TUBERCULOSIS OF THE HIP IN CHILDREN

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We have reviewed 74 tuberculous hips in 73 children treated from 1950 to 1991. From 1979 to 1991 we treated 28 patients with rifampicin, isoniazid and pyrazinamide given for nine months (series A), using active mobilisation for the more recent cases. Before this, 46 hips had been treated with streptomycin and isoniazid with or without para-aminosalicylic acid given for a mean of 18 months (series B), and all these patients were immobilised for a mean of 2.2 years.

The radiological appearances at presentation as classified by Shanmugasundaram (1983) predicted the outcome. Most hips were of the 'normal' type (50% and 59% of series A and B respectively) followed by the dislocating type (25% and 13%) and the atrophic type (8% and 9%). There were good or excellent results in 93% of the 'normal' type. All the atrophic type had poor results. The dislocating type had a poor result if the joint space was narrow after reduction of the hip.

Early mobilisation had no effect on the outcome of the 'normal' type of disease. The newer drug regimens allowed for shorter courses of treatment, but did not necessarily give a better outcome.

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Before the introduction of chemotherapy, tuberculosis of the hip often ended in a fibrous ankylosis (Hatcher and Phemister 1937; Ponseti 1948).

Streptomycin and isoniazid were introduced in the 1940s, and treatment at that time was by prolonged bed-rest and prolonged chemotherapy. Surgery, however, was advised by some authors. Roberts and Webster (1951) performed early extra-articular arthrodesis and Marmor et al (1969) and Wilkinson (1969) used synovectomy with or without curettage of the bone lesions. The introduction of rifampicin in 1967 allowed a shorter course of chemotherapy, and there was a tendency to earlier mobilisation.

either actively or with continuous passive motion (Salter et al 1980).

We have reviewed 74 hips in 73 children treated for tuberculosis over the 41-year period from 1950 to 1990. This spanned two eras of different treatment and we have therefore reviewed them as two series, considering first (series A) our most recent experience. In series A, treated from 1979 to 1990, we used rifampicin, isoniazid and pyrazinamide in short courses and in the later years tended towards earlier mobilisation. In series B, treated from 1950 to 1978, the methods were prolonged immobilisation and a long course of streptomycin, isoniazid and para-aminosalicylic acid. The aims of our review were to determine whether short drug regimens and early mobilisation altered the outcome, and to assess the value of the clinicoradiological classification of Shanmugasundaram (1983) in predicting the result.

PATIENTS AND METHODS

Series A. Twenty-seven patients with 28 infected hips presented during the 12 years from 1979 to 1990. There were 14 boys and 13 girls; 16 were black and 11 of coloured race. Their average age was 5 years (1 year to 13 years 10 months). All case records and serial radiographs were available, as were chest radiographs and the results of ESR and Mantoux skin tests. All patients had had open biopsy, and had been treated with rifampicin, isoniazid and pyrazinamide for nine months. The involved hip was either immobilised in a spica or on a frame, or was mobilised actively on skin traction, with or without continuous passive motion (CPM).

The radiological appearance of the hip at presentation was recorded by the 1983 classification of Shanmugasundaram (Fig. 1). At review all patients were assessed

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range of flexion (degrees)</th>
<th>Radiography</th>
<th>Result</th>
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<tbody>
<tr>
<td>Ia</td>
<td>Full</td>
<td>Normal</td>
<td>Excellent</td>
</tr>
<tr>
<td>Ib</td>
<td>&gt; 90</td>
<td>Ovoid/irregular</td>
<td>Good</td>
</tr>
<tr>
<td>II</td>
<td>35 to 90</td>
<td>Destroyed</td>
<td>Fair</td>
</tr>
<tr>
<td>III</td>
<td>&lt; 35</td>
<td>Fibrous ankylosis</td>
<td>Poor</td>
</tr>
<tr>
<td>IV</td>
<td>Nil</td>
<td>Bony ankylosis</td>
<td>Poor</td>
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Table I. Grading of results of treatment of tuberculosis of the hip, modified from Shanmugasundaram (1983)

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clinically and radiologically at an average follow-up of 3 years 9 months (2 years to 6 years 8 months). The results were graded as shown in Table I, modified from Shanmugasundaram (1983).

**Series B.** From 1956 to 1978, 86 patients had been seen at Maitland Cottage Hospital with the presumed diagnosis of tuberculosis of the hip. No hip had been biopsied, and only 46 were considered to be suitable for detailed review. Of the 40 hips excluded, 11 did not have the radiological features of tuberculosis and 29 had been treated elsewhere for at least one year before referral.

There were 18 boys and 28 girls; 12 were black and 34 were of coloured race. Their average age was 7.1 years (2 to 14). All 46 patients had been treated with streptomycin and isoniazid, sometimes with the addition of para-aminosalicylic acid, for a mean of 18 months (9 to 24). All had been immobilised in a spica or on a frame for a mean of 2.2 years (1 to 4).

These patients were not available for follow-up, and assessments were made from case records and serial radiographs from admission to the time of discharge from hospital.

**RESULTS**

**Series A.** Chest radiographs were positive for active or healed pulmonary tuberculosis in 42%, and the mean ESR on admission was 70 mm in the first hour (25 to 130). The Mantoux skin test was positive in 26 of the 27 patients.

All hips had a definite or probable diagnosis of tuberculosis. The presence of acid-fast bacilli on direct microscopy, or on histological examination or positive Kirschner culture was recorded for 16 hips. Twenty-six hips had histological findings of caseating granulomas.

The distribution of the different Shanmugasundaram types is shown in Figure 2. Half of the hips (14) showed 'normal'-type radiographs, seven were of the dislocating type and four of the Perthes type. There were no cases showing a ‘travelling acetabulum’ or protrusio acetabuli.
The results were excellent in 43% of hips, good in 28.5%, fair in 3.5%, and poor in 25% (Tables I and II) and these are shown in relation to each radiological type in Figure 3. Of the 14 'normal'-type hips (Fig. 4) six patients had been on frames and eight had been mobilised, six actively and two by CPM. Eleven of these patients had an excellent result, two had a good and one a poor result.

Of the seven dislocating or subluxing hips, two were immobilised, one by spica and one on a frame. The other five were mobilised, four actively and one by CPM. One patient had an excellent result, three had a good and three a poor result. The three dislocating hips with poor results all had a joint space reduced to 3 mm or less after reduction (Fig. 5).

Table II. Results in series A and B by number and percentage

<table>
<thead>
<tr>
<th>Result</th>
<th>Series A (n = 28)</th>
<th>Series B (n = 46)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>12 43</td>
<td>19 41</td>
</tr>
<tr>
<td>Good</td>
<td>8 28.5</td>
<td>9 19.5</td>
</tr>
<tr>
<td>Fair</td>
<td>1 3.5</td>
<td>3 6.5</td>
</tr>
<tr>
<td>Poor</td>
<td>7 25</td>
<td>15 33</td>
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Fig. 3
Results for each radiological type in series A.

All the four Perthes-type hips (Fig. 6) were mobilised actively; three had a good result and one a poor result. Both atrophic-type hips, with joint spaces ≤ 3 mm, had poor results (Fig. 7). The single mortar-and-pestle-type hip was immobilised and had a fair result (Fig. 8).

Series B. The radiological types are shown in Figure 9. Again, most were of the 'normal' type (27/46), with six of the dislocating type (6/46) and six of the mortar-and-pestle type. There was one Perthes-type hip.

The results, as shown in Tables I and II, were excellent in
41% of hips, good in 19.5%, fair in 6.5% and poor in 33%; these are shown for each radiological type in Figure 10. Most excellent or good results were seen in 'normal'-type hips, with most poor results in dislocating, atrophic, and mortar-and-pestle types.

DISCUSSION

We have confirmed the findings of Shanmugasundaram (1983) that the radiological appearance of the hip at presentation accurately predicts the final outcome.

The 'normal' type of disease has mainly synovial involvement. There may be cysts or cavities in the femoral head, neck, or acetabulum, but there is no gross destruction of subchondral bone and the joint space is normal. Shanmugasundaram had eight such hips in his series of 31 in children under 14 years of age; six of the eight had an excellent or good result. In our series 41 of 74 hips (55%) were of the 'normal' type; all but three had excellent or good results.

In the Perthes-type hip the femoral head is sclerotic at presentation; only one of our five patients with this type had an isotope bone scan, which appeared cold or avascular. Shanmugasundaram reported three Perthes-type hips all in patients under five years of age, and all with poor results; he stated that the distinction from true Perthes' disease may be extremely difficult.

Four of our five patients with Perthes-type hips (aged 1 year 9 months to 8 years 4 months at presentation) had good results. Because of the high prevalence of tuberculosis in South Africa we perform ESR and Mantoux tests on all patients suspected of Perthes' disease. Our tuberculous Perthes-type hips all had radiological features which differentiated them from true Perthes' disease: the whole head was always involved, but there were none of the metaphyseal changes seen in true Perthes' disease (Catterall...
Acetabular osteopenia and cysts are not seen in true Perthes' disease (Fig. 6a). Those with good results all had an ovoid femoral head suggesting recurrent vascular insults with a tendency to revascularisation. Shanmugasundaram did not state whether his patients had open biopsies, but he did suggest that surgery provided little benefit. All our patients had an open biopsy, which may have resulted in some decompression of the hip.

In the dislocating type, the dislocation or subluxation in series A was seen in all cases at open biopsy to be due to capsular laxity and synovial hypertrophy and not to accumulation of pus. Shanmugasundaram had poor results in all six cases in children. Four of the seven dislocating hips in series A had excellent or good results, but in series B only two of the six hips had a good result. The better results in series A were probably due to open relocation of the hip, as opposed to frame traction in series B. A narrow joint space after reduction (≤ 3 mm) predicted a poor result, suggesting that there was also an atrophic element.

The travelling-acetabulum, protrusio, and mortar-and-pestle type hips result from erosion of subchondral bone. The travelling-acetabulum hip was common in Shanmugasundaram's series (9 of 31 hips). We saw only two cases and as in his study they both had a poor result.

The mortar-and-pestle type was seen by Shanmugasundaram only in adults, but we had seven such hips, most early in series B. Shanmugasundaram classified his results as good or excellent, because of the good range of movement. We have modified his classification, however, (Table I), regarding a destroyed femoral head with a good range of movement as a fair result (2 of the 7 hips). The other five hips had fibrous ankylosis and therefore poor results. We had no hips of the protrusio-acetabuli type.

Shanmugasundaram reported poor results for the atrophic-type hip, seen almost exclusively in adults. We saw six atrophic-type hips in patients under 14 years of age, and had poor results in all six. Initial radiographs showed a joint space of 3 mm or less, but at open biopsy the cartilage
looked normal and glistening. In one case histological examination of the cartilage was normal (Fig. 7). This suggests that articular cartilage is not destroyed by surface pannus, but by subchondral erosion which appears as joint-space narrowing on radiographs, as reported by Phemister (1925) and Phemister and Hatcher (1933). These hips inevitably progress to fibrous ankylosis despite treatment by vigorous active movement, with CPM in later cases; this supports the supposition that there is subchondral erosion.

Shanmugasundaram reported that the mean duration of symptoms in ‘normal’, Perthes, dislocating and atrophic types varied from 4 to 7 months, and for the travelling-acetabulum, protrusio-acetabuli and mortar-and-pestle types, for 10 to 14 months. We had an accurate record of

Radiograph of a 10-year-old boy showing an atrophic type of hip at presentation, with the joint space almost obliterated (a). A radiograph at two years shows fibrous ankylosis (b).

Radiograph of a 6-year-old girl with mortar-and-pestle type of disease of the left hip.
duration of symptoms for 20 of the 28 patients in our series A. ‘Normal’. Perthes, dislocating and atrophic types showed a mean duration from 2 to 5 months. This suggests that duration of symptoms may be a factor: in travelling-acetabulum, protrusio-acetabuli and mortar-and-pestle types with a longer duration, there is time for significant local subchondral bone destruction to occur. Patients with a similar duration of symptoms, however, may present with a ‘normal’ type of hip and have a good outcome, or with an atrophic hip and have a poor outcome. In a ‘normal’ hip, the disease is mainly localised to the synovium. Pannus does not proliferate over the area of joint contact and caseation is a form of local control and necrosis of the disease (Phemister 1925; Phemister and Hatcher 1933). By contrast, there is significant subchondral erosion in the atrophic hip.

It is now accepted that the immune mechanism in tuberculosis may either confer protection or lead to tissue-destroying hypersensitivity (Ainslie and Bateman 1991). Protective immunity is related to granuloma formation and is seen in the ‘normal’, synovial type of tuberculous hip disease. It seems possible that tissue-destroying hypersensitivity, causing subchondral erosion, may be respons-

The closely similar results in our series A and B (Table II) confirm that the newer drugs rifampicin, isoniazid and pyrazinamide allow shorter courses of treatment than the older drug regimes using streptomycin, isoniazid and para-

REFERENCES
