ULTRASOUND EXAMINATION OF THE IRRITABLE HIP

D. R. BICKERSTAFF, L. M. NEAL, A. J. BOOTH, P. O. BRENNAN, M. J. BELL

From Sheffield Children's Hospital

We made a prospective study of 111 children with acute hip pain to assess whether ultrasound can replace traditional radiography.

An effusion was diagnosed in 71% by ultrasound but in only 15% by radiography. This effusion persisted for a mean of nine days; symptoms lasted for five days. Two patients found to have Perthes' disease had longer-lasting effusion and symptoms. Patients without an effusion had no obvious cause for their pain, so the pressure of an effusion from a transient synovitis does not account for all patients with irritable hips. Patients with an effusion persisting for over 24 days (the mean + 2 s.d. of our series) had more symptoms, a significantly larger effusion and greater limitation of movement. They may be more at risk for avascular necrosis.

We found that radiographic examination influenced the immediate management of only two patients, those with Perthes' disease. We therefore propose a protocol of management for irritable hip, using ultrasonography at the first presentation of certain categories of patients. This would reduce the number of early radiographs by 75%.

Irritable hip is a common disorder of childhood, characterised by the acute onset of a painful limp which gradually resolves. Nearly 100 years ago Lovett and Morse (1892) described it as a "...short-lived and ephemeral form of hip disease which presents at first the characteristics of common hip disease, but the symptoms of which disappear in a few months instead of continuing for years". This differentiated it from the then prevalent tuberculosis. The aetiology of irritable hip remains unknown; this may be partly due to the fact that the diagnosis is one of exclusion, by investigation or by the subsequent course of the disease (Sharrard 1979). Radiographic examination is the commonest of these investigations. The syndrome has however been associated with the development of Perthes' disease.

We have used ultrasound examination to investigate the incidence and natural history of the effusion seen in children with acute hip pain. Our findings have brought into question the need for traditional radiography, and we have tried to identify a population of children who are particularly at risk of developing avascular necrosis of the capital femoral epiphysis.

PATIENTS AND METHODS

In a pilot study, all patients admitted with a diagnosis of irritable hip had ultrasound examinations at three-day intervals. In the first 17 patients the effusion persisted for a mean of 10 days with symptoms for five days, excluding one child subsequently shown to have Perthes' disease, in whom the effusion was still present after 45 days.

In the main study, all children presenting with an irritable hip had an ultrasound examination and antero-posterior and frog-lateral radiographs within 24 hours. If indicated on clinical or social grounds the child was admitted for bed rest; otherwise treatment was at home with outpatient follow-up assessments. In those admitted, an ultrasound examination was made every three days until the effusion had subsided. If the patient had been discharged on clinical grounds or treated entirely at home, he returned 10 days later for further ultrasound examination. If an effusion was still present at 10 days, ultrasound examination was repeated weekly. Final review and a further ultrasound examination was at three months. Symptoms and the range of hip movement were recorded at each examination.

The ultrasound scans were performed using an ATL 100 machine with a 7.5 MHz sector probe. The patient was supine with hips in neutral position. The normal side was examined first, to gain the child's confidence. The
probe was positioned over the hip and moved along the plane of the femoral neck until the maximal distension of the anterior capsule away from the femoral neck could be detected. This frame was frozen, the distension marked, and a hard copy made for later review (Fig. 1).

All the ultrasound copies and radiographs were reviewed by one of the authors (AJB) without access to any clinical information. Displacement of the capsule by 3 mm or more was taken as evidence of an effusion. On the radiographs, the displacement of the femoral head from the medial acetabular wall was measured and the appearance of radiolucent shadows were assessed. These shadows (Fig. 2) represent fat in the intermuscular planes. Of the three commonly visible, the medial of the two lateral planes is thought to represent the lateral border of the capsule and displacement of this shadow is usually considered to be significant.

When comparing groups, we used the paired or unpaired Student's t-test depending on the nature of the data, and give confidence intervals as + 2 standard error of mean (s.e.m.).

RESULTS

Of 111 children, 26 were treated as in-patients and 85 as outpatients. Their mean age was six years (s.d. 2.85, range 1 to 13). The ratio of boys to girls was 2.2:1; the left hip was affected 65 times and the right hip 46 times (ratio 1.4:1). The mean duration of symptoms before presentation was five days (s.d. 8.06), range 0.2 to 42. The commonest complaints were a limp and hip pain (Table I). All movements of the affected limb were significantly restricted (p < 0.001) except abduction and external rotation.

Those admitted were in hospital for a mean of seven days (s.d. 2.5) of which five days (s.d. 1.75) were spent on traction. Five children had a recurrent hip effusion and symptoms at the six-week follow-up. After three months all the children, excluding the two diagnosed as having Perthes' disease, were asymptomatic.

Only 17 of the radiographs (15%) showed evidence of an effusion and in only three cases was other pathology detected: one patient had the appearance of previous osteomyelitis of the proximal femur and two had Perthes' disease, both with effusions on ultrasound. One of the children with Perthes' disease had presented initially with a persistent effusion and developed the radiological signs later.

Displacement of the radiolucent lines around the hip was of little value: in only six cases was there bulging of the lateral plane; this line could be seen with clarity in only 66% of cases, and the psosas and obturator planes were even less distinct (52% and 34%, respectively). There was no difference in the lateral displacement of the femoral head between the symptomatic hip (9 mm, s.d. 1.55) and the other hip (8.9 mm, s.d. 1.60).

Of the 111 children, 79 (71%) had an effusion detected on ultrasound examination. This effusion was still present at 10 days in 36 (32%). In the 30 patients who had ultrasound examinations every three days, the effusion persisted for a mean of nine days (s.d. 4.82). Using log-transformed data, probit analysis of the duration showed a uniform distribution of the population (correlation co-efficient, r = 0.97). The 95% confidence interval for the duration of the effusion was 2.4 to 24.6 days (mean ± 2 s.d.). The symptoms and the limitation in range of movement settled at the same time (mean five days, s.d. 2.04), with an upper limit of nine days (mean ± 2 s.d.). The mean capsular distension on admission was 6.3 mm (s.d. 1.99) on the affected side and 2.6 mm (s.d. 0.75) on the normal side.

### Table I. Presenting complaints in 111 children with an irritable hip

<table>
<thead>
<tr>
<th>Complaint</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limp</td>
<td>87</td>
</tr>
<tr>
<td>Hip pain</td>
<td>80</td>
</tr>
<tr>
<td>Unable to bear weight</td>
<td>72</td>
</tr>
<tr>
<td>Knee pain</td>
<td>26</td>
</tr>
</tbody>
</table>

### Table II. Age and range of movement related to the presence or absence of an effusion (mean, 2 s.e.m.)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Effusion (n = 79)</th>
<th>No effusion (n = 32)</th>
<th>Significance of difference (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Loss of movement (degrees)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexion</td>
<td>4.10</td>
<td>4.92</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Abduction</td>
<td>3.20</td>
<td>3.16</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Adduction</td>
<td>3.10</td>
<td>2.02</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Medial rotation</td>
<td>3.58</td>
<td>3.24</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lateral rotation</td>
<td>3.56</td>
<td>3.26</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

The other 32 patients (29%) had no evidence of an effusion either at presentation or on follow-up. They were slightly younger, but there was no significant difference in the sex, duration of symptoms, presenting features or incidence of predisposing factors between this group and those with an effusion. There was however a difference in the limitation of movement (Table II). No other abnormality was seen in the radiographs to account for their symptoms.

Six patients (5%) had an effusion which persisted for longer than 24 days. In these the effusion lasted 33 ± 7.88 days, though symptoms subsided by seven ± 2.3 days. The mean size of the effusion at presentation (7.8 ± 1.58 mm) was significantly larger (p < 0.05) than the 6.2 ± 0.46 mm found in those whose effusion had subsided.
The three translucent lines seen around the hip are 1) the psoas plane; 2) the gluteal plane; and 3) the lateral plane which has been thought to represent the lateral border of the hip capsule.

Ultrasound scans and diagrams of both hips. Figure 1a — Normal hip. Figure 1b — Affected hip showing wide displacement of the anterior capsule from the femoral neck.

by three weeks. There was also greater restriction in flexion and medial rotation (p < 0.05). Again, we found no evidence of any predisposing factor.

DISCUSSION

One of the difficulties of studying the irritable hip has been the establishment of a definite diagnosis. Kemp (1973) described lateral displacement of the femoral epiphysis from the acetabular wall as the first radiological sign and several authors have drawn attention to the soft-tissue shadows around the hip, one of which was thought to represent the hip capsule (Fig. 2). Lateral displacement of this shadow was believed to represent the capsular thickening of transient synovitis of the hip (Hermal and Albert 1962; Adams 1963), but this has largely been disproved by Brown (1975) who showed that the appearance is related to lateral rotation and abduction of the hip. In our study only six hips showed bulging of the lateral plane, and it was only seen clearly in two-thirds of our cases. We found no difference in lateral displacement of the head between the affected and unaffected hips.
In 1979 Kramps and Lenschow showed that the anatomy of the hip could be demonstrated by ultrasound and Seltzer, Finberg and Weissman (1980) demonstrated an effusion in four patients. Since then, there have been a number of reports of the use of ultrasound in cases of transient synovitis of the hip (Wilson, Green and MacLarnon 1984; Jäppinen, Kallio and Siponma 1984; Adam et al 1986) and Egund et al (1986) have shown that ultrasound is comparable in accuracy to computerised tomography.

We found that 71% of the children presenting with acute hip pain had an effusion on ultrasound examination, which persisted for a mean of nine days though symptoms settled by five days. The steady decrease in the size of the effusion in transient synovitis of the hip and its persistence for longer than the symptoms have previously been reported (Kallio and Ryöppy 1985; Wingstrand et al 1985). The earlier resolution of the symptoms may be due to intracapsular tension falling below the level necessary to produce pain.

In the six patients in whom the effusion lasted much longer it had been significantly larger at presentation and symptoms had lasted longer. This group includes the two patients with radiographic Perthes' disease. In one of these, the effusion had not settled by 42 days at the last ultrasound scan. This patient had had three episodes of acute hip pain and effusion over the previous six months, but without earlier radiographic features of Perthes' disease. The persistence of an effusion in Perthes' disease which presents as an acutely painful hip has previously been reported (Kallio and Ryöppy 1985; Wingstrand et al 1985; Vegter 1987).

An effusion persisting for longer than 24 days, and symptoms for longer than nine days will therefore identify those patients with Perthes' disease. A direct correlation has been shown between the size of the effusion and the increase in intra-articular pressure (Kallio and Ryöppy 1985; Wingstrand et al 1985), so those with persistent effusions had an original episode that was more severe and may have a higher risk of developing ischaemia of the femoral epiphysis. These factors also suggest that effusions should perhaps be aspirated as a matter of urgency.

In 32 patients (29%) we did not detect an effusion either because it was missed at repeated ultrasound

![Flow diagram for the investigation of cases of transient synovitis of the hip.](image)

An ultrasound scan of a patient with a slipped femoral epiphysis. There is no effusion but the femoral head is displaced off the neck.
examinations, which is unlikely, or because they had a different pathological process which did not result in an effusion. Apart from being slightly younger and having less restriction of movement, there were no distinguishing features and no abnormalities on radiography. We therefore consider that radiography is not justified at the initial presentation where there is no effusion on ultrasound. However, if symptoms still persist at 10 days, a radiograph should be taken.

One theoretical pitfall in using ultrasound rather than radiography is the risk of missing a slipped femoral epiphysis. This condition, however, is usually seen in older children at an average age of 11 to 12 years in girls, and 13 to 14 years in boys (Kelsey 1973). Very few cases have been reported before eight years and then only after moderately severe trauma. In addition, the mode of presentation of an acute slip is different. However, it is reasonable to take a radiograph at the initial presentation in patients over eight years of age to ensure that a slipped epiphysis is not missed. This would have been needed in 20% of our series. Interestingly, our only patient with a slipped femoral epiphysis at 12 years of age had no effusion, but the slip was visible on ultrasound examination (Fig. 3).

We suggest that ultrasound rather than radiography should be used in the initial assessment of irritable hips up to the age of eight years (Fig. 4). This would reduce the number of radiographs by 75%. Further review depends upon the presence of symptoms and of the effusion at 10 days (Fig. 4); at this stage a patient with symptoms, regardless of the presence or absence of an effusion, should have a pelvic radiograph. Those in whom the effusion is still present with no symptoms at 20 days, should have anteroposterior pelvic and frog-leg lateral radiographs. If the radiographs are normal, an isotope scan may be used to assess the possibility of avascular necrosis of the femoral head. Even if all investigations are negative we still advise regular clinical review, since, as in one of our patients with Perthes’ disease, a persistent effusion may predate any radiographic changes.

We believe that this protocol of management would decrease the irradiation of children, while still providing adequate screening for Perthes’ disease; it may also help define a group of children who are at risk of developing avascular necrosis of the femoral epiphysis.

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REFERENCES


