

The importance of combined clinical and sonographic examination of instability of the neonatal hip

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Summary. *A clinically unstable hip in a new-born may be an early sign of congenital dysplasia. Unless followed and treated at a young age, it can progress to a degenerative hip joint disorder with considerable functional disability in adult life. For this reason, the early diagnosis of neonatal hip instability is crucial. We present our experience with 9199 neonates examined independently by clinical and ultrasonographic techniques. Instability was diagnosed in 0.8% of the hips. Only 47% of the unstable hips were diagnosed by the initial clinical examination, in the remainder the dysplasia was recognised only by sonography. Sonographic changes were also detected on re-examination in 6% of the unstable hips following the recognition of clinical instability. It is evident that combined clinical and ultrasonographic examination significantly improves the detection rate of dysplastic hips in new-borns.*

Résumé. *Chez les nouveau-nés, une hanche cliniquement instable peut être un signe de dysplasie de la hanche. Si cette affection n'est pas traitée à un très jeune âge, elle peut devenir dégénérative et entraîner un handicap fonctionnel considérable à l'âge adulte. C'est pour cette raison que le diagnostic précoce de l'instabilité de la hanche chez le nouveau-né est cruciale. Notre expérience se base sur des examens cliniques et ultrasonographiques effectués indépendamment sur 9199 nouveau-nés. Dans 0,8% des cas, une instabilité de la hanche a été diagnostiquée. Cependant, seulement 47,4% des hanches instables ont été diagnostiquées grâce à l'examen clinique initial. Dans le reste des cas, la pathologie a été établie après que l'anormalité ait été reconnue grâce à l'ex-*

amen sonographique. Similairement, mais dans un moins grand nombre de cas, la pathologie a été détectée après un nouvel examen sonographique dans 5% des cas après que le diagnostic clinique d'instabilité ait été établi. Nous tenons à mettre l'accent sur le fait que les examens cliniques et sonographiques combinés ont sensiblement amélioré la détection des nouveaux-nés présentant un haut risque de développer une dysplasie de la hanche.

Introduction

The pathological basis of congenital dysplasia of the hip is underdevelopment of the hip joint which leads to the inappropriate containment of the femoral head in the acetabulum [1]. Left untreated, the condition can progress to a clinically complicated situation and result in functional disability which may require extensive surgical intervention [8, 24]. It is generally accepted that congenital dysplasia of the hip should be treated immediately upon early diagnosis. For this reason, major efforts are made to diagnose the abnormality as soon as possible after birth.

The diagnostic approach to congenital dysplasia of the hip in a new-born is based on three considerations [1]:

1. Recognition of the risk factors such as primiparity, breech presentation, female gender, a family history of hip dysplasia and other skeletal malformations [16, 18, 21].
2. Hip instability on clinical examination: The Ortolani [1] and Barlow [2] signs.
3. Ultrasonographic investigation [3, 7, 5, 13, 14, 28].

The combined approach is feasible when highly trained personnel, including neonatologists and pae-

diatric orthopaedic surgeons, are available together with proper equipment. Economic considerations, notably cost-effectiveness, are also relevant to neonatal screening [6, 22].

There is a controversy regarding the optimal approach to screening for congenital dysplasia of the hip in new-borns. In some centres, every neonate is examined manually and ultrasonographically [6]; in others, all the infants are examined clinically while sonographic investigation is reserved for those in a high risk group or to confirm abnormal physical findings [1].

The value of a false negative examination in a clinical assessment of congenital dysplasia of the hip has been discussed and is still far from satisfactory [12, 15, 16, 18, 23, 25]. It is well-known that a clinically abnormal hip, especially one with mild dysplasia, might appear stable on the initial manual examination. Hence there is a need for a more sensitive diagnostic approach, such as the use of routine ultrasonographic investigation combined with a repeated clinical examination. The present study estimates the effectiveness of the combined clinical and ultrasonographic approach in the diagnosis of congenital dysplasia of the hip in new-borns.

Patients and methods

Between 1/1/93 and 31/12/94, all live new-borns in our hospital, who weighed above 1000 g, were examined within 24 h of

birth by an experienced neonatologist for the evaluation of hip stability, using the Barlow and Ortolani tests. Independently, the hips in all new-borns were examined ultrasonographically by an experienced paediatric orthopaedic surgeon using the Graf method [14]. The ultrasonographic findings of grade 2A and higher were regarded as abnormal. There was no sharing of information between the paediatrician and the orthopaedic surgeon before the full investigation had been completed by each of them. When the results of one examination were incompatible with the other, the neonate was reexamined by both examiners to establish the final diagnosis. In this way, a group of new-borns with unstable hips was identified in whom clinical instabilities were diagnosed only at reexamination after the abnormality had been established on the sonographic examination, despite the initially normal physical examination by the neonatologist. Another small group of new-borns initially had normal ultrasonographical findings which appeared as pathological on reassessment, after the hip instability had been noted by the neonatologist. There were 9199 live new-borns [18398 hips] examined and evaluated clinically and ultrasonographically. Infants with abnormal findings were followed and, if necessary, treated in a special clinic.

Results

Abnormalities were detected on ultrasonographical investigation in 628 neonates, 5.5% of all the hips investigated. Of these, 15% [157 hips, 133 new-borns, 0.8% of all hips investigated] were unstable [Table 1]. In approximately 1% new-borns a unilateral or bilateral hip instability was diagnosed.

In 56 new-borns [73 hips, 47% of all the unstable hips], the instability was not recognised by the neona-

Table 1. Group characteristics

	Total	Sonographic pathology	Clinical examination		Sonographic and physical misdiagnosis of hip instability
			Stable hips	Unstable hips	
Hips	18398	1000	846	157 ^a	82
Newborns	9199	628	497	133	63
Percentage		5.5% ^b	84.9% ^c 4.6% ^b	15.0% ^c 0.8% ^b	53.2% ^d 0.4% ^b

^a includes 3 unstable hips [2 infants] with normal ultrasonographic imaging

^b of total number of hips investigated

^c of ultrasonographically pathological hips

^d of unstable hips

Table 2. Ultrasonographic grading in clinically unstable hips according to Graf's classification [14]

Classification of ultrasonographic findings	Total number of unstable hips	Unstable hips missed on physical examination/ % of total	Unstable hips missed by ultrasonography/ % of total
1	3	–	3/100%
2A	9	4/44%	–
2C	30	7/23%	5/17%
D	50	26/52%	1/2%
3A	39	24/62%	–
4	26	12/46%	–
Total number of newborns	133	56/50%	7/5%
Total number of hips	157	73/47%	9/6%

tologist on the initial clinical examination and was detected only on re-examination after sonography had revealed the abnormality [Table 2]. In seven neonates who were initially thought to be sonographically normal, nine unstable hips were found clinically. A further sonographic examination was made in which six hips in five babies were seen to be abnormal, leaving three hips in two children which still appeared normal on this investigation (Graf Type 1) [Table 2].

On the assumption that almost all unstable hips were eventually detected, the sensitivity and the specificity of an ultrasonographical diagnosis of neonatal hip instability was 94% and 95%, respectively. The clinical evaluation of the hip instability showed a markedly lower sensitivity of 54% whereas the specificity of the clinical examination for a hip instability can be estimated as 100%, because there were no false positive findings.

Discussion

The clinical examination of new-born hips for instability requires a high degree of skill and experience. Even in the hands of a skilled examiner the sensitivity of this technique is limited [4, 22]. In the large screening study undertaken by Macnicol [19] the rate of an initial instability in the new-born was about 6 in 1000; this is almost 50% less than our own findings of about 10 unstable hips per 1000 new-borns. This difference can be explained by several factors:

- A difference between the populations in terms of their incidence of ligamentous laxity, which is thought to be a main reason for hip instability in the neonate [9].
- Clinically missed hip instability.

From the data available to us we cannot discern the magnitude of the relative roles of these possibilities. Macnicol [19] reported that a clinical examination by an experienced orthopaedic surgeon reduced the incidence of late missed CDH almost to nil; these findings are inconsistent with the late development of hip instability, reported as a late acetabular dysplasia in infants with initially stable hips [9]. These observations are also inconsistent with our own findings, as we demonstrated that neonatologists, who are familiar and experienced with the technique of detecting new-born hip instability, did not record any false positive findings [the specificity of their examination reached 100%], although they failed to detect about 50% of unstable hips in the initial examination.

Sonography should identify all anatomically abnormal hips, stable and unstable, as the sensitivity of this technique in the detection of congenital dysplasia of the hip is very high, up to 100% for Types 3 and 4 of Graf's classification [26]. The performance of infant hip ultrasonography is highly dependent upon the skill and experience of the examiner and his/her abilities in interpretation of the sonographic image, as well as on the quality of the equipment [4, 5, 22].

This situation can lead to misdiagnosis and, indeed, in six hips [five new-borns] the hip abnormality was misinterpreted on the initial ultrasonographic examination; on reassessment 5 hips were diagnosed as Type 2C and one as Type D [according to Graf], after hip instability was found by the neonatologist. The additional three hips [two new-borns] were ultrasonographically normal on repeated examination, despite their instability on physical examination. Finally, initial ultrasonographic investigation failed to reveal instability in 9 hips [seven infants, 6% of unstable hips].

The uniformly high sensitivity and specificity values of sonographical examination, (94% and 95%), compared with clinical examination alone, with a very low sensitivity of 54%, could obviate the need for follow-up examination in about 50% of new-borns with unstable hips [56 infants in this group]. The majority of unstable hips which are detected in new-borns develop normally [11], but this normal hip maturation cannot be predicted by either of the conventional diagnostic modalities and must be evaluated by close clinical and sonographical follow-up in the first months of life.

Overall we found that 53% of unstable hips of new-borns were not diagnosed on the initial examination by both modalities. Approximately the same rate of 40–60% of misdiagnosis occurred for each sonographic subgroup, demonstrating no predisposition of either subgroup for misdiagnosis [Table 2].

It is apparent from several reports [7, 21, 26] that ultrasonographic investigation of the hip in the new-born raises the accuracy of detection of congenital dysplasia of the hip considerably. Indeed, this approach is the only early diagnostic modality when the hip is stable. In unstable hips, the rate of correct diagnosis is improved by the addition of a clinical examination [3, 10, 27], as was proven again in the present study. Reliance on clinical examination alone, with the 50% rate of initial misdiagnosis of hip instability, may prevent recognition and thorough follow-up in a high proportion of new-borns at risk. The combined approach which we have used should greatly improve the early detection of new-borns with unstable hips, who are at risk of developing hip dysplasia.

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