

# Management of Congenital Talipes Equino Varus (CTEV) by Ponseti Casting Technique

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## ABSTRACT

**OBJECTIVE:** The purpose of this study is to evaluate the results of Ponseti technique in the management of Congenital Talipes Equino Varus (CTEV) in children.

**METHODS:** It is a prospective observational study, conducted during the period of January 2012 to December 2014 at the Department of Orthopedics Nobel Medical College Teaching Hospital. All the patients with CTEV were treated with Ponseti casting technique. The children with clubfeet associated with meningocele, meningomyelocele, arthrogryposis multiplex congenita and other neuromuscular causes were excluded.

**RESULTS:** Sixty feet in 38 patients, 22 with bilateral and 16 with unilateral clubfeet in children less than two years of age and without any prior manipulation or surgical treatment were selected for Ponseti methods of manipulation. 26 were males and 12 were females. Thirty seven (61.66%) feet were of rigid variety and twenty three (38.83 %) feet were of non-rigid variety. Mean pre-treatment Pirani score of study group was 5.57. Mean number of plaster casts required per CTEV was 5 (range:3-6). Thirty seven rigid and fifteen non-rigid total 52(86.66%) feet required percutaneous tenotomy. Out of 60 feet 58 (96.6%) were managed successfully. Two (3.33%) patients developed complications like blister formation. Mean post-treatment Pirani score of the study group was  $0.36 \pm 0.43$ .

**CONCLUSION:** The Ponseti technique is an excellent, simple, effective, minimally invasive, and inexpensive procedure for the treatment CTEV deformity. Ideally it can be performed as a day care procedure without general anesthesia.

**KEYWORDS:** Talipes equino-varus, Ponseti technique, Pirani score.

## INTRODUCTION

The congenital talipes equinovarus (CTEV) or clubfoot is one of the most common and complex congenital deformities. The incidence of idiopathic clubfoot is estimated to be 1 to 2 per 1,000 live births.<sup>1</sup> The Ponseti treatment for clubfoot deformity was introduced in North America in the late 1940s<sup>2</sup> and has become a primary treatment option in many countries more recently.<sup>3</sup> 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.<sup>4</sup> The goal of the treatment is to correct all the components of clubfoot to obtain painless, plantigrade, pliable, cosmetically and functionally acceptable foot within the minimum time duration with least interruption of the socioeconomical life of the parent and child.<sup>4,5</sup>

Non-operative serial manipulation and casting,

as described by Kite (1939), was used for a long time in the past.<sup>1,5</sup> The reported success rates were only fair, ranging from 11 to 58%.<sup>1</sup> Over the past two decades, Ponseti casting technique which has become a gold standard worldwide. It includes serial corrective manipulation, a specific technique of the serial application of plaster cast supported by limited operative intervention (percutaneous Achilles tenotomy) The method has been reported to have success rate approaching 90- 96% in short, mid and long-term results.<sup>6-10</sup>

The Ponseti casting technique of club foot management has been shown to be very effective<sup>11</sup> and many centers now believe that most clubfeet can be treated by Ponseti casting technique rather than surgery.<sup>12</sup> Ponseti casting technique is especially important in developing countries, where operative facilities are not available in the remote areas. The physicians and personnel trained in this technique can manage the cases effectively with the cast treatment only.<sup>13</sup>

The purpose of this study was to evaluate the result of Ponseti casting technique for the treatment of congenital clubfoot.

## MATERIAL & METHODS

This is a prospective observational study, conducted in a tertiary hospital after getting approval from ethical review board of college. The study period was from January 2012 to December 2014. All the children with CTEV presented to Nobel Medical College Teaching Hospital were included in the study. The children with clubfeet associated with meningocele, meningomyelocele, arthrogryposis multiplex congenita and other neuromuscular causes were excluded. All feet received Ponseti method of casting technique. An informed written consent was taken from all parents. The initial severity of the deformity was assessed using Pirani severity scoring score<sup>12</sup> and same score used after each cast removal till final outcome. All relevant data were collected from each participants using predesigned data sheet that included

patient's demography, physical examination, management, Pirani severity scoring score, total number of the casts applied before tenotomy, pre and post procedure complications like plaster sore, skin excoriation, blister formation, excessive bleeding following tenotomy or any other complication.

### Treatment protocol and follow up:

We followed a protocol according to the Ponseti casting technique The treatment included gentle manipulation of the foot and the serial application of above knee plaster casts at weekly interval without anesthesia, as described by Ponseti.<sup>4</sup>

The first step in manipulation process is to supinate forefoot by gently lifting the dropped first metatarsal to correct the cavus and kept in first cast. Once the cavus is corrected the forefoot is gradually abducted keeping talar head as fulcrum in second, third and fourth cast.

The foot was markedly abducted up to 70 degrees without pronation (combined movements of abduction, extension and eversion of the foot) in the last cast, which is very important for complete correction and it prevent early recurrence. If the varus deformity of the heel had been corrected and residual equinus was observed after the abduction of the foot and, a simple percutaneous Achilles tenotomy was performed under local anesthesia. After the tenotomy, an additional above knee cast with knee flexed in 90 degrees was applied and left in place for three weeks to allow for healing of the tendon. As the tenotomy wound was very minimal (less than 0.5cm), done percutaneously and was not stitched, so no window was made in the cast. After removal of the cast, a Denis-Browne bar and shoes (D-B splint) was used to prevent relapse of the deformity. This is best accomplished with the feet in well-fitted, open-toed, medial bar, high-top straight-last shoes attached to Denis-Browne bar. The D-B splint was worn full time (day and night) or at least 23 hours per day for the first 3 months and then for 12 hours at night and 2 to 4 hours at day for a total of 14 to 16 hours during each 24 hour period. The protocol continues until the child

is 3 to 4 years of age. Once the child started walking custom made clubfoot shoes were used. The patients were followed up on a weekly basis during the initial stages of treatment. After applying D-B splint, on a monthly basis for three months and then once every three months till the patients was three years of age. The parent advised to come for follow up every six months to one year till 5 years and then after 1-2 years till skeletal maturity is achieved.

#### Final outcome measurement:

The outcome was measured by Pirani score.<sup>11</sup> This is the main variable of the study which can detect the degree of correction. It scores 6 clinical signs: 3 for midfoot, 3 for hindfoot. Three signs of midfoot score (MS) and hindfoot score (HS) grading the amount of deformity between 0 and 3. The Pirani score 0 means normal foot, the Pirani score 3 means moderately abnormal foot, the Pirani score 6 means severely abnormal foot. In our study the final outcome was categorized as excellent, good and poor. When Pirani score became 0, it was graded as excellent, when it became 0.5 to 1, it was graded as good and poor outcome occurs when the score became more than 1. Excellent and good outcomes

obviously reflected to successful management. Poor outcome reflected treatment failure; these patients were advised further surgical management.

The collected data was analyzed and presented in following tables.

## RESULTS

During the study period a total of 50 patients with 80 clubfeet were presented in our hospital. After exclusion we left with 38 children with 60 feet whom we treated and followed till final outcome. Majority of patients(28) reported to us within a month, 8 patients in one year and 2 patients after one year. There were 26 boys and 12 girls with a male female ratio of approximately 2:1.

Of the 60 clubfeet, 37 were rigid and 23 of non-rigid variety. Of the 16 patients having only unilateral involvement, 11 had right sided affliction and 5 had their left feet involved. Mean pre-treatment Pirani score in the study group was 5.57 (SD  $\pm$  0.56). There was no significant difference between mean Pirani scores for the rigid and the non-rigid varieties (5.69  $\pm$  0.47 vs. 5.37  $\pm$  0.69) as shown in Table 1

**Table 1: Initial Pirani score**

Pirani score	Rigid type N=37(61.66%)	Non rigid type N=23(38.33%)	Total feet N=60
6.0	23(62.16)	5(18.51)	28(46.66)
5.5	9(24.32)	11(47.82)	20(33.33)
5.0	2(5.4)	2(8.69)	4(6.66)
4.5	2(5.4)	-	2(3.33)
4.0	1(2.7)	2(8.69)	3(5.0)
3.5	-	2(8.69)	2(3.33)
3.0	-	1(4.34)	1(1.66)

Mean number of plaster casts required per CTEV was 5.75  $\pm$  0.80. More casts were required for the rigid feet as compared to non-rigid feet (7.11  $\pm$  6.21 vs. 5.40  $\pm$  0.77)

A total of 52 (86.6%) feet (37 rigid and 15 non-rigid) required percutaneous tenotomy. Only 8 (13.33%) feet (all non-rigid) were improved by plaster cast alone. Only 2 (3.33%) patients developed blister formation that was managed conservatively. Mean number of plaster cast required per CTEV was 5 (3-6).

**Table 2 Final Pirani score**

Pirani score	Rigid type N=37(61.66%)	Non rigid type N=23(38.33%)	Total feet N=60
1.5	2(5.40)	-	2(3.33)
1.0	4(11)	-	4(6.66)
0.5	18(49)	7(30.43)	25(41.66)
0	13(35)	16(69.56)	29(48.33)

The Pirani score after completion of overall treatment (with or without tenotomy) was recorded and is shown in Table 2. The Mean post-treatment Pirani score of the study group was  $0.36 \pm 0.43$ . Out of 60 feet 58 (96.66%) were managed successfully and successful outcome is shown in Table 3.

**Table 3 Final Result**

Result	Rigid No-37 (%)	Non rigid no-23 (%)	Total No-60 (%)
Successful	35	23	58
Excellent (Pirani score 0)	13(21.66)	18(30.0)	31(51.66)
Good ( Pirani score 0.5-1)	22(36.66)	5(8.33)	27(45.0)
Unsuccessful	2(3.33)	-	2(3.33)
Poor (Pirani score >1)			

The average approximate total cost of treatment per patient was 55 USD and its division is shown in Table 4.

**Table 4 Cost of the treatment per patient**

Items	USD
Plaster & Other hospital charges	25
Tenotomy	10
D-B Bar Shoes	20
Total cost	55

Mean follow up period was 2years. The patients with bilateral CTEV is shown in Fig. 1 before start of treatment and after full correction in Fig. 2



Fig 1 Bilateral CTEV before treatment



Fig. 2 After correction

## DISCUSSION

The congenital talipes equinovarus (CTEV) or clubfoot is one of the most common and complex congenital deformities comprising equinus, varus, adductus and cavus, which are difficult to correct. The goal of treatment is to reduce or eliminate these deformities so that patient has a functional, pain free, plantigrade foot with good mobility without calluses and does not need to wear modified shoes.<sup>14</sup>

The Ponseti casting technique of correction of CTEV deformity requires serial corrective casts with long term brace maintenance of the correction. The treatment needs to be started as soon as possible and should be followed under close supervision.<sup>4,15</sup> The Ponseti casting technique yielded satisfactory anatomical and functional result with simple, effective, minimally invasive, inexpensive and ideally suited for all countries and cultures.<sup>4</sup>

The available literature suggests that the results were better if this method of treatment was started as early as possible after birth.<sup>9,13</sup> The factors responsible for clubfoot deformity are active from the 12th to 20th weeks of fetal life upto 3-5 years of age.<sup>16,17</sup>

Majority of CTEV patients presented in the neonatal age. The two more authors<sup>13,18</sup> share similar experience and probably that reflects the growing awareness of the entity in the parents nowadays.

Mean pre-treatment Pirani score grouping this series were similar to those reported previously.<sup>8,14,19</sup> The mean number of plaster casts required per feet in our series was 5.75 which is similar.<sup>13,15</sup>

In our study, 52(86.66%) feet (37 rigid and 15 non-rigid) required percutaneous tenotomy. Tenotomy was needed in 95% of Gupta's patients<sup>13</sup> and 91% of Dobbs's patients.<sup>19</sup> All the studies show that tenotomy was required in those patients who initially have severe deformity. Majority of our patients came early so they had better outcome. A large number of pediatric orthopedic surgeons think that success of Ponseti casting technique depends on whether

Nepal Orthopaedic Association Journal (NOAJ) casting begins within hours of birth.<sup>20</sup>

In our study, 96.6% CTEV feet were managed successfully (Table 3). The complication rate was low. Only two patients (3.33%) developed blister formation and one patient who had rigid feet at presentation required posteromedial release (PMR) for both feet later. All the parents of the patients with successful repair were satisfied with the corrected feet of their children. The success rates for this technique in children have been quoted to range from 78% to 96.7%.<sup>6,8,9,10</sup>

The compliance for bracing is one of the challenging part in management. We agree with most of the authors that correction of the foot also depends on the brace protocol.<sup>7,8,14,17</sup> Parental compliance can be improved by educating the parents as to the proper use of bracing and the hazards of improper or insufficient bracing.

Another difficult part of the study was follow-up. Correction of foot by serial cast with or without tenotomy is only a part of the total management. With the initial correction of the foot, parents misunderstand that the main and difficult part of the treatment is over and hence they do not come for follow up. To overcome this problem, we motivated the parents and their family members. None of our patients dropped out from follow up.

We found this procedure to be very cost effective similar to the study by Ullah MS<sup>18</sup> and Zionts<sup>21</sup>

## CONCLUSION

It can be concluded that CTEV deformity can be effectively treated by Ponseti casting technique with excellent results and without significant morbidity. This method is simple, effective, minimally invasive, and inexpensive and ideally can be performed at outpatient department without general anaesthesia.

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