Ponseti treatment in the management of clubfoot deformity – a continuing role for paediatric orthopaedic services in secondary care centres

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ABSTRACT

INTRODUCTION The Ponseti technique is a well-proven way of managing paediatric clubfoot deformity. We describe a management set-up which spreads the care between secondary and tertiary care with no loss of quality.

PATIENTS AND METHODS In our audit of the first 2 years of Ponseti casting in the treatment of idiopathic congenital talipes equinovarus (CTEV, clubfoot) deformity, we identified 77 feet having been treated in 50 patients. Forty-nine feet were treated primarily in Oswestry, a tertiary referral centre for paediatric orthopaedic conditions, and 13 feet were treated in conjunction with the physiotherapy department at one of the region's district general hospitals (Leighton Hospital, Crewe, Cheshire).

RESULTS Similar good results and low requirement for surgical interventions other than Achilles tenotomy, which forms part of the Ponseti regimen, were found in both cohorts.

CONCLUSIONS This 'hub-and-spoke' approach would appear to be efficient in terms of resource utilisation. Additional benefits for patients and their carers include ease of access to services and reduced financial and transport burdens.

KEYWORDS

Clubfoot – Foot deformities – Congenital – Physiotherapy – Patient access – Hub-and-spoke

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The Ponseti treatment for clubfoot deformity was introduced in North America in the late 1940s^{1–3} and has become a primary treatment option in many countries more recently.⁴ The method is based on anatomical studies which concluded that the key landmark in obtaining safe reduction of the deformity was the talar head. The deformity can be broken down into the four constituent parts – cavus of the mid foot, adductus of the forefoot, varus of the hindfoot and equinus of the hindfoot. This deformity can be remembered by the mnemonic CAVE (Table 1).

The manipulative technique relies on gradual correction over a number of weeks to stretch the soft tissues gradually. Children attend on an out-patient basis every week for about 10 weeks. The manipulation consists of manual stretching of the tight anatomical structures of the foot. Following this, above-knee casts are applied and moulded to maintain this correction. The first manipulation and cast can be performed any time following delivery, although, practically, it is usually within the first 2 weeks of life. Re-inforced casts are needed as babies often manage to destroy plaster-of-Paris casts by attrition. When the

Table 1 Mnemonic for remembering CTEV deformities and order of correction

- Cavus
- Adductus
- Varus
- Equinus

family arrive at the out-patient clinic, the casts are removed and the child is allowed a bath and skin care which is not possible when the casts are in place. This whole process can be quite time-consuming with families in the out-patient clinic for a number of hours each week.

Correction of the deformity is in the order of CAVE, *i.e.* the cavus is corrected first followed by the adductus, *etc.* At this point, there is often a residual equinus deformity which requires percutaneous Achilles tendon release which is per-

formed in our hospital under a short general anaesthetic. Once this has healed (~3 weeks) the child wears 'boots-and-bar' (Denis-Browne splints) full-time for 10 weeks and then during sleeping time until the age of 4 years to prevent relapse of the deformity. The aim of treatment is to achieve a comfortable plantigrade foot for normal gait in unmodified footwear.

Other surgical interventions, such as posterior or posterior-medial release, are reserved for clubfoot resistant to manipulation and casting, thus representing a failure of Ponseti management. Traditional treatment modalities have been associated with high rates of extensive operative interventions with postoperative scarring and stiffness.⁴ Other surgical interventions are sometimes required following Ponseti treatment, such as tendon transfers for dynamic deformity, but these are associated with less postoperative stiffness.

Pirani introduced a scoring system to assess the severity of clubfoot deformity and response to treatments.⁵ This has been validated by independent review.⁶ It is based on hindfoot and midfoot deformities. In each of these groups, there are three deformities which are assessed (Table 2). These score one point each if present and fixed, half a point if mild, and zero if absent. A total score of six represents a severe clubfoot with a score of zero representing a normal foot. A corrected clubfoot deformity may still score 0.5–1 on the Pirani scale due to mild deformity of the hindfoot or skin creases, taking many years to score zero. Difficulty in palpating the calcaneus was the commonest reason for a residual score in our series but this does not constitute a functional problem.

Patients and Methods

Since the introduction of the Ponseti technique in our unit in 2002, 77 feet in 50 patients have been treated for idiopathic clubfoot. Bilateral involvement was present in 27 patients. We run a weekly 'Ponseti' clinic. Patients were identified for this study from electronic notes, Ponseti clinic records and review of records from one of the district general hospitals (DGHs) involved in combined care.

Statistical analysis was performed using XLStat v7.5.2 (Addinsoft) and Excel 2003 (Microsoft). The Mann-Whitney test was utilised for unpaired, ordinal variables. The chi-squared test with 1 degree of freedom and $P < 0.05$ was used to compare observed and expected rates of intervention.

Of the patients, 38 were male and 12 female. This is a slightly higher ratio compared to the quoted 2:1, male:female incidence ratio. Follow-up was 10–138 weeks with an average follow-up of 72 weeks.

Forty-nine of the feet were treated in Oswestry from the time of the first cast (RJAH group). Thirteen of the feet were treated in conjunction with the physiotherapy department in Leighton Hospital, Crewe, Cheshire (combined-care group). These patients were only referred to Oswestry for further opinions or for any intervention requiring a paediatric anaesthetist. It is this

Table 2 Description of deformity for Pirani scoring

Hindfoot deformities

- Posterior heel crease
- Empty heel
- Rigidity of equinus

Midfoot deformities

- Curvature of lateral border of foot
- Medial crease
- Lateral head of talus

Total score = [hindfoot + midfoot] deformity scores

lack of experienced paediatric anaesthetists which leads to difficulties in the provision of paediatric orthopaedic services in DGHs. We prefer the use of a general anaesthetic for Achilles tenotomy, although the procedure can be performed under a local anaesthetic block.

A further 15 feet were referred to our hospital from other hospitals where a variety of treatment modalities had already been utilised (late-referral group). This group was excluded from the study presented.

The mean Pirani score at presentation in the RJAH and combined-care groups were 3.84 and 4.23, respectively ($P = 0.25$, not significant). Of the feet treated in Oswestry, the majority had the first cast applied in the second week of life (35/49). In the DGH cohort, the modal group of feet (6/13) had first manipulation and casts applied during the patient's first week of life. In some cases, casts were applied within days of delivery. This reflects the logistics of being referred to a tertiary centre and then for parents to travel, often long distances, with a new-born child. Children frequently travel 2–3 h each way, every week to attend the Ponseti clinic in Oswestry.

For the purpose of this study, the results presented are for children who had progressed at least as far as boots and bar treatment. Regression of the deformity can occur after this point and further analysis at 4 years of follow-up, or ideally skeletal maturity, would be required to confirm the outcome of any study on clubfoot. This, however, is not the purpose of this paper.

In the RJAH group, one patient was lost to follow-up. This patient had progressed through the initial stages of treatment and was, at the time, in boots and bar for sleep. In the combined-care group, one patient moved out of region and local follow-up was organised.

Results

Table 3 shows the number of patients who had progressed into boots and bar at the time of the study and their mean Pirani score and the range of scores.

Table 3 Pirani scores for patients who had progressed into Denis-Browne splints (boots-and-bar)

Group	No. in boots	Average Pirani score*	Range
RJAH	41/49	0.65	0–2
Leighton DGH	10/13	0.15	0–0.5

* $P < 0.05$, difference is significant.

Percutaneous tenotomies were performed in 36/49 (73%) and 7/13 (54%) of feet in the RJAH and combined-care groups, respectively. The difference between the expected and observed rates of tenotomy was not significant.

Surgical interventions were required in 7 out of the 49 feet (14%) in the RJAH group. However, posterior-medial release was only required in three of the feet with lesser interventions of limited posterior release (2 feet) or plantar fascia release (2 feet) being required in the others. The one foot (7.7%) in the combined-care group that required surgical intervention required extensive surgery including posterior-medial release and later a tibial osteotomy and an Ilizarov frame.

Complications were generally minor in all groups with slippage of the casts, poor compliance with the boots (especially at night) and rubbing of either boots or cast causing superficial sores. Regression of the deformity was seen in five patients in the RJAH group. These patients tended to have poor compliance with the boots and bar. A further period in plaster was helpful in regaining correction.

Discussion

Ponseti treatment for clubfoot has been gaining in popularity due to the good results demonstrated by Ponseti and other institutions.⁷ Apart from the Achilles tenotomy, which is considered an integral part of the treatment, surgical intervention rates are low. In some North American units, the Achilles tenotomy is performed as an out-patient procedure under local anaesthesia although that is not the practice in our unit.

Our audit is based on the first 2 years' experience and, as such, no long-term inferences can be made in a deformity which can change up until skeletal maturity. However, the aim of this study was to ensure that the Ponseti method was safe and effective in the early stages of correction of clubfeet. We feel that we have confirmed this.

This study adds to the knowledge on Ponseti treatment by demonstrating the ability to share the burden of care between secondary and tertiary care centres. This has important implications with regards to resources. The children treated in the secondary care DGH setting tended to have their first manipulation

and casting earlier than the ones that had to be referred and travel long distances to the tertiary centre. We feel this may explain the apparently better scores achieved with the casting in this group though this is difficult to confirm with small numbers. Although statistically significant, it remains to be seen whether this will have any clinically significant effect on long-term outcome. However, it is safe to say that these patients do at least as well as the feet treated in Oswestry. The reduced travelling time and distance with new-born babies is of great benefit to the parents and their children. Tertiary care can be reserved for interventions requiring paediatric anaesthetics, for more difficult cases or when problems arise. This variation in case mix may be another explanation for the difference in Pirani scores between the two groups.

Antenatal counselling was also possible in the DGH with the physiotherapists discussing the nature of the deformity and Ponseti treatment with the parents following abnormal ultrasound scan findings at the 20-week gestation stage.

Training staff to run such a clinic is essential. The physiotherapists in the DGH attended a recognised Ponseti training course as had the nurses who assist in running the Ponseti clinic in Oswestry. In Oswestry, the manipulations and castings are performed by a paediatric orthopaedic consultant, a senior trainee or fellow, or one of the trained nurses. The DGH team regularly visit the Oswestry clinic to ensure the common treatment plan is being followed. Results of both teams are audited to confirm satisfactory standards of care are maintained.

Conclusions

Combined care between secondary and tertiary centres, where a common treatment protocol is utilised and with appropriately trained staff, has great benefits and is a safe and effective option in the management of paediatric clubfoot. This 'hub-and-spoke' approach to care may have applications in managing other surgical conditions.

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