

Management of clubfoot by Ponseti technique — our experience

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Abstract

We report our experience of using the Ponseti method for the treatment of congenital idiopathic clubfoot. From August 2007 to July 2010 we treated 107 feet in 79 patients by this method with the mean follow-up time of 15 months (6 to 24). The standard protocol described by Ponseti was used except that, when necessary, percutaneous tenotomy of tendo-achillis were performed under general anaesthesia in the operation theatre and change of plaster fortnightly. The Pirani score was used for assessment. The objectives of the study were to assess the results in terms of the number of casts applied, the need for tenotomy of tendo achillis and recurrence of the deformity. Tenotomy was required in 87 of the 107 feet. Ten feet failed to respond to the initial treatment regimen and required extensive soft-tissue release. Of the 97 feet which responded to initial casting, 35 (32.71%) had a recurrence, 19 of which were successfully treated by repeat casting and/or tenotomy and casting. The remaining 16 required extensive soft-tissue release and external fixator application. Poor compliance with the foot-abduction orthoses (Denis Browne splint) was thought to be the main cause of failure in these patients.

key words : Clubfoot, Ponseti technique, pirani scoring, percutaneous tenotomy.

Congenital idiopathic clubfoot is a common but complex deformity of foot in an otherwise normal child consisting of four components: cavus, forefoot adductus, heel varus and equinus¹⁻³. Some authors include atrophy

of calf muscle with decrease in foot size and tibial length as associated components⁴. Various degrees of medial tibial torsion may be associated with clubfoot⁵ but one must remind that normally, children have approximately 5° of internal tibial torsion at birth, which progresses to 10-15° in the adult⁶. The goal of treatment is to reduce or eliminate the four deformities and the patient have a functional, pain-free, plantigrade foot, with good mobility and without calluses, and does not need to wear modified shoes^{1-3,5}.

The estimated birth prevalence is 1 per 1000 live birth with male to female ratio of 3:1 and 40% bilateral cases⁷. The causes of congenital idiopathic clubfoot is unknown. Various theories have been proposed including muscular, viral, genetic, anatomical, environmental factors and the effect of the position *in utero*⁸. It is still a debate whether pathology at the talus or soft tissues along the posteromedial aspect is the causative factor. One study shows that the earliest changes occurs at the cells and collagen fibres of the medial ankle ligaments⁹ and another study shows that the muscle imbalance around the ankle

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Account of contributions

Dr Ningthoujam Jungindro Singh, the main author of this article took keen interest during the whole process of the study. The study was conducted during his tenure of DNB training at the National Institute for the Orthopaedically Handicapped, Kolkata. He was one of the interobserver of the study. The manuscript is solely written by him.

Dr Sanjay Keshkar, initiated the idea of the study. He gave the theoretical and practical knowledge of the study. He was also one of the interobserver and also done proof readings of the manuscript.

Dr Pampa De, was also involved in the study as an interobserver. She took part in the study while she was working as Junior Resident at NIOH, Kolkata.

Dr Ratnesh Kumar, as the head of the institute always motivated the study works and gave valuable advice during the study especially in orthotic designing and fitment. He also did proof reading of the manuscript.

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as the aetiological factor of the idiopathic club foot⁴. Chromosomal deletion [on chromosome 2 (2q31-33) (related to the CASP10 gene)] has been found associated with clubfoot in one of the study¹⁰.

Assessments of the severity of the deformity include imaging like radiograph, ultrasound, and MRI. The latter two used to visualise the non-ossified parts of the skeleton. Radiographs of the infant foot are difficult to interpret and hence, clinical examination remains the optimum means of assessment (Ponseti and Smoley system, Harrold and Walker system, Catterall system and Diméglio *et al*)¹¹. Pirani and Diméglio scoring systems are commonly used classification systems for clinical practice with both systems having very good interobserver reliability and reproducibility^{8,12}. Podograms may also be taken for documentation¹³.

It has become a general rule to start treatment as soon as possible after birth with the initial treatment being non-surgical^{1,5}. Many methods have been described in the literature (Kite technique, Ponseti method, French method, Ponseti modification etc.)^{5-8,14-16} which are mostly serial manipulation and casting. Ponseti method has become famous after the author reported successful correction in 85% - 90% cases without need for posteromedial release. The correction achieved has been reported as being long lasting with some patients followed up to their fourth or fifth decade.^{1,17}

Material and Methods

In our study we have included 107 idiopathic club feet, 79 patients (28 bilateral), 56 males and 23 females of 15 days to 1 year age group using Ponseti method of management. The study was conducted from August 2007 to July 2010 with maximum follow-up of two years. Secondary causes of talipes equinovarus and clubfoot associated with other deformities were excluded from this study. The patient and examination data were recorded in a 'Clubfoot Proforma'. This database included a detailed birth history and family history. Examination findings included side involved, grading of severity using Pirani score, other skeletal examination and the neuromuscular assessment.

Comment: Inclusion criteria needs to be more specified. Upper age limit of inclusion is preferably 9 months; though 1 year also can be accepted.

The results were evaluated for correction of deformity, the number of casts required, the need for tenotomy of tendo-achillis, relapse of the deformity and surgery required. We use the protocol as described by Dr. Ignacio Vives Ponseti⁵ with little modification that instead of the weekly change of plaster we did fortnightly and tenotomy of tendo-achillis [Fig.1], when required, was done under general anaesthesia in Operation Theatre under proper aseptic and antiseptic precaution which Ponseti does under local anaesthesia. Tenotomy was indicated when hindfoot score >1 and midfoot score <1 in Pirani scoring. After the last cast, the feet were kept with the foot abduction orthosis (Denis Browne splint). The orthosis consists of an open toe high-top straight last leather shoes attached to a bar with adjustable plastic screw [Fig.2]. The parents were advised to let the child use the orthosis for full time basis (23 hrs a day) for three months and thereafter at night time up to 3-4 years. The orthosis was kept at 70° external rotation on both sides for bilateral cases or 30-40° of external rotation on the normal side in unilateral cases. The verbal report given by the parents at follow-up was used to assess the compliance of the use of the splint. Follow-ups were done every 3 - weekly after the splint is given for the first 2 months and every 12-16 weeks thereafter. The result was designated as good (<0.5), fair (0.5-2) and poor (>2) using Pirani scoring system.

Results

The mean age of the patients was 12 weeks (3 to 48). Of the 79 study populations (*patients*) 51(64.56%) presented within 3 months of birth, 17(21.52%) between 3 and 6 months and 11 (13.92%) between 6 months and one year of age. Eight patients (10.13%) had already received 2-3 manipulations and plastering at some other centre. At the commencement, the severity of the case was assessed with Pirani scoring system and found the mean score of 5 (*range*- 4 to 6). The mean cast applied was 7 (*range* - 5 to 9). *Ten* failed (9.34%) to respond to casting (rigid cases) even up to 5 casts and were treated

by posteromedial soft tissue release (PMSTR). Eighty-seven feet (81.31%) underwent percutaneous tenotomy of tendo-achillis under general anaesthesia.

Of the 107 feet 97 (90.65%) responded to initial casting. The average time taken from the first cast to the full correction was 14 weeks (range - 10 to 18). After the successful treatment recurrence of the deformity occurred in 35 feet (32.71%) of which 11 feet were treated with replastering alone [mean plaster applied was 3 (range - 2 to 4)]. Eight of the recurrent feet were treated with tenotomy and replastering and 10 with PMSTR. Six feet were treated with universal mini external fixator (UMEX) system application.

**Most of the parents/guardians complained of difficult in maintaining the protocol of using the foot abduction orthosis. Other problems commonly faced were breakage of the plaster cast and slippage of the cast more in the first 2-3 plastering. Complications like pressure sore over the talar head occurred in 4 feet and skin erosion occurred in 5 feet. The most commonly occurred complication was mild swelling of the feet.*



Fig 1 — Percutaneous Tenotomy

Discussion

Ponseti technique of serial manipulation and casting is being employed vastly in many of the CTEV treating



Fig 2 — Foot Abduction Orthosis (D-B Splint, 70° abduction on Right Side and 40° on Left Side)

centres. Many authors have published their experiences. Ponseti and Smoley²¹ reported that by this method of manipulation surgery was avoided in 89% of cases. In Ponseti method of management^{5,20} the first element of correction is the cavus deformity by positioning the forefoot in proper alignment with the hindfoot. Cavus, which is due to the pronation of the forefoot in relation to the hindfoot requires only elevating the first ray of the forefoot to achieve a normal longitudinal arch of the foot. The forefoot is supinated not too high or too flat so that the plantar surface of the foot reveals a normal appearing arch. For subsequent correction of adductus and varus, alignment of the forefoot with the hindfoot is necessary to give an effective abduction movement of the foot. Using the stabilised talar head as fulcrum the foot is abducted. Pronation or eversion of the foot and external rotation of the foot to correct adduction while calcaneus remains in varus are to be avoided. Eversion of the calcaneus to correct heel varus (Kite's error) is not possible unless the calcaneus is abducted (i.e., laterally rotated) under the talus. Kite¹⁴ explained in his method of correction to abduct the forefoot against pressure at the calcaneocuboid joint which Ponseti described as Kite's error. It blocked the correction of hindfoot varus and internal rotation.

In our study we could avoid extensive open surgery in 81 feet (75.70%) which is slightly less than that of Ponseti and Smoley²¹ (89%), Changulani M *et al*¹ (81%) or Agrawal *et al*⁷ (96.7%). The main factor of low satisfactory result/recurrence was the noncompliance of use of the foot abduction orthosis, same as with many other studies.^{1,3,7,8,15,21} Dobbs *et al*² in their study predicted that the most strongly associated variable with an increase risk of recurrence is noncompliance of the orthosis followed by educational level of the parents.

We assess the result of satisfaction using Pirani scoring system and regarded satisfactory with the score (good + fair). Pirani scoring system^{8,18,19} is based on six clinical signs of contracture. Each is scored according to the following: 0, no abnormality; 0.5, moderate abnormality; 1, severe abnormality. The six signs are separated into three related to the hindfoot (severity of the posterior crease, emptiness of the heel and rigidity of the equinus), and three related to the mid foot (curvature of the lateral

border of the foot, severity of the medial crease and position of the lateral part of the head of the talus). Thus hindfoot score ranged between 0 and 3, mid foot score between 0 and 3 making a total score between 0 and 6.

Percutaneous tenotomy was performed in 87 feet (81.31%) and was not associated with any complication. However, Changulani *et al*¹ reported one case of neurovascular damage and Dobbs *et al*³ while performing tenotomy in 200 clubfeet produce serious bleeding in 4 patients either due to injury to the peroneal artery or lesser saphenous vein. Complications like pressure sore, skin erosion and mild swelling occurred during plastering. One limitation of this study was the non-availability of any objective tool to measure the compliance. Verbal reports were used, which might have been overreported or underreported. *Small number of patients and short follow-up of two years may also limit to generalise the study result.*

To conclude Ponseti technique of gentle manipulation and groin to toe plaster cast along with percutaneous tendo-achilles tenotomy is an effective treatment for congenital idiopathic clubfoot and reduces the need for extensive corrective surgery. Compliance to the use of the brace is the major factor to prevent recurrence. A long-term follow-up will decide the result to equate as par Ponseti's result.

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References

- 1 Changulani M, Garg NK, Rajagopal TS, Bass A, Nayagam SN, Sampath J, *et al* — Treatment of idiopathic club foot using the Ponseti method-Initial Experience. *J Bone Joint Surg Br* 2006; **88**: 1385-7.
- 2 Dobbs MB, Rudzki JR, Purcell DB, Walton T, Porter KR, Gurnett CA — Factors predictive of outcome after use of the Ponseti method for the treatment of idiopathic clubfeet. *J Bone Joint Surg Am* 2004; **86**: 22-7.
- 3 Dobbs MB, Gordon JE, Walton T, Schoenecker PL — Bleeding complications following percutaneous tendoachilles tenotomy in

- the treatment of clubfoot deformity. *J Pediatr Orthop* 2004; **24**: 353-7.
- 4 Feldbrin Z, Gilai AN, Ezra E, Khernosh O, Kramer U, Wientroub S — Muscle imbalance in the aetiology of idiopathic club foot-an electromyographic study. *J Bone Joint Surg Br* 1995; **77**: 596-601.
 - 5 Ponseti IV — Treatment of congenital club foot. *J Bone Joint Surg Am* 1992; **74**: 448-53.
 - 6 Wilson P, Apkon SD — Examination of the pediatric patient. In: Randall L. Braddom, editor. *Physical Medicine and Rehabilitation*. 3rd ed. St. Louis, Missouri: Elsevier Limited, 2007: 37-48.
 - 7 Agrawal RA, Suresh MS, Agrawal R — Treatment of congenital club foot with Ponseti method. *Indian J Orthop* 2005; **39**: 244-7.
 - 8 Siapkara A, Duncan R — Congenital talipes equinovarus – a review of current management. *J Bone Joint Surg Br* 2007; **89**: 995-1000.
 - 9 Fukuhara K, Schollmeier G, Uhthoff HK — The pathogenesis of club foot. *J Bone Joint Surg Br* 1994; **76**: 450-7.
 - 10 Heck AL, Bray MS, Scott A, Blanton SH, Hecht JT — Variation in CASP10 gene is associated with idiopathic talipes equinovarus. *J Pediatr Orthop* 2005; **25**: 598-602.
 - 11 Wainwright AM, Auld T, Benson MK, Theologis TN — The classification of congenital talipes equinovarus. *J Bone Joint Surg Br* 2002; **84**: 1020-4.
 - 12 van Mulken, Jeroen MJ, Bulstra, Sjoerd K, Hoefnagels, Nicolette HM — Evaluation of the treatment of clubfeet with the Dimeglio score. *J Pediatr Orthop* 2001; **21**: 642-7.
 - 13 Abbas M, Qureshi OA, Jeelani LZ, Qamar EA, Khan AQ, Sabir AB — Management of congenital talipes equinovarus by ponseti technique: a clinical study. *J Foot Ankle Surg* 2008; **47**: 541-5.
 - 14 Kite JH — Principles involved in the treatment of congenital clubfoot. *J Bone Joint Surg Am* 2003; **85**: 1847.
 - 15 Richards BS, Faulks S, Rathjen KE, Karol LA, Johnstone CE, Jones SA — A comparison of two nonoperative methods of idiopathic clubfoot correction: The Ponseti method and the French functional (Physiotherapy) method. *J Bone Joint Surg Am* 2008; **90**: 2313-21.
 - 16 Brewster MBS, Gupta M, Pattison GTR, Dunn-van der Ploeg ID — Ponseti casting – a new soft option. *J Bone Joint Surg Br* 2008; **90**: 1512-15.
 - 17 Lehman WB, Mohaideen A, Madan S, Scher David M, Van Bosse Harold JP, Iannacone M, et al — A method for the early evaluation of the Ponseti (Iowa) technique for the treatment of idiopathic clubfoot. *J Pediatr Orthop* 2003; **12**: 133-40.
 - 18 Dyer PJ, Davis N — The role of the Pirani scoring system in the management of club foot by the Ponseti method. *J Bone Joint Surg Br* 2006; **88**: 1082-4.
 - 19 Goriainov V, Uglow MG — The value of initial Pirani score assessment of clubfoot in predicting recurrence. *J Bone Joint Surg Br* 2010; **92**: 376.
 - 20 Lynn S — Clubfoot: Ponseti Management. 3rd ed. Global Help Publications, 2009.
 - 21 Ponseti IV, Smoley EN — Congenital club foot: the results of treatment. *J Bone Joint Surg Am* 1963; **45**: 261-75.

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