# The natural history of hip abnormalities detected by ultrasound in clinically normal newborns

## A 6–8 year radiographic follow-up study of 93 children

Agnar Tegnander[1], Ketil Jarl Holen[1] and Terje Terjesen[2]

Ultrasound screening for hip dysplasia or dislocation has revealed a group of children with clinically normal hips, but with abnormal or suspicious ultrasound. During the 3-year period 1988–90, we found 170 children with this combination. We evaluated the natural history of these hips.

93 children were examined clinically and with standard radiography 6–8 years after birth. The center edge (CE) angle of Wiberg and migration percentage (MP) were measured on the radiographs.

87 children had not undergone any treatment, whereas treatment with an abduction orthosis had been initiated at approximately 4 months of age because of persisting dysplasia in 6 cases. All hips were radiographically normal at this follow-up. The mean CE value was 24 degrees (SD 6.5) and the mean MP was 13% (SD 5.2). 73 children had no complaints in their lower extremities, whereas 12 had intoeing gait, 1 had outtoeing gait, 2 had hip or knee pain, and 5 had other complaints not relevant to hip dysplasia.

We conclude that infants with sonographically abnormal or suspicious hips, but with normal clinical findings, do not need immediate treatment because spontaneous resolution occurs in most of them. Postponement of treatment in the few with persistent dysplasia does not seem to affect the outcome.

Departments of Orthopedic Surgery, [1]Trondheim University Hospital, NO-7006 Trondheim, Norway. Tel +47 7386-8000. Fax -8722. E-mail: agnart@online.no; [2]The National Hospital of Norway, Oslo, Norway
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With the introduction of ultrasound screening for hip dysplasia and dislocation (HD) in newborns, a group of children with clinically normal hips, but with abnormal ultrasound, has been identified (Berman and Klenerman 1986, Clarke et al. 1989, Terjesen et al. 1989, Castelein et al. 1992, Graf et al. 1993). There is no agreement as to whether these infants should be treated from birth or be followed without any treatment initially. We have previously found that most of these hips will normalize spontaneously (Terjesen et al. 1996), but the follow-up period was limited to the first 4–5 months of life. The aim of the present study was to determine whether such hips would continue to develop normally.

## Patients and method

During the 3-year period 1988–90, we examined 4,973 children with ultrasound as part of a prospective randomized study, to evaluate the efficiency of ultrasound screening for HD. The newborns were examined with the Ortolani and Barlow tests by an experienced pediatrician on the first day of life. Ultrasound examination was performed by the orthopedic surgeon 2–4 days after birth, when we also repeated the clinical examination. We used the ultrasound technique of Terjesen et al. (1989), which is based mainly on measurement of the femoral head coverage (FHC).

170 (3.4%) children (134 girls) with normal hips at the clinical examinations had pathologic ultrasound findings (FHC < 50%) at birth. The mean FHC at birth in these hips was 44% (34–48). The infants were not treated from birth, but were examined at 2–3 months of age (ultrasound and clinical examinations) and at 4–5 months (ultrasound, radiographic and clinical examinations). At 4–5 months of age, 10 infants, all girls, had persistently abnormal hips on ultrasound and radiographs. They were treated with an abduction

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Radiographic results in the 93 children at the follow-up examination at 6–8 years of age

| Number of hips | US at birth | Treatment [a] | CE mean | CE SD | CE range | MP mean | MP SD | MP range |
|---|---|---|---|---|---|---|---|---|
| 122 | Abnormal | No [b] | 24 | 5.3 | 15–37 | 13 | 6.5 | -5–24 |
| 52 | Normal | No | 25 | 4.9 | 17–36 | 11 | 6.1 | 0–22 |
| 8 | Abnormal | Yes | 21 | 4.7 | 17–30 | 19 | 4.9 | 10–25 |
| 4 | Normal | Yes [c] | 19 | 4.4 | 15–25 | 18 | 7.6 | 7–25 |

[a] From 4–5 months of age. [b] Not treated because of normalization.
[c] Treated because contralateral side showed persistent dysplasia.
US ultrasound, CE center edge angle, MP migration percentage, SD standard deviation.

orthosis and developed normally (Terjesen et al. 1996). The remaining infants developed normally without treatment, and no further routine follow-up was performed.

All 170 patients were asked to attend a follow-up examination 6–8 years after birth. A clinical examination was performed and a standard supine anteroposterior pelvic radiograph was obtained to evaluate the development of the hips. We recorded any pain in the hip, thigh or knee and gait disturbances, and performed a hip motion examination. The range of hip motion was measured to the nearest 5 degrees. On the radiographs, we measured the migration percentage (MP, Reimers 1980) and the center edge (CE) angle (Wiberg 1939). MP of 25% or less and CE angle of 15 degrees or more were considered normal. A hip was classified as abnormal when both the CE angle and the MP were outside these limits. When one of the measurements was abnormal and the other normal, the hip was classified as having "possible dysplasia".

### *Statistics*

The difference between groups was calculated with the chi-square test. The difference between means was calculated with the Student's t-test or with one-way analysis of variance (ANOVA) using the Scheffe test. The significance level was set at 0.05.

## Results

93 (55%) children (70 girls) attended the follow-up examination after 6–8 years. Their mean age was 7.1 (6–8) years. The mean FHC of the affected hips (130) at birth in this group was 44%, the same as in the group not attending the follow-up examination (92 affected hips) ($p = 0.8$). The two groups were also similar regarding risk factors for HD (family history and breech position) and birth weight.

73 children had no complaints about their lower extremities, whereas 12 had intoeing gait, 1 had outtoeing gait, 2 had hip or knee pain, and 5 had other complaints not relevant to HD. The range of motion (ROM) of the hips was slightly reduced compared to a normal population.

All the children attending the follow-up examination had normal radiographs (Table).

Of the 93 children, 87 had not undergone treatment, whereas 6 had been treated with an abduction orthosis from approximately 4 months of age, because of persisting dysplasia (Terjesen et al. 1996). The mean CE angle of the treated hips was 21 (17–30) degrees, and the mean migration percentage was 19 (10–25)%. The MP of the pathologic hips in the treatment group was significantly larger than that of normal hips in the untreated group.

## Discussion

Since most authors recommend immediate treatment in newborn infants with abnormal ultrasound findings, but normal clinical findings (Hauck and Seyfart 1990, Tönnis et al. 1990, Ganger et al. 1992, Millis and Share 1992, Graf et al. 1993), there are few reports on the natural history of such hips. Short-term results have shown

that most of these hips normalize without treatment (Castelein et al. 1992, Terjesen et al. 1996). We found that the hips have remained normal when reviewed after 6–8 years. Thus, the assessment by ultrasound during the first 4–5 months of life proved to be sufficient, as no hips in the untreated group had deteriorated at further follow-up.

Compared to normal children of the same age (Terjesen et al. 1991), our study showed that the untreated children had somewhat lower coverage of the femoral head (lower average CE angles and higher MP). CE angles between 15 and 20 degrees were found in several cases, indicating that the final result is still somewhat uncertain and that these children should be reviewed at the end of the growth period. Previous studies have shown an increase in the CE angle with age in normal children (Severin 1941, Fredensborg 1976), resulting in a lower normal limit of 20–25 degrees in adults (Wiberg 1939). Whether all children reported here will eventually reach this level remains to be seen.

Several children had a slightly reduced range of motion. Apart from the trend towards intoeing gait, they had no complaints and had normal physical activity. Thus, the decrease in range of motion had little, if any, clinical significance.

The 6 children who had been treated with an abduction orthosis from 4–5 months of age also had radiographically normal hips at the follow-up examination. However, the CE angle in this group was lower than that in the untreated children. This indicates that the treated children represent a subgroup with true HD, whereas the remaining children had slight abnormalities that spontaneously resolved or never had any real abnormalities, but only "immature" hips during the first months of life. We have found that the postponement of decision regarding treatment had no negative effects on the outcome. Unless the hip becomes obviously dislocated or severely subluxated—in which case treatment should be started immediately—the expectant attitude that we adopted seems advisable. This policy will reduce overtreatment of neonatally abnormal hips diagnosed with ultrasound in clinically normal children. It should be emphasized that a prerequisite for this expectant attitude is that the clinical examination be performed by examiners with great experience.

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