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The effect of ultrasonographic screening on the incidence of developmental dislocation of the hip

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Summary. *The effect of ultrasonographic screening and treatment with a Pavlik harness on the incidence of developmental dislocation of the hip has been studied retrospectively. Observations were made at three different consecutive periods; in the first, clinical screening was carried out, in the second, ultrasonography was added for children up to 3 months of age, and in the third ultrasonography was used within the first few days of birth. A significantly decreased dislocation rate was demonstrated in each group, suggesting that early ultrasonography was of value in the early detection of dislocation.*

Résumé. *Les auteurs ont évalué dans une étude rétrospective l'influence de l'examen échographique et du traitement ultérieur par harnais sur la fréquence du développement de la luxation congénitale de la hanche. Ils ont utilisé au fil des années trois méthodes différentes. Pendant la première période ils ont eu recours à un simple examen clinique. Dans la deuxième ils y ont ajouté une échographie entre le ler et le 3è mois. Dans la dernière l'échographie a été pratiquée dans les jours suivant la naissance. Les résultats montrent que la fréquence de la luxation congénitale de la hanche a significativement diminué au cours des trois périodes d'observation, ce qui permet de conclure à l'efficacité de l'examen échographique précoce.*

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Introduction

The reported incidence of congenital dislocation of the hip (CDH) varies in different countries being quoted as 0.83% [1], 0.68% [7] 1.1% and 3.5% [12]. Absolute numbers relating to the incidence of reduction must be seen in relation to each country.

Early detection and treatment can achieve good long term results [2, 8]. Real-time ultrasonography of the hip used to detect early cases of dysplasia in the presence or absence of instability is an uncomplicated procedure [5, 6]. A prospective study has shown that hip sonography is as effective as radiography for following up children with dysplasia [10].

Both methods aim to lead to early treatment and so reduce the development of dislocation [7]. The figures for closed and operative reduction correlate with the incidence of dislocation and can, therefore, be used to compare both types of screening method.

Material and methods

Observations were made at three different consecutive periods; in the first, clinical screening was carried out, in the second, ultrasonography was added for children up to 3 months of age, and in the third ultrasonography was used within the first few days of birth. Since the incidence of CDH is low, large numbers are needed for an epidemiological study, and each group would have to consist of 20,000 babies to ensure a significance level of 0.05 [11]. To compare two groups of this size a minimum of 40,000 is required to evaluate the epidemiological effect of early detection by ultrasonography and treatment of CDH. A prospective study would be expensive and difficult and for these reasons we chose to perform a retrospective review.

The prerequisites for each group were more than 20,000 infants, and a follow up near to 100% over a sufficiently long time. In the Tyrol approximately 8000 children are born each year. To achieve the necessary 20,000 infants for one group, all babies born within 2½ years were sufficient. Nevertheless, we chose the size of both groups (A: n = 40,000; B and C: n = 40,000) to be twice as large. The second group (B and C together) was further subdivided:

A – 1979 to 1983: clinical examinations at regular intervals.
B – 1984 to 1986: ultrasonography was being introduced and its use increased to up to 80% of all infants. The first examination was up to the third month after birth.
C – 1987 to 1988: ultrasonography with institutionalised screening of newborns at various hospitals and general newborn screening at Innsbruck (2700 babies, one quarter of all born in Tyrol).

In 1974, a Mother-Child record was introduced in Austria and was linked to an attractive federal premium given to the parents. According to the Ministry of Health, 96% of all children were included throughout the whole period. These all had clinical screening at birth (Ortolani sign, difference in leg length and range of movement), as well as several examinations during the first year of life and then every year until the age of five.

The social security systems in our two neighbouring countries mean that Austrians almost never seek treatment in Italy or Germany. In Austria, examination and treatment are free to every citizen. The orthopaedic department at the University clinic in Innsbruck is the only place in the Tyrol where CDH can be treated, so that complete data are available on all closed and open reductions. Questionnaires were also sent to all 92 specialists in radiology, orthopaedics and paediatrics in other hospitals and private practices in the Tyrol since they might be involved with the diagnosis of CDH with or without ultrasonography; 91 questionnaires were returned.

No referrals to other institutions, at home or abroad, were reported. To ensure that this was the case, all doctors performing hip ultrasonography were contacted by telephone to ensure that no case of dislocation or dysplasia had been referred to institutions other than the University clinic at Innsbruck and that Graf's technique [5] was used exclusively.

During the whole observation period, the diagnosis of CDH was confirmed by dynamic hip examination with arthrography under an image intensifier. Dysplastic and unstable hips were treated by the Pavlik harness; dislocation was reduced either by the closed method or by operation, followed by a plaster cast.

To eliminate the statistical bias of the different observation periods, we had to chose a follow up long enough to detect nearly all dislocations. This was based on two considerations. In the first period (A) the age at reduction was 1.4 ± 0.5 years (only 2 dislocations were detected later than the age of 30 months) and Catford et al. reported that only one-fifth of dislocations were detected after 1½ years of age [4]. We therefore assumed that a minimal follow up of 2½ years would diagnose nearly all cases of CDH.

The birth rates for the years 1979 to 1988 could be deduced from data provided by hospital and federal authorities, and the exact number of newborns for each group was known.

As the frequency of ultrasonography is the only variable within the examination period, the rate of reductions should change dependently. The Wilcoxon test and Fisher's exact test were used to determine statistical significance.

Table 1. Incidence of surgical and closed reductions

Period	A	B	C
	79–83	84–86	87–88
Total birth rate	42,000	24,000	16,000
Birth rate per year	8,300	8,000	7,900
Reductions	93	32	13
Reductions per year	19	11	6
Reductions per thousand born infants	2.2	1.3	0.7

Fisher's exact test indicates a significant reduction between A and B ($p = 0.007$) and A and C ($p = 0.0002$), but not between B and C ($p = 0.17$)

Table 2. Incidence and annual rate of surgical and closed reductions for CDH allocated to the district of birth

District	Birth rates (hundreds)	Reductions in A (79–83)	Reductions in B and C (84–88)
Innsbruck city	12	14 (1.2)	7 (0.6)
Innsbruck country	18	22 (1.2)	9 (0.5)
Imst	7	6 (0.9)	3 (0.4)
Landeck	7	11 (1.6)	5 (0.7)
Lienz	7	9 (1.3)	3 (0.4)
Kitzbühl	7	5 (0.7)	2 (0.3)
Reutte	4	5 (1.3)	3 (0.7)
Schwaz	9	14 (1.6)	5 (0.6)
Kufstein	11	7 (0.6)	8 (0.7)
Total	82	93	45

The total amount of reductions in each district and the reductions in relation to the birth rate (in parentheses) are shown for period A and period B/C. The decrease of reductions is significant (Wilcoxon test: $p = 0.002$)

Results

Between 1979 and 1988, 81,540 children were born in the Austrian federal state of Tyrol, and within that period 213 hips had either closed or operative treatment for CDH. Out of these, 21 reductions were excluded because the patients had neuromuscular disorders. Furthermore, 54 children not born in Tyrol were also excluded. This left a total of 138 reductions (0.17%).

A significant decrease in reductions was shown to have occurred between period A (19 per year) and period B (11 per year), and there was a further decrease between periods B and C (6 per year) (Table 1). When evaluated for each district, the number of reductions in relation to birth rate is significantly lower when ultrasonography was carried out (periods B and C) than in period A (Table 2).

Discussion

We are not aware of any study which has evaluated the effect of ultrasonography screening on the incidence of reductions carried out. Our findings suggest that a statistically significant decrease of closed and open reductions is possible when general screening is performed up to the third month. When screening of all newborns by ultrasonography was introduced, a further decrease was achieved. As group C is relatively small (n = 16,000), the decrease is not significant ($p = 0.17$).

It is possible that this decrease could be caused by an increasing number seeking treatment in other federal states or in other countries, but we were able to confirm that all Tyrolean children with CDH were treated within our geographical borders.

We believe that our rate of 0.7 reductions in 1000 newborns in period C could be reduced even further by increasing the rate of ultrasonography in all districts. The need for reduction cannot be eliminated completely because:

(1) very severe cases of CDH do not respond to treatment in a Pavlik harness;

(2) one out of 4 failures are due to noncompliance by the parents [9];

(3) the sensitivity of the method is impaired since it cannot detect unstable hips with a normal acetabular roof which may develop CDH, and

(4) the specificity is also impaired since hips recognised as abnormal by ultrasonography can go on to develop normally without any treatment [3].

We are unable to make any statement about the sensitivity or specificity of the method, nor about the effectiveness of the Pavlik harness. Nevertheless, our results encourage us to recommend ultrasound screening in the newborn in order to decrease the number of closed and open reductions for CDH.

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