Treatment of idiopathic club foot using the Ponseti method

INITIAL EXPERIENCE

We report our initial experience of using the Ponseti method for the treatment of congenital idiopathic club foot.

Between November 2002 and November 2004 we treated 100 feet in 66 children by this method. The standard protocol described by Ponseti was used except that, when necessary, percutaneous tenotomy of tendo Achillis were performed under general anaesthesia in the operating theatre and not under local anaesthesia in the out-patient department. The Pirani score was used for assessment and the mean follow-up time was 18 months (6 to 30).

The results were also assessed in terms of the number of casts applied, the need for tenotomy of tendo Achillis and recurrence of the deformity. Tenotomy was required in 85 of the 100 feet. There was a failure to respond to the initial regimen in four feet which then required extensive soft-tissue release. Of the 96 feet which responded to initial casting, 31 (32%) had a recurrence, 16 of which were successfully treated by repeat casting and/or tenotomy and/or transfer of the tendon of tibialis anterior. The remaining 15 required extensive soft-tissue release. Poor compliance with the foot-abduction orthoses (Denis Browne splint) was thought to be the main cause of failure in these patients.

Congenital idiopathic club foot is a complex foot deformity in an otherwise normal child consisting of four components: equinus, heel varus, forefoot adduction and cavus. The aim of treatment is to achieve a painless, plantigrade foot with good mobility, with no need for special or modified shoes.

Most orthopaedic surgeons agree that the initial treatment should be non-surgical and should start as soon as possible after birth. Many methods have been described, most of which involve serial manipulation and casting. Although some success with non-surgical treatment has been reported the results have not always been encouraging with partial correction, recurrence and other complications occurring. As a result, surgical intervention, often within the first year of life, has become popular. However, complications may follow surgical treatment and many club feet treated surgically are painful, stiff and weak.

In 1950, Ponseti developed a method of treating club foot by manipulation and casting. The clinical correction achieved by this method has been reported to produce a functional, plantigrade foot without the need for posteromedial release in 85% to 90% of cases. The correction achieved has been reported as being long lasting with some patients followed up to their fourth or fifth decade. Until recently, these results have not been repeated at other institutions. Our aim was to review our initial experience of treating club foot by the Ponseti method.

Patients and Methods

Between November 2002 and November 2004, 66 consecutive children with 100 club feet were treated at our institution by the Ponseti method. There were 50 boys and 16 girls. Of these 34 (52%) had bilateral and 32 (48%) unilateral club feet. They had been referred from local and regional maternity units, general practitioners, and other orthopaedic centres, often after other methods of treatment had resulted in little or incomplete correction. All were otherwise normal. Children with other congenital deformities, syndromes or neurological causes of club feet were excluded.

Assessment of the deformity was by the Pirani club foot score. At a mean period of follow-up of 18 months (6 to 30). The results were evaluated for correction of deformity, the number of casts required, the need for a tenotomy of tendo Achillis, relapse of the deformity and possible further surgery.
The need for extensive surgery such as formal soft-tissue release was regarded as a failure of treatment. Compliance with the foot abduction orthosis (Denis Browne splint) is thought to be essential for the prevention of relapse after the initial correction. 14 The information given by parents at follow-up visits was used to judge compliance with the use of the splint. Poor compliance was defined as failure to use the splint continuously for at least ten hours a day.14

**Protocol of treatment.** We used the protocol described by Ponseti3,15 which was started as soon as possible after birth. Simultaneous correction of cavus, forefoot adduction and heel varus (except equinus) followed Ponseti’s technique with initial manipulation and immobilisation in an above-knee plaster cast at weekly intervals for four to 12 weeks. Tenotomy of tendo Achillis was performed, if necessary, under general anaesthesia in the operating theatre and not, as described by Ponseti, under local anaesthesia as an outpatient procedure. This was followed by the use of a foot-abduction orthosis (Denis Browne splint) with 70° of external rotation on the affected side and 40° of external rotation on the normal side. The brace was used on a full-time basis for three months followed by night- and nap-time use for up to four years.

**Results**

The mean age at presentation was 12 weeks (1 to 60). Of the 66 patients, 68% (45) presented within 12 weeks of birth, 20% (13) between 12 and 24 weeks and 12% (8) at 24 to 60 weeks. Initial treatment in 32 (32%) feet had been started elsewhere before presentation to our department. This was mainly by manipulation, stretching and application of a plaster cast.

The mean Pirani score at presentation was: hind-foot contracture score 2.5 (2 to 3), mid-foot contracture score 2.5 (2 to 3), and a total score of 5.0 (4 to 6). The mean Pirani score after treatment for the feet which responded to treatment was: hind-foot score 0.5 (0 to 1), mid-foot score 0 and a total of 0.5 (0 to 1). The mean number of casts required was six (2 to 12). Tenotomy was required in 85 (85%) of feet.

After initial casting, four feet (4%) did not respond to serial manipulation and casting. These could not be corrected to the point at which tenotomy of tendo Achillis was appropriate and were termed ‘resistant’ club feet. They required extensive soft-tissue release for correction of the deformity.

Of the 100 feet, 96 (96%) responded to initial casting; these were termed ‘responsive’ feet. Relapse of the deformity after initial success was noted in 31 (32%) responsive feet, 16 of which were corrected by repeat casting and/or tenotomy of tendo Achillis and/or transfer of the tendon of tibialis anterior. Four feet required repeat casting alone, seven repeat casting and tenotomy, and five with dynamic supination required transfer of the tendon of tibialis anterior to the lateral cuneiform. The remaining 15 feet required an extensive soft-tissue release. The mean initial Pirani scores for these 15 feet were hind-foot 2.5, mid-foot 2.5, with a total of 5.0, and at the end of initial treatment were hind-foot 1.0, mid-foot 0.5 and a total of 1.5.

Of the 31 feet which relapsed after initial treatment 21 (68%) were considered to have problems of compliance with the Denis Browne splint. Other problems encountered during treatment were slipping of the plaster in five children and bruising of the legs and swelling of the toes in two. Neurovascular injury occurred in one child after a percutaneous tenotomy and required open exploration, ligation of the posterior tibial artery and primary repair of the posterior tibial nerve.

**Discussion**

The method of serial manipulation and casting developed by Ponseti for congenital club foot was instituted in an effort to achieve a plantigrade, functional foot without the need to resort to major surgical intervention. Ponseti and Smoley6 reported that open surgery was avoided in 89% of cases by this technique of manipulation, casting and limited surgery.

At our institution, the treatment commonly used before the Ponseti method was introduced was stretching and strapping for between three and five months which often resulted in partial correction. The partially corrected feet were then treated by posteromedial soft-tissue release. Various techniques of posteromedial soft-tissue release for resistant club foot have been described16-19 and excellent or good results after open release have been achieved in 52% to 91% of cases.8,19 However, most of these cases had a relatively short follow-up, ranging between two and eight years. The long-term results have been disappointing with increasing pain in the foot, and disability.17,18 The short- and medium-term complications of posteromedial soft-tissue release range from simple wound infection to distal necrosis requiring amputation. Overcorrection, loss of correction and relapse have also been reported.11,19 Long-term complications include stiffness and weakness leading to premature arthritis.8,20 In most feet the standard accepted practice of serial manipulations and posteromedial soft-tissue release produced excellent short-term but disappointing long-term results; this encouraged us to change to the Ponseti method. This series represents our early experience with this method. In more than 80% of feet, the deformity was corrected avoiding the need for posteromedial soft-tissue release.

Few casting techniques have been described in detail in the literature. Kite20,21 illustrated his method in 1964. He recommended abduction of the forefoot against pressure at the calcaneocuboid joint. Ponseti described this manoeuvre as Kite’s error because it blocked the correction of hind-foot varus and internal rotation. Zimbler22 reported poor long-term results in 75 patients (90 feet) treated by Kite’s method. Only 10% of the children responded to conservative treatment. The remainder required surgery which was attributed to various types of club foot (e.g. rigid versus flexible).
Another factor to be considered in casting is whether to apply above-knee casts as recommended by Ponseti or below-knee casts in children younger than 12 months. In our experience a below-knee cast is not suitable for holding the foot in abduction and should therefore not be used at any age.

Posterior medial soft-tissue release was avoided in 81% of our cases, but percutaneous tenotomy was required in 85%. Cooper and Dietz have shown that percutaneous tenotomy of tendo Achilles performed during the first few months of life, is a benign procedure, with no long-term effect on muscle strength. However, Dobbs et al reported bleeding complications after percutaneous tenotomy for congenital club foot and in our series, damage to neurovascular structures occurred in one child. This was managed by open exploration, ligation of the artery and primary repair of the nerve. Transfer of the tendon of tibialis anterior was performed in five feet for dynamic supination. Ponseti reported this as occurring in 35% of his patients older than 2.5 years.

In 31 of our feet treated by the Ponseti method there was a relapse of the deformity. In most cases we believe that the cause of the relapse was related to a lack of compliance in the application of the Denis Browne splint. Many parents reported difficulty in keeping the foot/feet in this splint. Some found it difficult to apply the splint single-handed and others reported that their child was unable to kick the legs freely and was unable to roll over in bed with the feet in the splint. These problems caused frustration in the family and often sleepless nights leading to poor compliance. In 21 feet, 16 children) parents reported some or all of these problems. The most recent experience reported by Ponseti's group suggests a rate of relapse of 10%. The reduction in the rate of relapse is attributed to an increased emphasis on the need for careful follow-up treatment with the foot-abduction orthosis. Thacker et al reiterated the fact that compliance with the foot-abduction orthosis is essential for the success of the Ponseti technique.

We have introduced some methods to improve the compliance. We have found that parents need to be better informed, especially about the importance of continued splintage and the potential for relapse with poor compliance. This can be done by careful explanation at the start of treatment and by providing information leaflets explaining the deformity and treatment.

Of the 31 relapsed feet in our study, 15 required an extensive soft-tissue release. The initial Pirani score for these feet did not differ from that of the responsive feet, but the score at the end of treatment was higher than that for the latter. We do not have enough data to comment if there was any significant difference in the Pirani score between failures and successfully-treated feet immediately before tenotomy and whether we could have identified the failed feet earlier.

Our study is limited by the number of children and the relatively short follow-up. The subjective evaluation of examiners is also a limiting factor although we used a standard scoring system for the initial evaluation and measurable outcome criteria.

Our initial experience with the use of the Ponseti method suggests that it is a simple and effective method of treating congenital idiopathic club foot.

Although our short-term results failed to match those reported by Ponseti we are, however, encouraged to continue the use of this technique and to improve compliance with splintage.

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References