Acta Orthop Scand 1988;59(2):176–179

Foot deformities in the newborn – incidence and prognosis

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In a consecutive screening of 2,401 newborn, a foot deformity was noted in 100 of the infants (4.2 percent). At follow-up 5–6 years later, the children with a foot deformity were reexamined and compared with normal controls. Seventy-six infants had some adduction deformity of the foot at birth. At reexamination, 87 percent of the examined children had normal feet. No association was observed between sleeping prone and the presence of adduction deformity at the reexamination. Pes calcaneovalgus was diagnosed in 18 newborn. Of those reexamined, all had normal feet. Up to the age of 6 years, 4.3 percent of the 2,401 had been referred to the department of orthopedics because of a foot deformity; 50 because of an adduction deformity, and in 10 of these children the deformity was observed at birth. The investigation indicates that no treatment is required for pes calcaneovalgus or adductus deformity confined to the forefoot.

Three main foot deformities are encountered in infants. Pes equinovarus is recognized at birth and referred to the orthopedist immediately. Pes calcaneovalgus is also diagnosed at birth, but orthopedic treatment is seldom indicated. Pes adductus, however, is seldom referred before the age of 3 months. The reason for that may be that the deformity was overlooked at birth or that the deformity does not manifest until later. The association between the shape of the newborn foot and later observed deformities is not clear.

We have determined the incidence of various foot deformities in an unselected population of newborn. Further, the development of the observed abnormalities was studied in a follow-up examination after a period of 5–6 years. The referral rate for various foot conditions of preschool children was also analyzed.

Patients and methods

The study consisted of three parts:

I. A screening examination of a consecutive series of 2,401 newborn with recording of all foot deformities.

II. Reexamination 5–6 years later of the children with foot deformities at birth and, as a control, the examination of a random sample of children judged to have had normal feet at birth.

III. The referral rate to the department of orthopedics of preschool children for various foot conditions and gait disturbances was analyzed in the index population.

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Screening of newborn

During a 1-year period, a screening examination was carried out in all 2,401 newborn infants at Huddinge Hospital by three orthopedic surgeons (Widhe et al. 1983). Besides obstetric data and hip status, the foot deformities were recorded.

The following definitions were used in classifying the various foot deformities.

Pes equinovarus: Fixed equinus and varus deformity of the hindfoot and forefoot.

Pes metatarsus varus: Adduction and varus deformity of the midfoot and forefoot.

Pes metatarsus primus varus: Adduction of the first metatarsal with an increased angle between the first and the second metatarsal.

Pes adductus: Adduction deformity restricted to the forefoot.

Pes calcaneovalgus: Dorsiflexion and eversion of the foot. Plantar flexion to neutral or less.
Pes supinatus: The whole foot in supination.
No distinction was made between fixed and flexible deformities.

Follow-up examination

Between 5 and 6 years later, a second examination of the children with a foot deformity at birth and of a random sample of the children with normal feet at birth was carried out. The follow-up consisted of a case history centered on foot abnormalities in both the child and the family and information on the child's motor development. Clinical examination included measurements of the range of motion of the ankles, knees, and hip joints by devices developed for this purpose. A motor maturity evaluation and an assessment of any increased laxity of the joints were also performed (Gillberg and Rasmussen 1982, Wynne-Davies 1973).

Podography was performed in 40 children: 20 with pes planus and 20 with normal longitudinal arches. Photographic measurements were made of the total area of the sole and of the loaded part of the sole by using a Kontron 10 MoP.

At the follow-up of the foot abnormalities diagnosed by screening of the newborn, 85 out of the 100 children could be reached 5–6 years later, and 68 of these attended the examination. The parents of 17 children were contacted by telephone, and a case history centered on foot deformities and gait abnormalities was obtained. For 5 of the remaining 15 children with foot deformities at birth, information about their foot status could be collected from medical records available at the hospital. The control group consisted of a random sample of 58 children whose feet were normal at birth in the judgement of the orthopedist.

Referral pattern

Information about how many of the 2,401 children that had been referred to the orthopedic department was obtained from the outpatient and inpatient register. The patient records were used to collect information about diagnosis and treatment.

The two-tailed Student's t-test was used to evaluate differences between groups.

Results

Screening

During a 12-month period, 166 foot deformities were identified in 100 of the 2,401 newborn. There was no association between the occurrence of foot deformities and sex, birth weight, fetal posture, and parity. The most common foot deformities among the newborn were pes adductus, metatarsus varus, and metatarsus varus primus, accounting for some three fourths of the foot deformities observed (Table 1).

Follow-up

Pes adductus. At the follow-up, 13 percent of the 5–6-year-old children with some form of adductus deformity at birth still had this deformity, whereas only 3 percent of the children with normal feet at birth had an adduction deformity at this age. Six

Table 1. Foot deformities observed at birth in 100 infants out of 2,401 newborn screened. Infants referred to orthopedist within 6 years of birth are shown in the last column

	Right	Left	Bilateral	Total	Referred for treatment
Metatarsus varus primus	2	7	29	38	2
Pes adductus	4	9	23	36	6
Pes metatarsus varus	0	0	2	2	2
Pes calcaneovalgus	9	2	7	18	3
Pes equinovarus	0	0	3	3	3
Pes supinatus	1	0	2	3	1
Total	16	18	66	100	17

of the 76 children with adduction deformities diagnosed at birth, 2 of whom with metatarsus varus, were referred to the orthopedist before they were 1 year old. The treatment given consisted of instruction of the parents in manipulation, splintage, and in 1 child correction with a plaster cast. Another 4 of these 76 children were referred when between 1 and 4 years of age. The interviews at the follow-up examination revealed that adduction deformities were not more frequent among the children who as infants slept prone than among those sleeping supine.

Pes calcaneovalgus et supinatus. All the children in whom pes calcaneovalgus or supinatus were diagnosed at birth had normal feet at the follow-up. Of the 4 children referred to the orthopedic department, stretching exercises were recommended in 3 cases and 1 was judged to be normal. No association was found between the presence of pes calcaneovalgus at birth and pes planus or valgus position of the calcaneus at the follow-up.

Pes planus. Of the children examined at the follow-up, flatfeet were diagnosed in 26 percent. Although no established criteria for flatfeet were available, the clinical appraisal at the follow-up examination was closely consistent with the measurements performed by podography. The children judged to have flatfeet had a greater loaded area of the sole than the children with normal feet ($P < 0.01$). Moreover, the children with flatfeet had a greater range of motion of the ankle than the controls ($P < 0.01$). There was no correlation between body weight and flatfeet or valgus position of the calcaneus. Flatfeet were marginally more common among the children with joint laxity. There was no association between pes planus and the performance at the motor development test or the parents' assessment of their child's motor development.

Gait. At the follow-up examination, it was noted that intoeing was twice as common among the children judged to have an adduction deformity at birth as among controls, the respective proportions being 33 and 14 percent. The age at which children started walking was equal for children judged to have a foot deformity at birth as among controls. Children that slept supine as infants seemed to walk on an average 1.5 months later than those sleeping prone ($P < 0.05$). Infants with intoeing did not differ from those with normal gait in performance at the motor development test or in the parent's assessment of their child's performance.

Referrals

Of the 2,401 newborn, 102 children had been referred to the orthopedic department for various foot abnormalities from 0–6 years of age. Fifty children had been referred for adductus deformity and 38 for pes planus. Fifty-four children had been referred for gait disturbances, mostly intoeing.

Discussion

In the present study the incidence of foot deformities in 2,401 newborn infants was as high as 4.2 percent. The most common foot deformities were various types of adductus deformities, which were observed in 3.1 percent of the children.

However, of the newborn with adductus deformity, only a few were referred to the department of orthopedics before the preschool age. Further, only in a minor part of the children referred for adductus foot deformities before the age of 6 years was this deformity observed at birth. Thus, it seems that many of the adductus deformities found at birth resolve spontaneously, but also that adductus deformity of the foot may develop or become manifest after birth. In the present study, 87 percent of the adductus deformities observed at birth had resolved.

The favorable prognosis of adductus deformities was observed by Rushforth (1978), who studied the natural history of untreated pes adductus in children under aged 1 year. At follow-up at least 4 years after the initial examination, 86 percent of the feet had normalized; and even in the feet with residual deformities, the children were asymptomatic. Rushforth (1978) recommended that no treatment of pes adductus was justified. The opposite view was held by Bleck (1983), who in a retrospective study of children treated for metatarsus adductus could not find any correlation between the results of treatment and the severity of the initial deformity. Because Bleck (1983) found it impossible to predict which cases of metatarsus should be treated, he recom-

mended that all the patients should be treated and that the therapy be started early in life.

The 26 percent incidence of flatfeet in our patients is in close agreement with that reported by Morley (1957). However, the incidence is amazingly high in that only 1.6 percent of the 2,401 children were referred to the orthopedic department for flatfeet up to the age of 6 years. One explanation could be that the reason for referral is not the shape of the foot, but a symptom that the parents or the referring physician suspected may be due to flatfeet.

The difficulties arising from imprecise definitions become apparent when an attempt is made to compare the results of different studies. Pes calcaneovalgus was found in about 1 percent of the children in our series, whereas Wetzenstein (1970) reported an incidence of 30–50 percent in newborn if moderate degrees of the deformity were included. He found an association between calcaneovalgus in newborn and subsequent development of pes planovalgus. This could not be confirmed in our study, which agrees with Larsen et al. (1974), who found no difference between treated and untreated calcaneovalgus feet.

From the relatively high frequency of deformity observed in the present study and the diversity of opinion among different studies, it is evident that there is no unanimity as to where the demarcation line between normality and abnormality should be drawn.

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