

Original Research Article

Functional outcome of idiopathic congenital talipes equinovarus treated by Ponseti method: a midterm study

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ABSTRACT

Background: Idiopathic congenital talipes equinovarus is a characterized by deformities with lot of ambiguity regarding the forces maintaining the deformity and preventing its correction. The aim of our midterm study is to analyze the functional outcome of idiopathic congenital talipes equinovarus using Ponseti's technique in Indian children presenting to us within the first three months of life without any prior treatment.

Methods: 87 patients with 132 feet were treated for correction of idiopathic congenital talipes equinovarus using the Ponseti technique from September 2009 to January 2013 at our Institute. These patients were followed up in a prospective manner for a period ranging from twelve months to fifty seven months (mean period of follow up was thirty two months). Children were evaluated before casting and at the end of casting, then at monthly intervals for another two months. Further follow up was done every six weeks till three years of age and then at six monthly intervals.

Results: Our overall good to fair result was seen in 87.6% of cases. Rest of them had poor functional outcome. Long term follow up of all patients till skeletal maturity is required to know the final outcome of our treatment.

Conclusions: Severity of the deformity and the compliance of the parents and infants with orthotic devices for maintenance of the correction were the factors which ultimately determine the final outcome.

Keywords: Idiopathic congenital talipes equinovarus, Clubfoot, Ponseti's technique

INTRODUCTION

Idiopathic congenital talipes equinovarus (CTEV) is a deformity with lot of ambiguity regarding the forces maintaining the deformity and preventing its correction.¹ The incidence of CTEV is 1 in 1000 live births, male to female ratio is 3:1 and nearly 40 % of the cases are bilateral.² Clubfoot can be managed non surgically or surgically but non operative method of is the initial treatment of choice all over the world.³ The technique of gradual and simultaneous correction of all deformities of CTEV using manipulation and casting at weekly intervals described by Sir Dr. Ignatio Ponseti is inexpensive and

has gained wide acceptance throughout the world.⁴ Combination of initial casting technique and then soft tissue procedures have long term success rates of only 15-50%, whereas treatment by Ponseti method has high success rate of upto 90%.⁵⁻⁸ Although there are several studies of correction of CTEV using the Ponseti method with good long term results, there is no such study conducted in the Indian population. We have carried out this study to analyze the functional outcome of idiopathic CTEV using Ponseti's technique in Indian children presenting to us within the first three months of life without any prior treatment. The objectives of our study was to study the outcome following the use of Ponseti's

technique and to evaluate the efficacy of Ponseti method in reducing the extensive corrective surgery rates required for congenital talipes equinovarus.

METHODS

This study was conducted in BGS Global Institute of Medical Sciences, a tertiary referral Institute in Bengaluru. Patients were selected from cases that visited to our clubfoot clinic and those patients which were referred from paediatric and obstetric departments of our institute. Eighty seven patients with one hundred and thirty two feet were treated for correction of idiopathic CTEV using the Ponseti technique from September 2009 to January 2013. These patients were followed up in a prospective manner for a period ranging from twelve months to fifty seven months (mean period of follow up was thirty two months).

Children were evaluated before casting and at the end of casting, then at monthly interval for another two months. Further follow up was done at every six weeks till three years of age and then at six monthly intervals and the last follow up was done during the month of June 2017.

All infants were in the age group of one day to ninety days with mean age of presentation of thirteen days. All were assessed for associated syndromic pathology and only those infants with idiopathic CTEV were included in the study. The criteria suggested by Barker⁹ were used to diagnose the cases of Idiopathic CTEV.

There were fifty three male and thirty four female infants included in our study. All infants were assessed initially using Demiglio's scoring system.^{10,11} This scoring system is very easy to use after initial learning curve and provides very objective evaluation.¹² According to this scoring system, feet with score 0-5 were included in group-I, 6-10 were included in group-II, 11-15 were included in group-III, while feet with score 16-20 were included in group IV. Our distribution of cases is shown in Table 1.

Table 1: Grouping of our patients into Demiglio's group.

Demiglio's group	Number of feet
Group I	1
Group II	4
Group III	94
Group IV	33

Twenty five male infants and twenty female infants had bilateral deformities. Of the twenty eight male infants with unilateral deformity, nineteen involvement of right foot and nine had involvement of left foot. Out of fourteen female infants with unilateral involvement, eight had involvement of right foot and six had involvement of left foot.

Ninety five feet were of age less than one month while thirty seven were of age more than one month. One foot in group I and four feet in group II were of age less than one month while seventy six feet in group III and fourteen in group IV were of age less than one month. In group III we had eighteen feet of age more than one month and in group IV we had nineteen feet of age more than one month.

All infants underwent treatment as per the method described by Ponseti. All feet underwent serial manipulation and above the knee casting, at weekly intervals. Cavus deformity was corrected first, followed by simultaneous correction of other deformities. Equinus deformity was the last to be corrected. Depending upon the severity of the deformity, the number of casts varied between five and ten; with a mean number of five casts.

For correction of the residual deformity, infants underwent one of the following surgical procedures:

1. Percutaneous tenotomy of the tendoachilles under local anaesthesia.
2. Posterior release with ankle capsulotomy.
3. Posteromedial soft tissue release (PMSTR)

Percutaneous tenotomy was done when equinus was the only residual deformity. PMSTR was done only in those patients who had rigid clubfoot and cannot be corrected by Ponseti technique and those who had completed six months of their life. Table 2 shows the distribution of the cases and the procedures they underwent.

After all deformities were fully corrected the last cast was applied with foot in 15° of dorsiflexion at the ankle and 60°-70° of external rotation of whole foot under the talus. This cast was left in place for three weeks. After cast removal, the mother was taught to do passive stretching exercises. Those feet, which underwent PMSTR, required two or three casts at three weeks interval following surgery to full correction i.e., 15° dorsiflexion and 60°-70° of external rotation of whole foot under the talus. This was mainly done to avoid problems of skin healing.



Figure 1: Foot- abduction bar used in the initial period to maintain correction after casting.

After the last cast was removed, in all patients correction was maintained by using foot abduction bar in the initial period (Figure 1). But subsequently we found that patients had a very poor compliance with its use. Hence, in subsequent cases we used alkathene clubfoot splints till the infant starts walking (Figure 2). Once the infant started walking, clubfoot boots were used during daytime and clubfoot splint at night. Passive stretching exercises were taught to the mothers and they were asked to perform it at least twice daily. Those children, who were reluctant to use clubfoot boots, were asked to use the opposite shoe in the involved foot.

During the first year of life, infants were reviewed once a month for another two months after full correction of deformity. Further follow up was done every six weeks till three years of age and then at six monthly intervals and the recent follow up during the month of June 2017.



Figure 2: Club foot boots used once the patient started walking.

Statistical analysis

Statistical analysis was performed by applying ‘student t test’. P values were calculated for group conversions using this student t test and statistical significance was assessed.

RESULTS

All one hundred and thirty two feet had a correction of the deformity at the end of the treatment i.e., after initial casting. Residual deformity at the end of initial casting

was treated by either percutaneous tenotomy of tendoachilles (Figure 3), posterior release or posteromedial soft tissue release (PMSTR) depending upon the severity of the deformity. At the final follow-up, 62.2% of the feet were having a very good correction of the deformity, with forefoot adduction being the commonest residual deformity. At the end of initial casting the group conversion was shown in Table-3.



Figure 3: Method of needle tenotomy to correct the residual equinus deformity with tucked up heel.

We performed a statistical analysis to this conversion rate in group III and group IV only, as number of cases in group I and group II were not statistically significant. By applying student t test to this conversion rate, we found that p value for conversion into group I was 0.0063, which is less than 0.05 and is statistically significant. Similarly for the rate of conversion to group II, our p value was 0.0017 that was also then 0.05 and is statistically significant. Hence we found that Ponseti technique definitely useful in correcting CTEV deformity, with need for only minor surgical intervention.

Even though the method of surgical treatment for the correction of residual deformity is statistically not significant, in our experience posterior release and ankle capsulotomy has given better results than any other surgical procedure. We used the criteria described by Fripp and Shaw to classify the results as good, fair and unsatisfactory.¹³

Table 2: Distribution of our patients that required different treatment methods.

Demiglio’s group	Casting	Percutaneous tenotomy	Posterior release	Posteromedial soft tissue release	Total
Group I	01	00	00	00	01
Group II	00	03	01	00	04
Group III	10	17	65	02	94
Group IV	00	01	20	12	33
Total	11	21	86	14	132

Table 3: Showing group conversions following casting.

Pre casting group (no. of feet)	Post casting group (no. of feet)			
	Group I	Group II	Group III	Group IV
Group I	01	00	00	00
Group II	04	00	00	00
Group III	44	50	00	00
Group IV	05	27	01	00

In group I, we had 100% good correction of CTEV deformity by casting alone. In group II, we had 50% good results, 50% fair results. In group III, we had 71.3% good results, 21.2% fair results and 7.5% unsatisfactory results. In group IV, we had 27.3% good results, 30.3% fair results and 42.4% unsatisfactory results (Good results shown in Figures 4A to 4C).



Figure 4: Example of a good result. a: Deformity at presentation, b: Second casting to correct varus and adduction deformity, c: After final correction.

In our series we had 88.7% of supple feet while 11.3% were stiff. Stiff feet were either from Demiglio’s group IV or those feet which underwent posteromedial soft tissue release. This explains that severity of the deformity and extensive surgical procedures were the commonest cause of stiff feet. Overall we had 62.2% good results, 25.4% fair results and 12.4% unsatisfactory outcome.

Age

In group III, out of seventy six feet with age less than one month, fifty five had good results. Fifteen had fair and six had unsatisfactory results. Out of eighteen feet with age more than one month, twelve had good outcome, five had fair and one had unsatisfactory results. By applying chi-square test we had p value of 0.7263, which is not statistically significant.

In group IV, out of fourteen feet with age less than one month, four had good outcome, four had fair outcome and six had unsatisfactory outcome. Out of nineteen feet with age more than one month, five had good outcome, six had fair outcome and eight had unsatisfactory outcome. By applying chi-square test, we had p value of 0.9196, which is also not statistically significant. However, age didn’t affect the results significantly in the midterm follow-up.

Unsatisfactory outcome

In group II, we had one case of forefoot adduction as an unfavorable outcome. We had three cases of Rocker Bottom foot in group III with complete relapse of the deformity in five feet and persistent forefoot adduction in fifteen cases. Rocker Bottom Foot was due to faulty technique of manipulation and casting. One foot was stiff in group III. In group IV, we had fourteen feet with forefoot adduction, one foot with Rocker Bottom deformity while six were stiff feet, where some limitation of plantar flexion and inversion is compatible with adequate function and three had complete relapse.

Persistent forefoot adduction in majority of the cases was due to noncompliance with clubfoot splint or clubfoot boot, which was asked to be worn for the maintenance of deformity correction. Lack of exercises was an additional contributing factor for the recurrence of the deformity.

Relapse

In group III, five out of ninety four patients had complete relapse of deformity. Where as in group IV, three out of thirty three had complete relapse. Overall our relapse rate was 6.8%. In group III it was 5.3% where as in group IV it was 9%. We performed statistical analysis and the ‘p’ value was 0.6 and was not statistically significant. So irregular follow-up was the main cause for the relapse of the deformity in groups III and IV rather than the severity of the deformity.

DISCUSSION

Changulani et al reported that the aim of treatment of idiopathic CTEV is to achieve a painless, plantigrade foot with good mobility, with no need for special or modified shoes.¹⁴

Laaveg et al reported the improvement of clinical results of non-operative treatment following the reemergence of CTEV.¹⁵

The sequence of deformity is most important to avoid complications like Rocker Bottom foot, persistent cavus and locking of calcaneus under the talus leading to persistent heel varus. Frick has emphasized on the importance of maximal forefoot supination in the initial casting, failure of which results in persistent rigidity and

incomplete correction of the deformity.¹⁶ During manipulations we never pronate the foot in order to prevent bean shaped deformity and incomplete correction of heel varus.

Ponseti advocates only a spurious correction of the deformity, as this will provide good functional and cosmetic results and avoid many of the complications of talar release surgery.¹ The term spurious correction must be taken in the meliorative sense of superficially like but morphologically unlike and not in the pejorative sense of false or fraudulent.

Our midterm study shows that in group III and group IV, age of the patient was not statistically significant and hence does not affect the final outcome. However the treatment should be started as early as possible.

Another observation made from our study was that the size of the heel directly tells the prognosis and need for posterior release. A small tucked up heel ultimately needed posterior release than percutaneous tenotomy.

Most of our patients (65%) underwent posterior release with Z-lengthening of tendoachilles along with capsulotomy of the ankle and subtalar joint. We believe that removal of the thickened posterior capsule of the ankle and subtalar joints ensures good equinus correction. Green et al were also of the opinion that persistent manipulation in the presence of unyielding tethers of the hind foot which inhibit eversion at the talo-calcaneal joint and dorsiflexion of ankle, may result in spurious correction in either coronal plane (Rocker Bottom foot) or the sagittal plane (bean shaped foot).¹⁷ Scher et al reported requirement of posterior release only in patients with Demiglio's group IV feet.¹⁸ Laaveg et al reported in their long term follow-up of patients treated with Ponseti technique that initial correction obtained at surgery was lost in due course of time and final dorsiflexion in cases treated with percutaneous tenotomy and posterior release were same.¹⁵

Doobs et al reported bleeding complications following percutaneous tenotomy of tendoachilles due to neurovascular injury.¹⁹ Changulani et al reported injury to neurovascular structures with percutaneous tenotomy. We did not come across any such complications in our study.¹⁴

Our results in group I, shows that as the severity of deformity is less, the results are good without any need for surgery. In group II even though the severity of the deformity was less, we had considerable number of fair results. This is mainly due to irregular follow-up patients and non-compliance with the use of splint.

In group III and IV, even though we had more good results than fair results, we did have a number of unsatisfactory results owing to the severity of the deformity.

Overall our relapse rate was 6.8%. In group III it was 5.3% whereas in group IV it was 9%. Laaveg et al reported 47% of feet had one relapse at a mean age of thirty nine months.¹⁵ A second relapse occurred at a mean age of fifty three months, and then the third and fourth relapse occurred at a mean age of sixty three and seventy seven months respectively. However children in our study should be followed till skeletal maturity to know the final relapse rate.

From our study non-compliance of children with foot abduction bar and even with clubfoot splints or boots as well as low educational level of the parents are important factors to predict the relapse after the use of Ponseti method of CTEV management than the severity of the initial deformity. Changulani et al reported that in most cases the cause of the relapse of deformity was related to a lack of compliance in the application of the Denis-Brown splint.¹⁴

The rate of postero medial soft tissue release was increased from 4% to 10% when compared to our previous short term study, which was mainly due to the inherent nature of severity of deformity in group III and IV and irregular follow up. However the rate of posteromedial soft tissue release was reduced drastically in our Institute following initiation of CTEV treatment using the Ponseti technique (from 78% to 10% only). Herzenberg et al made a similar observation in his study. We consider that extensive surgery like postetomedial soft tissue release was rarely necessary for correction of the deformity.²⁰ Colburn et al reported a similar finding following treatment of CTEV by the Ponseti method.²¹

Our results showed that as severity of the deformity increases percentage of good results were reduced. Severity of the deformity and the compliance of the parents and infants with orthotic devices for maintenance of the correction were factors contributing to poor results and which ultimately determine the final outcome.

Our overall good to fair results was 87.6% which was almost nearing Laaveg et al satisfactory results i.e., 90%. But we still need to follow all the patients till skeletal maturity to know the final outcome of our treatment.¹⁵

CONCLUSION

Ponseti method of managing CTEV is a very simple procedure, easy to learn for every orthopaedic surgeon. It's less invasive and cost effective procedure for treating clubfoot deformities. The rates of complications are less when compared to other techniques. It can be performed on outpatient basis in most of the patients or on day care basis without requirement of anaesthesia. It can be concluded that Ponseti method is very effective procedure in treating clubfoot deformities.

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