ULTRASONOGRAPHY IN TRANSIENT SYNOVITIS AND EARLY PERTHES' DISEASE

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We used ultrasonography to examine 36 children suffering from transient synovitis and 12 children with early Perthes' disease. Widening of the joint space was revealed by ultrasonography in all affected hips with either disease.

In the patients with transient synovitis, capsular distension was attributed to synovial effusion, while in the patients with Perthes' disease it was produced by thickening of the synovial membrane. Neither capsular distension nor thickening of the joint cartilage was seen in the contralateral normal hip in the patients with transient synovitis, but they were common in early Perthes' disease.

Ultrasonography may provide significant diagnostic clues to differentiate early Perthes' from transient synovitis.

Transient synovitis of the hip is usually diagnosed by excluding other more serious conditions such as Perthes' disease, septic arthritis, juvenile chronic arthritis and tumours. The relationship between Perthes' disease and transient synovitis is controversial. One hypothesis is that the vessels supplying the growing epiphysis are affected by the elevated intra-articular pressure in transient synovitis. This could then lead to necrosis of the femoral head. Although Perthes' disease associated with transient synovitis has been reported by many authors, the incidence varies between 1% to 20%. One reason for the confusion is that observers do not agree on the interpretation of the initial radiographs. Kemp and Boldero (1966) described the first radiographic changes in the course of Perthes' disease as lateral displacement of the femoral epiphysis (Waldenström's sign), and flattening of its surface. However, it is well known that Waldenström's sign, even if it is greater than 2 mm, is sometimes present in patients with transient synovitis. Harrison and Blakemore (1980) reported that contour irregularities, such as surface flattening or dimpling, were present in 10% of normal young children.

Scintigraphy and magnetic resonance imaging (MRI) have proved their value in early detection of Perthes' disease, but are too expensive to use for routine examination. Ultrasonography requires only a few minutes with inexpensive equipment. We compared ultrasonograms of the two diseases with a view to distinguishing between them.

PATIENTS AND METHODS

Thirty-six patients with transient synovitis and 12 patients with early Perthes' disease (one bilateral) were examined by ultrasound at the Medical Centre for Children, Shiga, during the 14-month period from May 1988 to July 1989. The ages of the patients with transient synovitis (25 boys and 11 girls) ranged from four to ten years (average 5.7), while those with early Perthes' disease (8 boys and 4 girls), ranged from three to nine years (average 5.6). We included 'early' cases which were seen by us within one month of the onset of symptoms. All patients were studied by clinical history, physical examination, laboratory investigations, radiography, and arthroscopy.

Transient synovitis was diagnosed by a painful hip with or without capsular distension on ultrasonography, and with no pathological changes seen on radiographs taken during the follow-up period. The diagnosis of Perthes' disease was made if the hip was painful, with osteonecrosis of the femoral head seen on radiographs. Some patients originally seemed to have transient synovitis but later developed definite sclerotic changes in the femoral head.

For the ultrasound studies, a high-resolution 7.5 MHZ linear type scanner (Shimadzu SDU-500,
A 9-year-old girl's hip has a UJS of 7 mm (indicated by arrows) and a femoral cartilage thickness of 2 mm (indicated by wedges). She complained of mild hip pain for five days. The surface of the femoral cartilage of an 8-year-old boy with transient synovitis is clearly visible as a strong reflection (arrows).

Kyoto, Japan was used. The patients were placed in the supine position with their legs extended naturally. The probe was placed longitudinal to the axis of the femoral neck. The ultrasonographic joint space (UJS) was measured as the distance between the ventral margin of the joint capsule and the femoral neck (Fig. 1a). We

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<th>Table I. Width of joint space measured by ultrasound</th>
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<td>Numbers</td>
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<td>Transient synovitis</td>
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<th>Table II. Capsular distension and thickness of joint cartilage</th>
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<td>Synovial effusion (%)</td>
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<td>Large</td>
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classified capsular distension as positive when the UJS was more than 6.0 mm. The thickness of the articular cartilage was also measured on the anterior aspect of the femoral head. With careful positioning of the probe, vertical to the surface of the head, ultrasound reflection by the cartilage surface can be identified (Fig. 1b). The width of the anechoic space between the deep contour of the labrum and the subchondral bone was measured on each side.

RESULTS

Increased joint space was detected by ultrasound at the initial examination in all symptomatic hips. Most patients, especially those who were suffering from transient synovitis, were in the acute symptomatic phase at the time of the examination. The UJS measurements are summarised in Table I and Figures 2 and 3. The mean UJS in the hips with transient synovitis was 9 mm compared to 5 mm in the asymptomatic hips. All patients with Perthes' disease also showed capsular distension; the mean UJS was 8.2 mm on the affected side, and 5.8 mm on the other side. There was no significant difference in mean UJS for the affected side. However, mild distension of the asymptomatic hip (UJS > 6 mm) was detected in nine cases (75%) of early Perthes' disease and 11 cases (30.6%) of transient synovitis. The UJS of asymptomatic hips was significantly greater (p < 0.05) in the latter group (unpaired t-test).

Synovial effusion and synovitis. There were two types of capsular distension. Group I showed an anechoic homogeneous UJS which was classed as the 'synovial effusion type', proven by aspiration (Fig. 4a). Group II showed an irregularly echogenic UJS, less capsular distension but more synovial thickening, the 'synovitis type' (Fig. 5). The results of this classification are summarised in Table II. All nine patients who were unable to walk or move the affected hip belonged to group I, and the hips in this group tended to cause more severe symptoms than those in group II. Almost 78% of patients with transient synovitis belonged to group I (definite 61.1%; uncertain 16.7%). Ultrasound revealed synovial effusion in four of 12 cases with early Perthes' disease, but only two were judged to be extensive. Therefore, synovial effusion appears to be significantly more common (p < 0.02) in the transient synovitis group (Fisher's exact test). Of the patients with transient synovitis, 22% were classed as group II. These patients often had persistent dull pain and many were suspected of having early Perthes' disease because of the long duration of disease (Fig. 5).

Thickening of the cartilage was observed in all but one of the patients with early Perthes' disease, ranged from 1 to 3 mm (Table II). Only two of 36 cases with transient synovitis showed this phenomenon. Therefore, cartilaginous thickening is significantly more common (p < 0.02) in the Perthes' disease group (Fisher's exact test). In most patients with transient synovitis (29, 80.6%),

Fig. 4a
Synovial effusion type (group I). Figure 4a shows the left hip of an 11-year-old boy with transient synovitis. Note the anechoic UJS of 14 mm; six weeks later (Fig. 4b) the UJS decreased to 8 mm, associated with relief of pain.

Fig. 4b

Fig. 5
Synovitis type (group II); A 4-year-old boy with transient synovitis had a UJS of 7 mm, with an irregularly echogenic space (UJS of the other hip was 5 mm). The symptoms continued for six weeks.
symptoms disappeared within two weeks; persistent hip pain or limping which lasted for more than one month was present in only four out of these 36 patients (Figs 4, 5).

**DISCUSSION**

Wingstrand et al (1985) reported that increased intracapsular pressure, which is often seen in transient synovitis of the hip, might cause ischaemia of the femoral head. They suggested that its duration and severity might determine the development of necrosis. However, some writers disagree (Gershuni et al 1983). Following a prospective study of 119 children, Kallio, Ryöppy and Kunnamo (1986) concluded that the two entities were different diseases with no causal relationship. Landin, Danielsson and Wattsgård (1987) reported ten cases of Perthes’ disease which developed in 275 patients originally diagnosed as transient synovitis, though only two of them had completely normal radiographs at the initial examination. They employed prospective methods excluding cases which had shown minor radiographic changes; so the false-positive ratio is unclear. Harrison and Blakemore (1980) reported that 10.4% of healthy children had radiographic irregularities of the epiphyseal surface, such as flattening or dimpling; such changes also occurred in the normal hips of 48.4% of children with Perthes’ disease. They suspected that this could reflect the vulnerability of young children’s hips. Such studies demonstrate the difficulty of diagnosing early Perthes’ disease by radiography alone.

There have been recent reports on the successful use of ultrasound to identify effusions in hips affected by transient synovitis. Using cadavers, Marchal et al (1987) demonstrated that an anechoic UJS indicated synovial fluid. Our findings show that such an anechoic UJS is eliminated by joint aspiration. Capsular distension, showing irregular areas of high echogenicity, existed in most cases of early Perthes’ disease, and the same appearance was observed in transient synovitis after aspiration and in its healing phase. Kallio et al (1985) stated that the mean synovial fluid volume of patients with transient synovitis was 2.5 ml, and 0.7 ml in those with Perthes’ disease. Their ultrasound studies demonstrated that patients with Perthes’ disease did not show as clear an enlargement of the joint space as did those with transient synovitis. We also observed that the UJS could be classified into two types; one consisted of an echo-free space, the ‘synovial effusion type’; the other, the ‘synovitis type’, showed high echogenicity of the UJS. Most of the patients with transient synovitis had the former type in the acute phase of the illness.

The contralateral hip in patients with early Perthes’ disease showed the UJS to be mildly increased in 75% of cases. Other workers have described radiographic abnormalities in the unaffected hips of children with Perthes’ disease; distension is more common in the hips of these children than in controls.

Cartilaginous thickening of hips with Perthes’ disease has been demonstrated both experimentally and clinically using arthrography and MRI (Rush, Bramson and Ogden 1988). Thickening may be due either to swelling or hypertrophy. Gershuni, Axer and Hendel (1978) explained the hypertrophy as a response to local bone infarction and subsequent fracture. Conversely, Ueo et al (1987) suggested that the swelling resulted from pathological changes in osmotic pressure. Our results suggest that this phenomenon of cartilage thickening was almost specific to early Perthes’ disease and was rare in transient synovitis.

Wingstrand et al (1985) suggested that the position of a hip with an effusion could influence the likelihood of subsequent avascular necrosis. Although most children with transient synovitis were relieved of symptoms within two weeks of immobilisation in flexion of 30° to 45° with slight external rotation, a few showed persistent...
synovitis on ultrasound, similar to that seen in early Perthes' disease. Linnenbaum et al (1989) insisted that if ultrasound revealed persistent effusion for four to six weeks, the development of Perthes' disease should be suspected, even if no radiological change was present. Therefore, if we follow carefully such cases by ultrasonography, we might reduce the frequency of the condition. When the affected hip shows cartilaginous thickening and there is capsular distension of the contralateral hip, we should also consider the possibility of early Perthes' disease. By contrast, if the initial ultrasound examination reveals definite synovial effusion, the likely diagnosis is transient synovitis.

There are still difficulties in making an accurate diagnosis based solely on ultrasound examination because of the exceptional cases found in each disease (Fig. 6). However, the information gained from this method can help to differentiate the two disorders, and detect cases which might progress from transient synovitis to Perthes' disease.

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No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


