Natural history of infantile tibia vara

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We have observed the natural history without treatment of 46 limbs in 29 patients with infantile tibia vara and a metaphyseal-diaphyseal angle (MDA) of more than 11°. The femorotibial angle (FTA) and MDA were measured, and Langenskiöld’s classification of radiological changes in the proximal medial metaphysis of the tibia was used. In 22 limbs which were not in Langenskiöld stages II to III the condition resolved spontaneously without treatment. Of the remaining 24 which were in stages II to III, in 18 it resolved spontaneously by the age of six years, but six showed little or no improvement at the latest follow-up. It was impossible to differentiate by measuring the FTA or MDA whether spontaneous resolution could be expected before the age of four years. There was no difference in the rate of resolution of the deformity between those patients who had been treated by a brace and those who had received no treatment. We advise no initial treatment but review at six-monthly intervals until the age of four years, even in patients with Langenskiöld stage-II to stage-III deformity. When a deformity persisted or progressed we carried out a corrective osteotomy after the age of four years.

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Some authors1-3 have recommended treatment in a brace for infantile tibia vara, but have not considered either the natural history of the disorder or the criteria for the treatment of bow-leg deformity which does not resolve spontaneously. In its early stages, infantile tibia vara may be confused clinically and radiologically with physiological bowing. We have hesitated to apply above-knee bracing for severe bow-leg deformity because of the difficulty in making the diagnosis, of patient compliance and of cost. We decided not to offer brace treatment for patients with bow legs but to observe the natural history of the condition on a six-monthly basis in order to assess the incidence of spontaneous resolution.

Patients and Methods

Between 1991 and 1996, 57 patients presented with a bilateral bow-leg deformity. We assessed the alignment of the lower limbs using standing anteroposterior (AP) radiographs and measured the femorotibial angle (FTA) and Drennan’s metaphyseal-diaphyseal angle (MDA).4 In patients in whom the MDA was more than 11° at the initial visit, the deformity was diagnosed as infantile tibia vara as suggested by Levine and Drennan.2 We studied 46 limbs in 29 patients (15 boys and 14 girls) who were considered to be suffering from infantile tibia vara; 17 were affected bilaterally and 12 unilaterally. In the latter one limb had infantile tibia vara and the other physiological bowing. The mean age at presentation was 19 months (16 to 31) and the mean age at which they had started to walk was 11 months (8 to 16). They were followed up at six-monthly intervals until the age of three years, or until there was resolution of the deformity. This was considered to have occurred when the FTA was less than 0°. The mean follow-up was 42 months (30 to 72). Parental consent was obtained for all patients in the study who were treated by observation for six months without bracing.

We divided the patients into two groups based on the radiological changes in the proximal tibia. Limbs which showed simple beaking of the medial metaphysis and not the characteristic step-like deformity of Langenskiöld stage II to stage III were classified as group I. Those which had step-like deformities and irregularities in the medial metaphysis of the proximal tibia and which correlated with stage II or stage III were classified as group II (Fig. 1).

The statistical significance was determined by Student’s t-test.
Results

A total of 40 limbs in 27 patients (87% of the total) showed spontaneous resolution without treatment and six (13%) showed no improvement at final follow-up. We had classified 22 limbs in 15 patients as in group I. Of these, 21 showed complete correction of the deformity by four years of age. The other limb corrected between the ages of four and six years without treatment. Of the 24 limbs in 14 patients classified as group II, 15 showed spontaneous improvement by four years of age and three at between four and six years of age (Fig. 2). Thus, 18 limbs (75%) showed spontaneous resolution without treatment. The remaining six limbs in five patients did not resolve. Three limbs in three patients (aged 4.5, 5 and 6 years at the latest follow-up) still showed a mild deformity with an FTA of less than
5° varus, but a decrease in the severity of deformity. The remaining three (6.5%) in two patients aged 4.5 and 5.5 years, required corrective tibial osteotomies because of clinical and radiological deterioration (Fig. 3). These three limbs showed no recurrence four years after osteotomy.

**Measurements of the FTA and MDA.** The mean FTA at presentation in both groups was 23 ± 7° (13 to 40) and 24 ± 7° (10 to 37), respectively. In group I the FTA decreased steadily from 16 ± 10° when the children were aged two years, to 2 ± 7° when aged 2.5 years, and to 3 ± 6° valgus at three years of age. Children in group II had FTA values of 24 ± 6°, 15 ± 8° and 6 ± 8° at the ages of 2, 2.5 and 3 years, respectively. These values were significantly higher than those in group I at the ages of 2 and 3.5 years (p < 0.01), but there were no significant differences at the age of four years (Fig. 4).

At presentation, the mean MDA in both groups was 13 ± 2° (12 to 20) and 16 ± 3° (12 to 21), respectively. Values in group I were 12 ± 4°, 3 ± 3° and 0 ± 1° at the ages of two, three and four years, respectively. The pattern of
change of the MDA with age in group I was the same as that for the FTA. The MDA in group II was 15 ± 3°, 10 ± 5° and 8 ± 7° at the ages of two, three and four years, respectively (Fig. 5). The differences between the two groups were significant (p < 0.01) until the age of four years. The improvement of the MDA in group II was slower than that of the FTA.

In order to differentiate those patients in group II who would not show spontaneous resolution we studied the relationship between the FTA and MDA, and the distribution of the FTA relative to age.

The simple correlation coefficient (Pearson’s r) between the FTA and the MDA in group II was 0.30 (n = 24) at the age of two years, 0.84 (n = 24) at three years and 0.94 (n = 24) at four years of age. There were statistically significant correlations between these two measurements at the ages of three and four years, respectively (p < 0.0001), but not at two years. This may have been due to errors in the radiographic measurement caused by ligamentous laxity and flexion of the knee in the standing position in early childhood. Therefore, we showed only the changes in the measurement of the FTA for each limb between two and four years of age.

In order to determine the distribution of the FTA in relation to age, individual measurements in group II were plotted against age (Fig. 6). It was impossible to select those limbs which would not show spontaneous resolution at 2.0 and 2.5 years of age. At three years of age six limbs which did not resolve spontaneously had an FTA of 10° or more of varus. If this is taken as the criterion for differentiation, however, four limbs which later resolved would be included. In order to resolve this dilemma further obser-
vation was necessary. It was noted that the FTA in the three limbs which required osteotomy remained at 10° or more of varus and did not show any improvement when the children were aged three and four years. By contrast, the limbs which continued to improve spontaneously with time showed a gradual decrease in the FTA which measured 5° or less of varus by the age of six years.

Discussion

The natural history of bow-leg deformity in children is not clear. Most children with so-called physiological bowing will have spontaneous resolution and will require no treatment. A small number remain in varus and have slow progression of the deformity, which is defined as pathological genu varum (infantile tibia vara). Johnston\(^6\) claimed that infantile tibia vara was always progressive, but Hagglund et al.\(^1\) suggested that spontaneous improvement may occur. Blount\(^5\) indicated that the deformity may resolve spontaneously and that the value of braces or other types of supportive treatment was unknown. Langenskiöld and Riska\(^5\)\(^\text{a}\) reported spontaneous resolution in only two of 71 patients. Unfortunately, there are few reports of the natural history of infantile tibia vara since treatment by splints or surgery is generally advised.

Many authors\(^1,5,9\) believe that treatment by bracing is important in the early stages of infantile tibia vara and have reported successful outcomes. Braces apply considerable pressure to the limbs and even conventional knee-ankle-foot orthoses are uncomfortable for many children. For this reason, brace compliance has been poor in our experience. Richards et al.\(^1\) reported improvement after brace treatment in 65% of patients with Langenskiöld stage-II infantile tibia vara. This corresponds to our group-II patients in whom 18 of 24 limbs (75%) resolved spontaneously. Zions and Shean\(^2\) reported that treatment with braces for early infantile tibia vara, which showed no improvement by two years of age, was effective in 29 of 42 limbs (69%). According to these indications, we would have applied braces to 40 limbs (87%) which showed spontaneous recovery without treatment. Raney et al.\(^3\) advised brace treatment for patients with MDAs of >16° or between 9° and 16° who had clinical risk factors. If we had applied these criteria, 27 limbs in our series would have required braces, whereas only three did not resolve spontaneously. The rate of spontaneous resolution in our study approximates to the successful outcomes reported for brace treatment.\(^1,3\) We conclude that brace treatment may not be necessary even if the MDA is >11° and the proximal medial tibia is classified as Langenskiöld stage II to stage III.

Differentiating physiological bowing from infantile tibia vara in its early stages is very difficult. Several diagnostic criteria have been suggested.\(^4,10,11\) Levine and Drennan\(^4\) reported that 29 of 30 limbs with an MDA which was more than 11° developed Blount’s disease. Zayer,\(^12\) however, reported that ten patients with MDAs of more than 11° (11 to 21) showed spontaneous resolution. Eggert and Viemann\(^13\) concluded that neither the FTA nor the MDA allowed differentiation between physiological bowing and infantile tibia vara. Hagglund et al.\(^7\) reported that in individual cases a single measurement of the MDA cannot be used to determine whether the bowing is progressive and requires treatment. A considerable number of our patients in group II with stage II to stage III and diagnosed as having infantile tibia vara, showed spontaneous resolution without treatment. We believe that the diagnosis of infantile tibia vara should be restricted to a bow-leg deformity which continues to progress. It has proved impossible to differentiate infantile tibia vara from a bow-leg deformity which resolves spontaneously at 2.5 to 3 years, based on our results relating FTA to age (Fig. 6). The characteristic feature of the three limbs which required osteotomy was that they remained in 10° or more of varus and had shown no improvement when the children were aged three and four years (Fig. 6). Hayek et al.\(^14\) recommended serrated tibial osteotomy before the age of four years. In our study, however, follow-up was necessary until the age of four years in order to distinguish infantile tibia vara from spontaneously resolving bow-leg deformity.

Our study supports the view that the effects of brace treatment remain unclear. We would suggest review at six-monthly intervals without treatment until the age of four years even in those children with Langenskiöld stage II or stage-III deformity, group II in our study. When bow-leg deformity showed a gradual improvement after the age of four years we preferred to continue observation. If the deformity progressed or showed no improvement, we carried out corrective osteotomy after the age of four years.

We advise parents that spontaneous resolution of severe bow-leg deformity occurs in most patients without treatment. Patients should be observed until the age of four years and corrective osteotomy undertaken only in those who show no improvement after this age.

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References


