TRANSIENT SYNOVITIS AND PERTHES' DISEASE

IS THERE AN AETIOLOGICAL CONNECTION?

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A prospective study was made of 119 children with transient synovitis or any other cause for synovial effusion and elevated intra-articular pressure. During a follow-up of one year not one case of Perthes’ disease was diagnosed and the late clinical and radiographic changes were minimal with moderate overgrowth of the femoral head in 33% and widening of the joint space in 14.2%.

Our results do not support the widely accepted concept that Perthes’ disease develops as a result of the period of elevated intra-articular pressure found in transient synovitis. Further research into this and Perthes’ disease should follow the premise that they are two different diseases without any aetiological connection.

Transient synovitis of the hip has been recognised as a clinical entity since it was first reported in 1892 by Lovett and Morse. It was accepted as a self-limiting disorder of unknown aetiology until Ferguson and Howorth (1934) pointed out that some patients with transient synovitis developed Perthes’ disease. Since then transient synovitis has been associated in long-term follow-up studies with such pre-arthritis conditions as coxa magna and with osteoarthritis itself (de Valderrama 1963).

Clinically, transient synovitis and Perthes’ disease may be indistinguishable, presenting with limited or painful joint movement in patients of similar age and sex distribution. This has encouraged the search for a common pathogenesis. One favoured hypothesis is that the unique vascular anatomy of the developing hip is affected by the synovial effusion and elevated intra-articular pressure of transient synovitis. The vessels supplying the growing epiphysis run intra-articularly and subsynovially, and are vulnerable to compression by tamponade (Trueta 1957; Bassett et al. 1969; Ogden 1974; Chung 1976). Animal studies (Tachdjian and Grana 1968; Kemp 1981; Lauder, Hungerford and Jones 1981; Lucht et al. 1983) have shown that a high intra-articular pressure severely interferes with the blood supply of the epiphysis, and this finding is supported by the observation of reduced radioisotope uptake in some hips with a synovial effusion (Kloiber et al. 1983), or haemarthrosis from a femoral neck fracture (Drake and Meyers 1984). It can therefore be argued that a temporary rise in intra-articular pressure could lead to partial necrosis of the epiphysis which would be revealed by radiography some weeks or months later.

There are, however, some contradictory experimental results which refute this theory (Gershuni et al. 1983). Nor is the theory supported by the finding that there is relatively lower intra-articular pressure in Perthes’ disease (3.4 kPa, 25.5 mmHg) than in transient synovitis (17.3 kPa, 130 mmHg) (Kallio and Ryöppy 1985). The observation of disturbed circulation in the epiphysis in transient synovitis, made in some earlier scintimetric studies, may be invalidated by the fact that the exact posture at the hip during the examination was not given. Reduced radioisotope uptake is to be expected if the intra-articular pressure is unintentionally raised by extending the hip during the examination (Kallio and Ryöppy 1985).

Epidemiological studies have as yet failed either to prove or disprove the theory, and in fact have raised further questions. Most patients with Perthes’ disease have never had a previous episode of hip pain attributable to transient synovitis and it is well known that most patients with transient synovitis will make a permanent recovery even without treatment or pressure relief by joint aspiration. Furthermore, the development of Perthes’ disease has never been reported after some other forms of infective or reactive arthritis of the hip. The results of follow-up studies are conflicting. Some authors have found the risk for subsequent Perthes’ disease to be as high as 17.7% but the majority of larger series have been reported to show a minimal risk (Table 1).

The presence of synovial effusion or elevated intra-articular pressure was not critically assessed in these studies. The criteria for diagnosis were mainly clinical or radiographic, such as lateral shift of the capsular shadows or widening of the medial joint space. Both
these findings have been shown to be non-specific, capsular shadows indicating merely the position of the painful hip in slight flexion, abduction and lateral rotation (Brown 1975), and widened joint space indicating thickening of the cartilage layer rather than excess synovial fluid (Gershuni, Axer and Hendel 1978). Thus, especially as few joint aspirations were performed, patients with para-articular disease or arthralgia of the hip without synovial effusion may have been included in the series. Recently, ultrasonography has proved to be a reliable method for diagnosis of synovial effusion of the hip (Seltzer, Finberg and Weissman 1980; Kallio et al. 1985).

Our aim in this study was to determine the possible short-term ill-effects of a temporary rise in intra-articular pressure in a prospective series of patients with synovial effusion of the hip confirmed by joint aspiration, measurement of intra-articular pressure and ultrasonography.

PATIENTS AND METHODS

In all 252 children with acute hip symptoms were seen at the Aurora Hospital and the University Children’s Hospital, Helsinki, from May 1982 to December 1983. As a result of comprehensive administrative arrangements (Kunnamo, Kallio and Pelkonen 1986), this is known to include practically every child with hip pain, limp or restricted joint movement in the greater Helsinki area.

Table I. Reported risk of Perthes’ disease after an episode of transient synovitis

<table>
<thead>
<tr>
<th>Author</th>
<th>Follow-up (years)</th>
<th>Risk of Perthes’ disease</th>
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<tbody>
<tr>
<td>Butler 1933</td>
<td>3</td>
<td>0.22</td>
</tr>
<tr>
<td>Rauch 1940</td>
<td>2.5</td>
<td>0.20</td>
</tr>
<tr>
<td>Caravias 1956</td>
<td>0.5 to 8</td>
<td>0.46</td>
</tr>
<tr>
<td>Fox and Griffin 1956</td>
<td>2</td>
<td>2.23</td>
</tr>
<tr>
<td>Rosenberg and Smith 1956</td>
<td>0.5 to 8</td>
<td>0.36</td>
</tr>
<tr>
<td>Spock 1959</td>
<td>0.1 to 3</td>
<td>3.47</td>
</tr>
<tr>
<td>Ebert and Lechten 1960</td>
<td>2</td>
<td>1.32</td>
</tr>
<tr>
<td>Adams 1963</td>
<td>1 to 15</td>
<td>0.50</td>
</tr>
<tr>
<td>Mills 1964</td>
<td>2 to 11</td>
<td>9.105</td>
</tr>
<tr>
<td>Gledhill and McIntyre 1969</td>
<td>not given</td>
<td>6/117</td>
</tr>
<tr>
<td>Nachemson and Scheller 1969</td>
<td>20 to 22</td>
<td>6/102</td>
</tr>
<tr>
<td>Jacobs 1971</td>
<td>2 to 12</td>
<td>11.62</td>
</tr>
<tr>
<td>Vandeputte et al. 1971</td>
<td>0.2 to 2.5</td>
<td>1/21</td>
</tr>
<tr>
<td>Schmid-Ullrich and Stock 1975</td>
<td>not given</td>
<td>1/13</td>
</tr>
<tr>
<td>Stock et al. 1977</td>
<td>0.5 to 15</td>
<td>0/24</td>
</tr>
<tr>
<td>Barta and Belyei 1979</td>
<td>not given</td>
<td>5/38</td>
</tr>
<tr>
<td>Sharwood 1981</td>
<td>5 to 15</td>
<td>1/101</td>
</tr>
</tbody>
</table>

which has a population of 148,000 children under 16 years of age.

On admission, a careful clinical examination was followed by laboratory tests and radiography of both hips in anteroposterior and Lauenstein projections. Intra-articular pressure in various positions of the joint (Kallio and Ryöppy 1985) was measured at the time of diagnostic aspiration before any other treatment had been given. Ultrasonography was performed before joint aspiration and also at the time of a routine clinical examination two weeks later. Further clinical and radiographic reviews took place after three months and one year. Special attention was paid to the range of joint movement and to leg-length inequality. A difference of 1 mm in the width of the joint space and of 2 mm in the diameter of the femoral head compared with the healthy side were regarded as positive radiographic findings. The skeletal age of all patients with synovial effusion was determined (Greulich and Pyle 1959) at the three-month follow-up.

The final diagnosis was based on the findings from radiography, hip aspiration, haematology, serology and bacterial culture from throat, blood, urine and synovial fluid. The criteria for inclusion in the follow-up study were a positive synovial aspiration of 0.5 ml or more, an elevated intra-articular pressure (normally sub-atmospheric, Levick 1983) or positive ultrasonography with widening of the anterior joint space by 1 mm or more compared with the healthy side. Excluded from the series were 18 patients who showed radiographic evidence of Perthes’ disease when first seen, 8 patients with epiphyseolysis and 22 patients with transient synovitis or other type of arthritis diagnosed only by clinical and radiographic methods. Of the total, 73 patients with non-specific arthralgia, mild trauma or over-use symptoms, none of whom had restriction of joint movement or ultrasonographic evidence of effusion, served as controls.

Thus, 131 patients with confirmed synovial effusion were considered in our follow-up study (Table II), and were admitted to hospital and treated with bed rest. Skin traction with the hip in neutral extension was not used because of our earlier finding of extremely high intra-articular pressure in this position (Kallio and Ryöppy 1985). Specific treatment was given only to the patients with infective or reactive arthritis, or with osteomyelitis in the hip region.

RESULTS

After one year 119 (91%) of the patients with synovial effusion, and 40 (54.8%) of the control patients were re-examined clinically and radiographically. Three of the 18 patients excluded with Perthes’ disease had been initially diagnosed as transient synovitis, but in all three retrospective analysis of the original radiographs showed minor changes, such as a slightly widened joint space with a subcortical clear zone, which provided early evi-
dence of Perthes’ disease and which had progressed by the three-month follow-up. The relatively low intra-articular pressure, the small volume of synovial fluid (Kallio and Ryöppy 1985) and the retarded skeletal development in these cases were in accordance with findings from other patients with Perthes’ disease. Not a single case of Perthes’ disease developed in patients with pure transient synovitis or other form of arthritis.

The distribution of the bone age in 66 patients with synovial effusion was comparable with that of a normal population. A moderately retarded bone age (by 6 to 17 months) was found in 11 patients with transient synovitis and one with septic arthritis. Severe retardation (more than 18 months) was found in four cases, a moderate advance (6 to 17 months) in three and severe advance (more than 18 months) in one patient with transient synovitis.

Two patients with transient synovitis in one hip had recent symptom-free Perthes’ disease in the other hip, and in both cases the hips with synovitis made a permanent recovery.

Subjective complaints and clinical findings were minimal after one year. Only eight of the 98 patients after transient synovitis had symptom-free restriction of rotation (5 to 30°, mean 13°) on the previously affected side, while three had 5 to 15° restriction on the healthy side. Leg-length inequality of up to 10 mm was found in 42 patients, the affected leg being longer in 23. Radiographic abnormalities which could be attributed to the previous synovitis were minor: 37 patients (33%) had moderate overgrowth of the femoral head and 16 (14.2%) had persistent widening of the joint space. All of these were symptom-free.

**DISCUSSION**

Our results do not support a causal connection between transient synovitis and Perthes’ disease; we did not find a single case of Perthes’ disease after transient synovial effusion and rise of intra-articular pressure. This may, of course, be due to treatment based on immobilisation in the position of minimal pressure. The intra-articular pressure with the hip in flexion (mean 2.3 kPa, or 17 mmHg, in transient synovitis) hardly ever exceeded the estimated arteriolar pressure, although it clearly exceeded the venous pressure in many patients. The possible favourable effect of joint aspiration can be discounted by the fact that none of the patients who did not have synovial aspiration developed Perthes’ disease.

The clearly coincidental occurrence of Perthes’ disease in one hip and transient synovitis in the other in two of our patients is against the theory of the individual susceptibility of the vascular supply to the effects of intra-articular pressure. In this, we agree with Harrison and Burwell (1981).

The distribution of skeletal age was normal in patients with transient synovitis, and this casts further doubt on the theory of common pathogenesis of the two diseases. The few cases with delayed skeletal maturation were within the range of normal variation and did not have a worse prognosis than those with normal bone age.

The previous concept of an aetiological connection between transient synovitis and Perthes’ disease can be explained by several factors.

First, early Perthes’ disease may be misdiagnosed as transient synovitis because of scanty or absent radiographic changes. Radiographic progression may then be misinterpreted as development of Perthes’ disease after transient synovitis. The synovial effusion found in some hips with Perthes’ disease (Kallio et al. 1985) is probably due to a secondary synovial irritation.

Secondly, transient synovitis has often been treated by traction with the hip in an extended position, in which the intra-articular pressure is highest (mean 17.3 kPa, or 130 mmHg, Kallio and Ryöppy 1985). Consequently, in some cases Perthes’ disease may be caused by the treatment. The conflicting results of the clinical and scinti- metric studies on the risk of Perthes’ disease after transient synovitis may simply be due to different methods of treatment, immobilisation and positioning during scintigraphy. Such details are rarely given in earlier studies.

Finally, the possibility that there are two different diseases, each with its own incidence, must be considered seriously. In our study, the incidences were about 7/100 000 per year for Perthes’ disease and 51.9/100 000 for transient synovitis in children under 16 years of age (Kunnamo et al. 1986), and the figures are at least four times this in the age group most frequently involved. Furthermore, patients with minimal epiphyseal changes and few or absent clinical symptoms would be more likely to be diagnosed if they were already being followed up for previous transient synovitis. The rare accidental coincidence of transient synovitis and Perthes’ disease in the same patient is statistically likely.

**Table II. Results for patients included in the prospective follow-up study**

<table>
<thead>
<tr>
<th>Clinical diagnosis</th>
<th>No.</th>
<th>Mean result (number examined)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Ultra-sound (mm)*</td>
<td>Volume of aspiration (ml)</td>
<td>Intra-articular pressure (kPa)* (mmHg)</td>
</tr>
<tr>
<td>Transient synovitis</td>
<td>110</td>
<td>2.5 (96)</td>
<td>2.6 (90)</td>
<td>8.6 (64.5)</td>
</tr>
<tr>
<td>Osteomyelitis</td>
<td>10</td>
<td>1.4 (9)</td>
<td>1.2 (7)</td>
<td>4.7 (35)</td>
</tr>
<tr>
<td>Septic arthritis</td>
<td>6</td>
<td>2.4 (5)</td>
<td>1.9 (5)</td>
<td>10.0 (75)</td>
</tr>
<tr>
<td>Arthritis with serum sickness</td>
<td>2</td>
<td>3.0 (2)</td>
<td>7.8 (2)</td>
<td>23.0 (172.5)</td>
</tr>
<tr>
<td>Reactive arthritis</td>
<td>2</td>
<td>1.5 (2)</td>
<td>6.5 (1)</td>
<td>16.0 (120)</td>
</tr>
<tr>
<td>Juvenile arthritis</td>
<td>1</td>
<td>1.0 (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td>(115)</td>
<td>(105)</td>
<td>(70)</td>
</tr>
</tbody>
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* widening of the anterior joint space
† pressure in slight spontaneous flexion
Until now, the treatment and follow-up of patients with transient synovitis has varied. We have used bed rest without traction until the symptoms subside; we also advise avoidance of strenuous physical activity for a further two weeks. Our diagnostic procedures include radiography and ultrasonography, measurement of erythrocyte sedimentation rate, C-reactive protein, total and differential leucocyte count, haemoglobin, and examination of urine sediment and a throat swab for streptococci. Patients with general symptoms are admitted to hospital in order to exclude infection.

The need for aspiration of a hip should be decided individually for each case; its purpose is diagnostic, to rule out infective arthritis in a patient with fever or an elevated C-reactive protein level. Articular puncture to relieve pressure has been recommended as a therapeutic procedure, but our experience of daily examination by ultrasonography in patients with transient synovitis does not support this view. We found that on the first day after aspiration the size of the effusion had already returned to pre-aspiration level, and that it subsided gradually over 5 to 10 days, reflecting the clinical course in most of these patients. The effusion, whether aspirated or not, had disappeared in most patients by two weeks after admission (Kallio et al. 1985). Thus "blowing the nose does not cure 'flu". The pathogenetic basis for synovitis is not the effusion itself but the diseased synovium with its disturbed pattern of production and absorption of fluid. Instead of aspiration, we choose to relieve pressure by simple flexion of the hip.

We do not consider that routine radiography several weeks after an episode of transient synovitis is necessary; we advise patients and parents to consult a doctor if any symptoms, however mild, persist or recur.

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REFERENCES


