SEASONAL VARIATION IN THE INCIDENCE OF
CONGENITAL TALIPES EQUINOVARUS

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A review of 77 neonates who presented with congenital talipes equinovarus over a seven-year period revealed an increase in the condition amongst babies born in the winter quarter. This finding was particularly apparent among the less severe cases of club-foot. Possible reasons for this seasonal variation are discussed.

A seasonal variation for the incidence of congenital talipes equinovarus has not been previously reported, although Wynne-Davies (1970) demonstrated the winter preponderance of congenital dislocated hip.

In both conditions environmental factors operate in genetically predisposed individuals.

To determine whether a similar pattern existed in congenital talipes equinovarus, a review was carried out of all cases treated in the orthopaedic department of Addenbrooke's Hospital between 1983 and 1989.

PATIENTS AND METHOD

Throughout the period of review, a uniform policy existed for the management of talipes equinovarus. All neonates with the condition were immediately referred to a paediatric orthopaedic clinic. Babies were seen by a consultant orthopaedic surgeon who confirmed the diagnosis on the appearance of the foot, with the ankle in equinovarus and the heel, midfoot and forefoot inverted and adducted. This definition covered a range of deformity, from a postural club-foot which may be corrected with a course of carefully applied strapping, to a rigid deformity with an underlying structural abnormality.

Initially all babies were managed by strapping. This was applied and subsequently supervised by one of the authors (AR), who also made a subjective assessment of the deformity as being severe, moderate or mild. The severe cases included babies with a rigid deformity and obvious calf wasting; almost all needed surgical treatment. Where the deformity could be corrected by passive manipulation but required strapping for four to six weeks, it was classified as mild. A trivial postural deformity that resolved without treatment was not considered to be true congenital talipes equinovarus and was excluded from the study. On treatment the birth date of each child was recorded. No child was over six weeks old when first diagnosed.

The population of Cambridge and district are served by a single maternity unit, the Rosie Hospital, and by a single orthopaedic unit; both are on the same site. It is unlikely that any significant number of local mothers would give birth outside the area or that any babies born with club-feet would not be seen at Addenbrooke's orthopaedic department.

To confirm that the variation in monthly totals of affected neonates was not due to a seasonal difference in the birth rate, the number of live births occurring at the Rosie Maternity Hospital during each month of the study period was determined (Fig. 1).

The number of home births in the catchment area was less than 1% of the annual total and was therefore discounted.

RESULTS

Between 1983 to 1989, 77 neonates presented with talipes equinovarus. The male to female ratio for the group was 2.3:1; 10 patients (13%) had other associated congenital anomalies, the commonest being spina bifida (four infants).

The incidence of talipes was 2.9 per thousand live births for all cases; for the severe cases alone it was 1.2 per thousand. The monthly totals of children born with congenital talipes equinovarus for the whole study period are presented in Table I. The combined monthly totals for the years 1983 to 1989 are given in Figure 2.

The range of deformity in the group is illustrated in Table II. In the whole group approximately 40% of the
The pattern of severity was uniform throughout each of the years surveyed. To discover whether the trend was present in the severe cases, figures were plotted separately (Fig. 2).

To determine the statistical significance of the variation, the monthly totals were combined into four quarters: December to February, March to May, June to August and September to November. A chi-squared test indicated that the differences were significant ($p = 0.01$, 3 degrees of freedom). Exclusion of the four cases with spina bifida did not alter the significance figures.

**DISCUSSION**

Our review of neonates who presented with congenital talipes equinovarus over a seven-year period reveals a consistent seasonal variation in the occurrence of the condition. A winter peak is present in each of the years surveyed and the variation in occurrence over the period is statistically significant. The frequency of congenital dislocated hip amongst babies born in winter was originally considered to be due to swaddling but in club-foot diagnosed at birth, prenatal factors must operate.

The trend has not been reported previously. The location of a single maternity hospital and orthopaedic unit on the same site makes it most unlikely that neonates with club-foot would be referred for treatment elsewhere, which should enhance the accuracy of the data.

The study group compares reasonably well with the known epidemiological features of the condition, the male predominance and proportion with associated anomalies is similar in other studies. The incidence of 2.9 per thousand is higher than that reported in a retrospective study of cases from Devon for the years 1948 to 1960. However the same study quotes a rate of 4.4 per thousand for Birmingham over a similar period (Wynne-Davies 1964).

Diagnosis and referral in the neonatal period ensured that all degrees of deformity were seen, and the fact that less than 1% of births occurred at home meant that the
condition was very unlikely to be overlooked. The lower incidence reported in some earlier studies may have been a reflection of a lower referral rate from a largely home-delivered population.

While it is true that our series includes a range of deformity as illustrated in Table II, the milder, more postural deformity cannot be ignored. In practice we have found that club-foot cannot be strictly divided into the rigid fixed type and a benign postural variety, but presents a spectrum of deformity. Moreover, a relatively mild club-foot may, if left untreated, become fixed due to secondary soft-tissue changes. It differs from a true benign, postural deformity such as talipes calcaneo-valgus.

Although the exact cause is unknown, both genetic and environmental factors are probably involved. It has been suggested that the presence of a genetically determined connective tissue defect and a transient deforming force allows the abnormally mobile foot to be pushed into equinovarus at a vulnerable time in its development. The foot then becomes set in a deformed position with stretched muscles unable to correct it. A deforming force exerted later in fetal life could account for the less severe deformity of essentially a postural club-foot (Wynne-Davies 1964).

The results of our review suggest the influence of a seasonally variable environmental factor. This variation appears particularly marked in the less severe cases, so it may well operate relatively late in fetal life.

The primary bony defect is in the orientation of the talus. In normal fetal life the talus attains its correct alignment at around 16 weeks after gestation; environmental influences may have their maximum impact at that time. The peak incidence we found amongst babies born in the winter period, December to March, makes the 16th week of gestation fall between July and October.

We can only speculate on the seasonal factors which may be implicated in the pathogenesis of this condition; they might include temperature, food toxins or seasonal viruses. Animal experiments indicate that maternal hyperthermia during gestation can produce a club-foot deformity in the young (Edwards 1971). Nutritional factors and viral infections have been implicated in the cause of neural tube defects which also show a seasonal variation in incidence and may be associated with talipes equinovarus (Laurence 1969).

We conclude that congenital talipes equinovarus, as it occurs in at least one area of East Anglia, does appear to have a seasonal incidence. The pattern of a winter peak is repeated in all the seven years studied. It suggests an unidentified environmental influence maximal in the summer months.

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REFERENCES


