Unilateral limitation of abduction of the hip
A VALUABLE CLINICAL SIGN FOR DDH?
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Between 1992 and 1997, we undertook a prospective, targeted clinical and ultrasonographic hip screening programme to assess the relationship between ultrasonographic abnormalities of the hip and clinical limitation of hip abduction. A total of 5.9% (2 of 34) of neonatal dislocatable hips and 87.5% (7 of 8) of ‘late’ dislocated hips seen after the age of six months, presented with unilateral limitation of hip abduction. All major (Graf type III) and 44.5% of minor (Graf type II) dysplastic hips presented with this sign.

Statistically, bilateral limitation of hip abduction was not a useful clinical indicator of underlying hip abnormality because of its poor sensitivity, but unilateral limitation of abduction of the hip was a highly specific (90%) and reasonably sensitive sign (70%). It was more sensitive than the neonatal Ortolani manoeuvre, which has been considered to be the method of choice. It was, however, not sensitive enough to be of value as a routine screening test in developmental dysplasia of the hip.

We consider unilateral limitation of hip abduction to be an important clinical sign and its presence in an infant over the age of three to four months makes further investigation essential.

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Limitation of hip abduction (LHA) is a common clinical sign in ‘late’ dislocation of the hip, although it is not regarded as a quantifiable test and is usually recorded as either positive or negative.

We carried out a prospective trial over a five-year period to investigate the relationship between LHA found on clinical examination and developmental dysplasia of the hip (DDH) as demonstrated by ultrasound.

Patients and Methods

Between 1 May 1992 and 30 April 1997, we undertook a prospective, targeted hip ultrasound screening programme. Neonatal clinical instability, as defined by a positive Ortolani or Barlow test, was assessed by ultrasound at one to two weeks of age. Infants considered to be ‘at risk’ as a result of breech presentation, family history, postural and structural foot deformity, torticollis and oligohydramnios were assessed ultrasonographically at between six and nine weeks of age, when clinically stable, but ‘at-risk’ hips, have become normal. Of the 20 452 births in the Blackburn district, 1107 neonates considered to be ‘at risk’ were examined clinically and ultrasonographically by the senior author (RWP). The clinical assessment of LHA was made with both hips flexed to 90° and full abduction of both joints was attempted. Any block or limitation of abduction was noted and the angle of limitation of abduction was measured from the horizontal. Clinical limitation of abduction was considered to be present and positive, if it was more than 20° compared with the contralateral side. Bilateral LHA was more difficult to assess and proved to be an unsatisfactory sign. Clinical examination of the fractious neonate or infant is difficult and requires considerable experience. Some authors recommend that LHA should be tested with the child prone. The senior author (RWP) found that this method was no more useful than that described above, particularly as it was not easy to fix the pelvis, making accurate measurement difficult. It was therefore not used routinely.

Ultrasound examination was undertaken using both dynamic and static morphological methods of assessment. The Graf alpha angle was used as a morphological measure of the hip. A normal hip has an alpha angle of over 60°, a Graf type-II (minor) dysplastic hip an alpha angle of between 43° and 60° and a Graf type-III (major) dysplastic hip an alpha angle of under 43°. Dislocated or dislocatable hips were assessed as type-IV hips. All hips were scanned with the child on its side, with the hip flexed and adducted. This minimised potential errors produced by pelvic obliquity which could lead to misinterpretation of the scan.
Statistical analysis was used to determine the sensitivity and specificity of LHA in a number of clinical situations.

Results

The 1107 infants who were examined by ultrasound were referred as clinically unstable (Ortolani or Barlow positive) or as ‘at-risk’ hips. Unstable hips usually underwent ultrasound examination within one to two weeks of age and ‘at-risk’ hips when the infants were between six and nine weeks of age.

There were 36 with ‘early’ dislocation (34 dislocatable and 2 irreducible, Graf type IV), 36 with major dysplasia (Graf type III) and 101 with minor dysplasia (Graf type II). The two irreducible hips were diagnosed from screening the ‘at-risk’ hips. Only two of 34 hips (5.9%) which were Ortolani- or Barlow-positive and were confirmed as dislocatable by ultrasound had limitation of hip abduction.

Clinical examination revealed LHA in 203 (18%). Ultrasound examination of these 203 neonates confirmed that 85 (42%) had DDH (Fig. 1). Of these 85, 45 (22%) had minor dysplasia, 36 (18%) had major dysplasia, two (1%) had an irreducible dislocation and two (1%) had a dislocatable hip. Most neonates with dysplastic hips had unilateral LHA (Figs 2 and 3).

As a proportion of the total number of neonates presenting with DDH, screening for LHA identified all 36 (100%) with major dysplasia, 45 of 101 (44.5%) with minor dysplasia and four of the 36 (11%) with ‘early’ dislocation.

Ultrasound assessment of the clinically normal contralateral hip in those cases with unilateral LHA in association with DDH revealed that 72% were normal and 26% had minor dysplasia of the hip (Graf type II).

Eight infants presented with ‘late’ dislocation after the
The age of six months (0.39 per 1000 live births); seven had LHA (87.5%). Two infants were seen after the age of one year with persistent ‘late’ dysplasia. The two cases of ‘early’ irreducible dislocation (probable prenatal dislocation) required surgical reduction (see above). These ten dislocations and the two ‘late’ dysplasias resulted in an overall rate of surgery of 0.58 per 1000 live births. As shown in Table I, statistical analysis showed that LHA was a specific, but not a sensitive, sign in the diagnosis of DDH (sensitivity 43%, specificity 90%). However, unilateral LHA was a much more sensitive sign in DDH (sensitivity 70%, specificity 90%). Specificity is a measure of the probability that a test result will be negative (100% specificity = no false-positive results). Sensitivity is a measure of the probability that a test result will be positive (100% sensitivity = no false-negative results).

Discussion

The relationship between the presence and severity of hip dysplasia diagnosed by ultrasound and clinical LHA of the affected hip is controversial. This confusion may be due to the difficulty in detecting this clinical sign accurately. Terjesen thought that limitation of the range of abduction greater than 20° was the most important clinical sign of a pathological hip. Bialik and Wiener concluded that LHA was usually associated with the less severe types of ultrasound abnormality. Stoffelen et al noted a link between a limited range of abduction and hip dysplasia. The more restricted the range of abduction the greater the risk of Graf type-II A or more severe ultrasonographic dysplasia of the hip. Green and Griffin noted an association between unilateral radiological acetabular dysplasia and an abduction contracture in the contralateral hip in a group of children aged from three weeks to eight months. ‘Early’ dislocatability appears to be a different pathology to ‘late’ or irreducible dislocation/major (Graf type III) dysplasia. The main clinical differences are the age of presentation and the low level of limitation of hip abduction in the ‘early’ dislocatable (2/34, 5.9%) compared with the ‘late’ dislocated type (7/8, 87.5%) or ‘early’ irreducible (100%). Generalised neonatal joint laxity may be sufficient to mask any tendency to LHA in the ‘early’ dislocation cases. LHA does not appear to be pathological per se, but is common in ultrasonographically normal hips and in Graf type-II hips (Fig. 1 and Table I) which generally resolve without treatment. This may explain why certain neonatal hip instabilities resolve spontaneously. As the hip instability lessens, the femoral head centres in the acetabulum and the dysplasia resolves. If, however, there is limitation of abduction, in association with a tight psoas tendon, the femoral head may decenter in a dysplastic acetabulum. If the dysplasia does not resolve dislocation may occur when the child starts to stand, leading to ‘late’ dislocation which usually presents after the age of six months. Jones has highlighted the problems of detecting neonatal dislocatability using the Ortolani and Barlow tests. These tests have a high specificity (100%), but a low sensitivity (< 60%) which falls still further if undertaken by the inexperienced. This low sensi-

![Fig. 2](image_url)
The distribution of LHA in 118 hips, normal on ultrasound screening. In 14% of these hips, it was noted that although there was LHA the side(s) was not recorded.

![Fig. 3](image_url)
The distribution of LHA in 85 ultrasound screened dysplastic hips.

### Table I. Sensitivity (%) and specificity (%) of LHA (all and unilateral) in detecting hip dysplasias

<table>
<thead>
<tr>
<th>Type of dysplasia</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
</tr>
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<tbody>
<tr>
<td><strong>Type III</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All limited hip abduction</td>
<td>18 (13 to 24)</td>
<td>100 (99.6 to 100)</td>
</tr>
<tr>
<td>Unilateral limited hip abduction</td>
<td>32 (23 to 42)</td>
<td>99.7 (99.1 to 99.9)</td>
</tr>
<tr>
<td><strong>All DDH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All limited hip abduction</td>
<td>43 (50 to 64)</td>
<td>90 (88 to 92)</td>
</tr>
<tr>
<td>Unilateral limited hip abduction</td>
<td>70 (60 to 69)</td>
<td>90 (88 to 92)</td>
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tivity confirms that these are poor screening tests. Their value is in hip surveillance not screening. Our study suggests that unilateral LHA has a higher sensitivity than the Ortolani test, but the sensitivity falls short of the level that could be considered adequate for a universal screening programme. The high specificity and reasonable sensitivity of unilateral LHA suggest that it is an important clinical sign, which should be sought earlier than the traditional six-month surveillance check. If undertaken at three to four months, it may represent a window of opportunity in which dysplastic hips may be diagnosed by ultrasonographic or radiological means. If these abnormal hips are treated at this stage, this may reduce the number of ‘late’ dislocations by identifying those ‘at risk’ of ‘late’ dislocation earlier on. We consider that if unilateral limitation of abduction is detected clinically at three to four months, further investigation should be undertaken. By contrast, bilateral LHA was not shown to be a useful clinical sign due to its poor sensitivity.

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


