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Idiopathic club foot treated with the Ponseti method. Clinical and sonographic evaluation of Achilles tendon tenotomy. A review of 221 club feet

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KEYWORDS

Idiopathic club foot;
Ponseti;
Sonography

Summary The Ponseti method applied to treating idiopathic club foot consists in placing successive corrective casts, possibly an Achilles tendon tenotomy, then derotation braces, a method that has proven its efficacy. This study compared 221 cases of club foot treated with this method between 2002 and 2007 divided into two groups, based on whether or not Achilles tendon tenotomy was performed. Assessment was both clinical and sonographic. We observed clear improvement of the results in the group that underwent Achilles tendon tenotomy and a significant difference in the rate of secondary surgery. The sonographic evaluation also showed improvement of the morphological results. We now systematically propose Achilles tendon tenotomy however severe club foot may be.

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Introduction

In the treatment of early idiopathic club foot, the Ponseti method [1] includes weekly wear of corrective casts [2], followed by derotation braces to preserve the corrections obtained. Ponseti suggested percutaneous Achilles tendon tenotomy when dorsiflexion of the ankle was less than 15 to 20° or when the calcaneus appeared "high" before the last cast [3]. We compared 230 club feet treated using this method, divided into two groups depending on whether or

not Achilles tendon tenotomy was performed. The evaluation was both clinical and sonographic.

Material and methods

This was a retrospective study of 158 patients (221 idiopathic club feet) treated between 2002 and 2007 using the Ponseti method (sex ratio, 2.3 boys for one girl; 54% bilateral forms).

Our initial experience of this method in 2002 did not incite us to propose an Achilles tendon tenotomy. Beginning in 2005, the feeling that this procedure seemed beneficial, including in the most severe forms, encouraged us to propose an Achilles tendon tenotomy to all the children treated. We were therefore able to make up two groups:

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- group 1: no Achilles tendon tenotomy (77 patients; 22 females and 55 males; 106 club feet) treated between 2002 and 2004;
- group 2: with Achilles tendon tenotomy (81 patients; 28 females and 53 males; 115 club feet) treated between 2005 and 2007.

To compare the results of the two groups, we used two methods:

- a clinical method including the Diméglio classification [4] and the clinical aspect (excellent, good, fair, poor). The need for complementary surgery (posteromedial release [PMR] or a later intervention including Achilles tendon lengthening) was taken into account and subjected to a statistical test (Z-test). $P < 0.05$ was considered significant. The need for transfer of the anterior tibial tendon was studied, as were repeated tenotomies;
- a sonographic method: the sonographs were performed systematically before the first cast was placed, before Achilles tendon tenotomy when it was proposed, then at 3, 6, 9, and 12 months.

Four cuts were made: three cuts described by Hamel and Becker [5] as well as one cut through the anterior approach, with the angle measurements made in the maximum correction position. We worked on the hindfoot, calculating the talocalcaneal divergence (TCD) (Fig. 1) and the equinus deformity (metaphyseal-talocalcaneal [MTC] angle) (Fig. 2). The value that we chose for the TCD corresponded to the

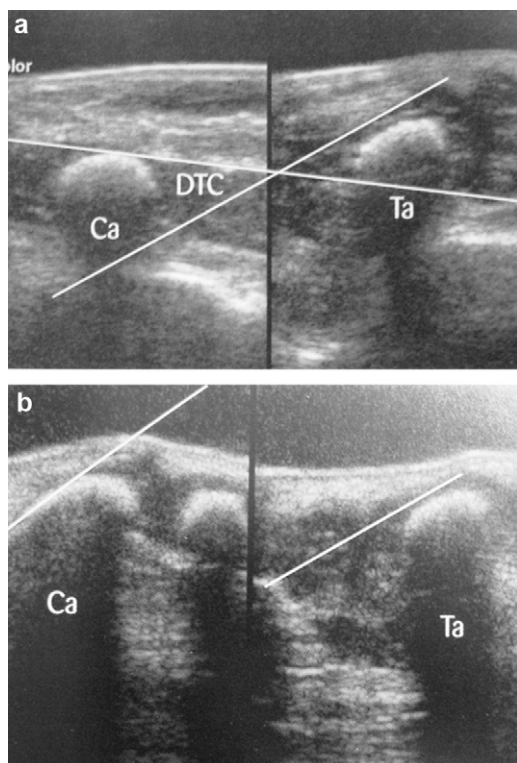


Figure 1 Example of an axial cut via the medial approach (a: normal foot; b: club foot). Measurement of talocalcaneal divergence (TCD). Ca: calcaneus; Ta: talus.

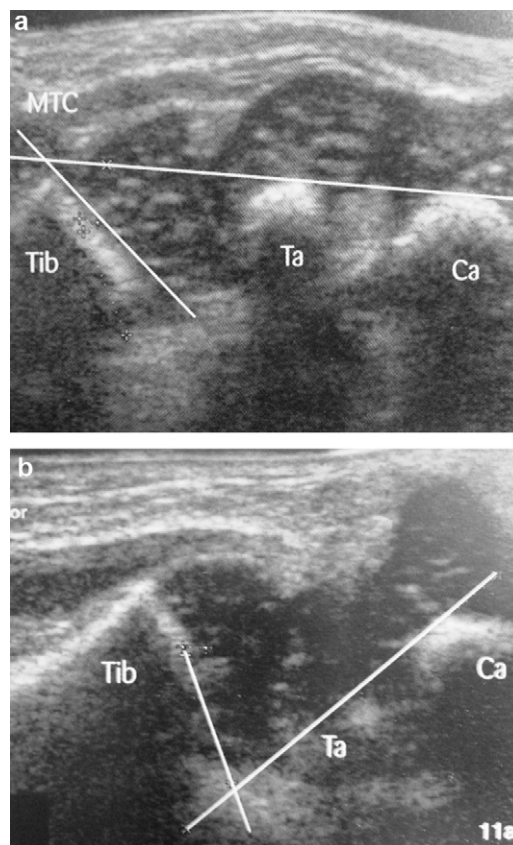


Figure 2 Example of a sagittal cut via the posterior approach (a: normal foot; b: club foot). Measurement of the metaphyseal-talocalcaneal angle (MTC). Tib: tibia; Ca: calcaneus; Ta: talus.

mean of the two measurements taken of this angle via the medial and lateral approaches.

Reference measurements were taken on a control group (17 infants less than 1 month old) [6]. The mean TCD was $47^\circ \pm 5^\circ$ and the MTC angle was $104^\circ \pm 10^\circ$.

We compared the measurements of these two angles between the beginning of treatment and at 1 year. The differences observed were subjected to the Z-test. If $P < 0.05$, the difference was significant.

Results

Clinical results

The club feet were distributed based on the groups and severity of the deformity (Figs. 3 and 4). The first cast was made at a mean 6.9 days (range, 2–32 days) in group 1 and 9.1 days (range, 4–19 days) in group 2. The number of casts was the same in the two groups (mean, 9.2 casts). The tenotomy was performed in the operating room under general anesthesia or premedication if there were contraindications. The mean age at the time of tenotomy was 2 months and 15 days.

No complications were observed after the tenotomy.

The mean follow-up for the group 1 patients was 6 years (range, 4–9 years) and 4 years for group 2 (range, 2.5–5 years).

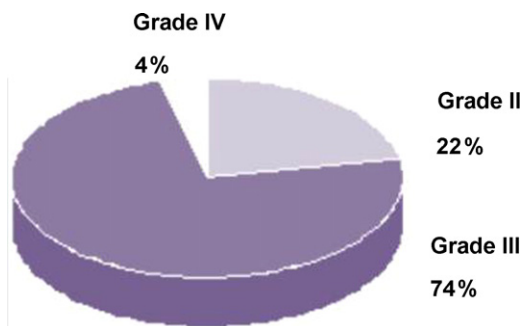


Figure 3 Distribution of group 1 patients (%) according to grade.

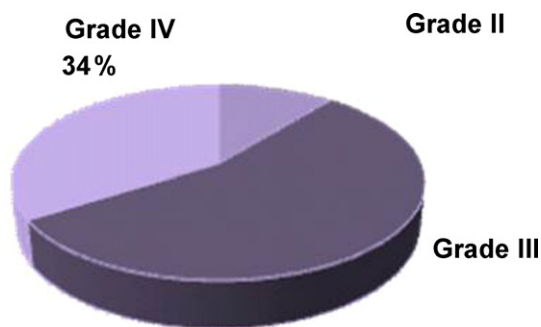


Figure 4 Distribution of group 2 patients (%) according to grade.

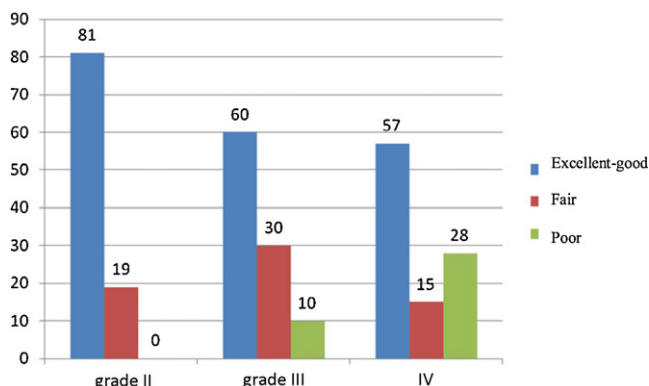


Figure 5 Distribution of results (%) according to initial grade in group 1.

We correlated the Diméglio grades and the clinical aspect at the last follow-up for each of the groups (Figs. 5 and 6).

The results and the different statistics on complementary surgery were studied (Table 1). The mean age at surgery was 21 months in group 1 and 24 months in group 2.

Anterior tibial transfer was infrequent in this study (two cases in group 2 at 3 years), an Achilles tendon tenotomy was repeated in one case. No statistical analysis was done on the latter two results.

Sonographic results

Sonographic results are shown in Table 2.

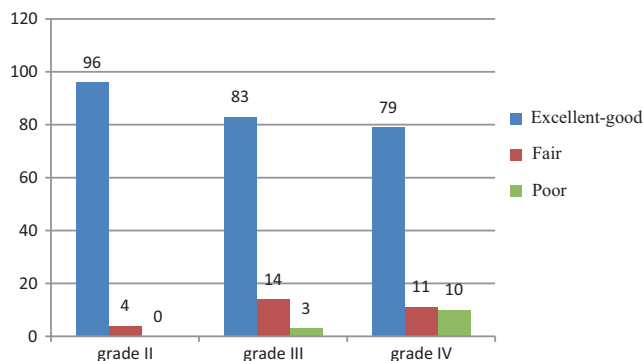


Figure 6 Distribution of results (%) according to initial grade in group 2.

Discussion

The Ponseti method [7] is recognized as being the first-choice method in early treatment of club foot [8]. However, the place of Achilles tendon tenotomy remains under debate, with Ponseti proposing it in his original method only for ankle dorsiflexion values less than 15 to 20°. These values are also suggested by Scher et al. [9]. For these authors, following the analysis of 50 club feet treated according to Ponseti, with 36 feet (72%) having undergone a tenotomy, there was no significant difference clinically between the two groups when the last cast was removed. They used the Diméglio classification and reported 89% excellent results for the tenotomy group and 86% in the group without. On the other hand, a significant difference (P=0.02) was found when using one of the items on the Pirani score (emptiness of the heel, cited by Sher et al. [9]), with less good results in the group with no Achilles tendon tenotomy. Sher et al. [9] concluded that severe club feet were improved with tenotomy and achieved the results of moderate club feet patients without tenotomy.

To our knowledge, comparison of the results of patients who had or did not have Achilles tendon tenotomy has not been reported. Morcuende et al. [10] did not provide a response to this question despite a study on 230 patients (319 club feet), 68% of whom had Achilles tendon tenotomy. In 2002, Chotel et al. [2] published the preliminary results of 50 club feet with a follow-up of 20 months. Achilles tendon tenotomy was performed in 95% of the cases. At the end of the series of casts, the authors reported one reduction failure and at follow-up recurrence of the deformity in 16 patients, explained by the insufficient time for derotation brace wear. These patients all had a new series of casts early, which made it possible to forego surgery for seven of them according to the authors.

In the present series, we observed overall improvement of the results in group 2 compared to group 1. We believe it is useful to attempt to improve the results of moderate club foot deformities as well, and systematic Achilles tendon tenotomy could be a means to do so. These observations have prompted us to propose Achilles tendon tenotomy systematically, particularly since it is simple and minimally invasive, with only rare complications [11], with rapid healing of the Achilles tendon [12].

Table 1 Secondary surgery rate.

	Group 1 (%)	Group 2 (%)	Statistical difference, <i>P</i>
Overall revision rate	48	6	< 0.001 (CI = 95%)
Posteromedial release (PMR)	16	4	0.06
Later intervention	32	2	< 0.001

Table 2 Sonographic measurements of progression in degrees of the talocalcaneal divergence and the metaphyseal-talocalcaneal angle before treatment and at 1 year.

	Group 1	Group 2	Statistical difference (Z-test), <i>P</i>
Talocalcaneal divergence	+15°	+18°	0.06
Metaphyseal-talocalcaneal angle	+10°	+22°	< 0.001 (CI = 95%)

Moreover, the analysis of the complementary surgery rate shows a significant difference, which we find to be an additional argument for making Achilles tendon tenotomy systematic.

As for the sonographic analysis, we report results on the talocalcaneal divergence and equinus deformity (Table 2), which to our knowledge, have never been reported. Sonography showed that Achilles tendon tenotomy participates in the improvement of equinus foot as well as talocalcaneal divergence.

Conclusion

Achilles tendon tenotomy, proposed for imperfectly corrected equinus deformity, is a simple intervention and does not contraindicate eventual surgical revision. We found overall improvement in both the clinical and ultrasound results in the group of patients with Achilles tenotomy. Moreover, a significant difference was demonstrated for the secondary surgery rate. All of these conclusions have prompted us to perform systematic Achilles tendon tenotomy whatever the clinical aspect may be at the end of the series of casts.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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