranged from a few days (three infants) to twelve months; six out of the ten patients were under three months of age. The duration of symptoms before admission varied between seven and twenty-eight days in the seven cases in which this point was recorded.

None of the infants had a high temperature after admission: although a few were very ill and most showed marked local swelling (Figs. 1 and 32), often with purple discolouration, yet in none was the temperature above 101 degrees Fahrenheit (38-3 degrees Centigrade). The swelling of the thigh is often shown in the early radiographs (Figs. 9 and 12). The limited constitutional upset in the presence of severe bone and joint infection—sometimes with multiple foci—has been noted by others: Greengard in 1946 classified his patients into two groups, one showing very slight constitutional reactions and the other a severe and often overwhelming toxæmia. The introduction of antibiotics has favoured the first group, and no death occurred in this series.

In Case 10 the osteomyelitis was extensive but the hip joint escaped, while in Case 1 the hip and upper third of the femur were involved; yet the extent of the swelling and the position in which the limb was held gave no indication of this important difference in pathology.

The organisms responsible for these infections were: Streptococci, 2; staphylococcus aureus, penicillin resistant, 1; staphylococcus aureus, sensitivity not known (1936), 1; pneumococcus, penicillin sensitive, 1; gram negative bacillus, possibly haemophilus, 1.

In two cases the organism could not be determined because no pus was obtained, and in two the records are inadequate. Although the streptococcus was found more often than it is in osteomyelitis and septic arthritis in older children it did not dominate the picture as in the series recorded by Green and Shannon (1936) in which 60 per cent of infections were caused by this organism. Potter (1954) also noted the frequency of streptococcal infection in an excellent review of osteomyelitis of the new-born.
TABLE I

<table>
<thead>
<tr>
<th>Case number</th>
<th>Age at onset</th>
<th>Duration of symptoms on admission</th>
<th>Pyrexia after admission</th>
<th>Treatment</th>
<th>Organism</th>
<th>Late surgery</th>
<th>Result</th>
<th>Follow-up period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9 weeks</td>
<td>28 days</td>
<td>Never above 100°F (37.7°C)</td>
<td>Drainage of abscess down to bone. Traction with abduction. Streptomycin in 21 days. Later abduction plaster 5 weeks</td>
<td>Staphylococcus aureus. (Penicillin resistant)</td>
<td>Open reduction planned</td>
<td>Loss of capital epiphysis. Dislocation.</td>
<td>1¼ inches shortening</td>
</tr>
<tr>
<td>2</td>
<td>12 months</td>
<td>28 days</td>
<td>Never above 101°F (38.3°C)</td>
<td>Aspiration. Penicillin locally and systemically. Traction 7 weeks. Walked after 8 months</td>
<td>Gram negative, pleomorphic bacillus, possibly haemophilus</td>
<td>Abduction osteotomy at 5 years</td>
<td>Remnants of capital epiphysis attached to acetabular rim. Femoral neck remained in acetabulum</td>
<td>10 years</td>
</tr>
<tr>
<td>3</td>
<td>8 weeks</td>
<td>21 days</td>
<td>Only once above 100°F (37.7°C)</td>
<td>Drainage of abscess. (Minor surgery.) Sulphathiazol</td>
<td>Haemolytic streptococcus</td>
<td>Abduction osteotomy at 6 years</td>
<td>Loss of capital epiphysis. Neck remained in acetabulum.</td>
<td>1¼ inches shortening</td>
</tr>
<tr>
<td>4</td>
<td>6 weeks</td>
<td>No records available</td>
<td>Abscess aspirated</td>
<td>None obtained</td>
<td>Staphylococcus aureus</td>
<td>Abduction osteotomy at 10 years</td>
<td>No dislocation. Epiphysis survived. Loss of epiphysial plate. 2½ inches shortening</td>
<td>20 years</td>
</tr>
<tr>
<td>5</td>
<td>3 months</td>
<td>12 days</td>
<td>102°F (38.9°C)</td>
<td>Penicillin for 21 days. Full abduction in plaster or splint for 4 months. Some abduction in splint for further 14 months</td>
<td>None obtained</td>
<td>—</td>
<td>(Severe subluxation and metaphysical changes.) Good reduction and coxa magna resulted</td>
<td>10 years</td>
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</table>

In two of these infants skin sepsis had occurred within a few days of the onset of the bone and joint infection, and the possibility of the umbilicus as a source of entry must be accepted in a further three infants in whom the illness started within a few days of birth. The importance of skin sepsis was stressed by Green and Shannon (1936).

TREATMENT

The literature reveals a difference of opinion on the early surgical treatment, some surgeons (Wilkinson 1952, Nicholson 1949) strongly advising aspirations only, whereas Blanche (1952) advised drainage. The treatment in this series was determined by the clinical picture; in most. aspiration was sufficient, and in only two cases did the local swelling and induration seem to call for the open drainage that was employed. This lends some support to those who confine their surgery to aspiration. The soft bones and delicate periosteum are readily penetrated by the pus; much bone necrosis does at times occur but the powers of repair in infancy seem to make light of this.

If the lesion is mainly a septic arthritis—albeit resulting from intra-articular rupture of a
metaphysial focus—aspiration, local and systemic antibiotic treatment, and rest to the joint in the abducted position, seem to suffice. If the osteomyelitis is widespread in the bone (although the hip was spared in Case 10), and if there is much local swelling with tense and often discoloured skin, then it is probably best to release the pus by free incision and to close the skin immediately. No wide dissection seems necessary because the pus is usually encountered during separation of the muscles.

Poor results seem to arise from the frequently insidious course of the disease with a late diagnosis and treatment; free drainage cannot then save the joint (Case 1). We need to be very much on the lookout for this condition, which, like osteomyelitis in general, seems to be becoming rather more prevalent. Wilkinson's (1952) somewhat fatalistic approach was summed up in his remark: "The story of these hips has been written when the patients reach us." He is right to the extent that really improved results will come only with earlier diagnosis, which, at the time it should be made, is of course purely clinical and has no radiological confirmation.

Late surgery has been confined to abduction osteotomies both in patients in whom the

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<tbody>
<tr>
<td>6</td>
<td>21 days</td>
<td>No records available</td>
<td>No records available</td>
<td>Abscess drained. (Minor surgery)</td>
<td></td>
<td>Abduction osteotomy at 2 years</td>
<td>No dislocation. Epiphysis survived. Loss of epiphysial plate. 24 inches shortening</td>
<td>10 years</td>
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<tr>
<td>7</td>
<td>11 days</td>
<td>Records deficient. (Also had osteomyelitis lower end of opposite femur)</td>
<td>No records</td>
<td>No record of early treatment. Resultant subluxation treated in abduction plaster for some months, starting at 9 months of age</td>
<td></td>
<td>—</td>
<td>(Subluxation and moderate epiphysial change.) Good reduction and mild coxa magna resulted</td>
<td>10 years</td>
</tr>
<tr>
<td>8</td>
<td>6 months</td>
<td>12 days</td>
<td>100 F. (37.7 C.) on two occasions</td>
<td>Dry aspiration. Penicillin. Traction. Abduction splintage. Plaster and later splint for 10 months</td>
<td></td>
<td>—</td>
<td>(Subluxation and severe epiphysitis.) Good reduction with marked coxa magna</td>
<td>8 years</td>
</tr>
<tr>
<td>9</td>
<td>12 months</td>
<td>7 days</td>
<td>103 F. (39.4 C.) on two occasions</td>
<td>Aspiration. Penicillin. Traction. Abduction plaster 3 months</td>
<td>Pneumococcus. (Penicillin sensitive)</td>
<td>—</td>
<td>(Subluxation and epiphysitis.) Good reduction with slight coxa magna</td>
<td>4 years</td>
</tr>
<tr>
<td>10</td>
<td>17 days</td>
<td>12 days. Sepsis on skin of wrist. (Also had osteomyelitis of thoracic spine)</td>
<td>101 F. (38.3 C.) on two occasions</td>
<td>Drainage with drilling of intertrochanteric region. No pus from hip aspiration. Penicillin. Leg held in abduction; no splintage was needed</td>
<td>Haemolytic streptococcus</td>
<td>—</td>
<td>(Gross osteomyelitis of whole femoral shaft.) Complete resolution</td>
<td>4 years</td>
</tr>
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</table>
Case 1. Figure 1—This child was nine weeks old on admission. There was fluctuation in the adductor region. Traction and abduction for a total of three months. Figure 2—Two weeks later. Figure 3—Two years later. There is no sign of the epiphysis, and dislocation has occurred. Figure 4—An arthrogram showing no cavity save that outlining the cartilaginous neck of the femur two and a half years after the acute arthritis.

Case 2. Figure 5—Twelve months old, this child had a history of five weeks. Dislocation with separation of the ischaemic capital epiphysis has occurred. Figure 6—Nine weeks later, after penicillin and aspiration, the dislocation and separation of the epiphysis persists. The child has been on traction for seven weeks. Figure 7—The capital epiphysis is seen to be adherent to the acetabular lip three and a half years later. Figure 8—The capital epiphysis has united with acetabular lip five years after the acute arthritis and eighteen months after osteotomy. The range was: flexion, 80 degrees; abduction, 30 degrees; internal rotation, full; external rotation, 5 degrees. There was 1 inch of shortening.
epiphysial plate was destroyed and in those in whom the femoral neck was retained in the acetabulum although the capital epiphysis was destroyed. In all, the osteotomies have contributed greatly to stability at the hip. Surgery for the child with complete dislocation (Case 1) may be along the lines advocated by L’Episcopo (1936) and Harmon (1942); an arthrograph can reveal a good femoral neck and confirm the absence of a capital epiphysis.

RESULTS

The period of observation on these patients is from two years upwards. In three of them it exceeds five years; in three, ten years; and in one it exceeds twenty; so some impression of

later results can be obtained. The outcome of the disease was: 1) Loss of capital epiphysis with persisting dislocation—one; 2) loss of capital epiphysis—neck of femur in acetabulum—two; 3) loss of epiphysial plate and survival of capital epiphysis in acetabulum—two; 4) epiphysial changes leading to coxa magna—four; 5) gross osteomyelitis of whole femoral metaphysis, with the hip escaping infection and the capital epiphysis remaining normal—one.

The present series includes two infants treated before penicillin was available (1936 and 1944), while the other eight were born in more fortunate days. While antibiotics have played an important part in the treatment of the later patients, it must be noted how reasonably successful the two infants (Cases 3 and 4) were in mastering their infection without the assistance of these powerful drugs.
Case 4. Figure 12—A six-weeks-old baby had an abscess of the hip and dislocation on admission. Figure 13—Three weeks later.

Case 4. Figure 14—Eight months later. Figure 15—After two years the femoral shaft has not ridden up.

Case 4. Figure 16—Ossification of the capital epiphysis was first seen when the child was nearly four years old. Here it is seen at the age of nine years. The epiphysial plate has been destroyed, and there is a fibrous union. Figure 17—At the age of twenty, six years after controlled abduction osteotomy, the range of movement is: flexion, 180-90 degrees; abduction, 20 degrees; external rotation, 45 degrees; shortening, 2½ inches.
Case 6. Figure 21—This infant was a few days old when the abscess was incised. Penicillin was given. The destruction of the epiphysial plate is shown here at eighteen months but the capital epiphysis has survived and remains in the acetabulum. Figure 22—Controlled abduction osteotomy at two years of age. Figure 23—Nine years old. The plate has been removed and there seems to be a fibrous union. The abduction at the osteotomy has largely grown out. The range of movement was: flexion, 180-90 degrees; abduction, 20 degrees; external rotation, 0-150 degrees; shortening, 2½ inches.
Case 7. Figure 24—Eleven days old. Septic arthritis of the left hip and osteomyelitis of the lower end of the right femur in an eleven-days-old baby. Subluxation of the left hip is seen here nine months after the acute arthritis. Figure 25—At eighteen months a well centred epiphysis shows epiphysitis with a widened cartilage space around it. Figure 26—There is some coxa plana at seven years of age.

Case 8. Figure 27—A six-months-old baby with a two-weeks' history on admission. Subluxation and metaphysical changes are seen in this radiograph ten days later. No fluid was obtained on aspirating the hip. Penicillin was given and traction in abduction was maintained for ten months. Figure 28—Five months later there is subluxation and considerable epiphysial change. Figure 29—Two and a half years later there is a marked coxa magna. The child is three.
Case 9. Figure 30—Twelve months old, this child had a seven-days history. Pus was aspirated from the hip, which was treated with penicillin. Traction for four days was followed by an abduction plaster for three months. Figure 31—The epiphysial changes are disappearing when the child is nearly three years old, twenty months after the septic arthritis.

Case 10. Figure 32—Twenty-seven-days-old child with a ten-days history. Pus was released from the intermuscular planes and the medulla of the bone, which was drilled. No fluid was obtained on aspirating the hip. Figure 33—The radiograph on admission. The soft-tissue swelling is easily seen.

Case 10. Figure 34—Four weeks later, the leg is still held in abduction and requires no splintage. Figure 35—Fifteen months later.
The prognosis largely depends on the survival of the epiphysis and the epiphysial plate. The dislocations and subluxations were successfully controlled in all but one infant, in whom the femoral neck without its capital epiphysis lies well outside the acetabulum. In two patients with destruction of the epiphysis the femoral neck has been kept in the acetabulum and has so far given stability and good movement, and in one the epiphysis survived sufficiently to form a graft on the upper lip of the acetabulum, providing a valuable shelf under which the femoral neck appears securely held. Apart from these three, there are two in whom the capital epiphysis has been preserved but the epiphysial plate has been destroyed and replaced by a fibrous union. No metaphysial growth has occurred and some shortening has developed (so far two and a half inches); yet satisfactory hip movement is maintained. In one of these the epiphysis was not recognisable in the radiograph until the child was nearly four years old; the survival of the epiphysis could be suspected because the femoral neck did not ride up, but an arthrograph is clearly needed before any reconstructive surgery in such an infant is undertaken. This interesting case has been followed for nearly twenty years.

Of the remaining five cases, four showed epiphyseal changes, somewhat resembling the ischaemic epiphysitis which occurs in congenital dislocation of the hip under treatment. In the more severely affected it possibly implied a septic epiphysitis, as demonstrated by Smith in 1874. All developed some degree of coxa magna although retaining a hip without symptoms or clinical signs of abnormality.

The last child (Case 10), with the greatest bone change in the femur, has retained the most nearly normal femoral head of the whole series, but no septic arthritis occurred in this infant.

SUMMARY

A series of ten infants is reported, seven of whom showed evidence of osteomyelitis of the upper end of the femur; the remaining three did not, but presented with an acute subluxation of the hip in a febrile illness. Four sequelae among the seven more severe cases were: 1) destruction of the capital epiphysis with dislocation at the hip; 2) destruction of the capital epiphysis, the femoral neck remaining in the acetabulum; 3) destruction of the epiphysial plate with the femoral head, remaining in the acetabulum, connected to the femoral neck by a fibrous union; 4) recovery with coxa magna but no other deformity.

The streptococcus plays a greater part in this osteomyelitis of infancy than in osteomyelitis of older children, but various other organisms were identified. The organism should be sought by blood culture as well as from the local lesion.

Aspiration of the hip, treatment of the hip in abduction and the use of the appropriate antibiotic are recommended. If there is marked swelling and induration, freer release of the pus is strongly advised.

Controlled abduction osteotomy plays a useful part in stabilising the femoral neck in the acetabulum or in stabilising the femoral neck beneath the capital epiphysis, but may usefully be preceded by an arthrograph because late ossification of a detached head sometimes occurs.

REFERENCES