



FUNCTIONAL OUTCOME OF CONGENITAL TALIPES EQUINOVARUS TREATED BY SERIAL CASTING USING PONSETI METHOD

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ABSTRACT Congenital Talipes Equinovarus is the most common congenital condition first described by Hippocrates. The term —"Talipes Equinovarus" is derived from the Latin: Talus means ankle; pes means foot and equinus meaning —"horse-like" (plantarflexed) and varus meaning inversion plus adduction.¹ Congenital talipes equinovarus (CTEV), commonly known as congenital clubfoot, is one of the most prevalent birth disorders affecting the musculoskeletal system and is found in one out of every 1,000 live births.² Every year, a large number of infants are born with congenital clubfoot. One CTEV occurs for every 1000 live births. The majority of these children were born in nations where they continue to receive inadequate or no treatment, which lowers their quality of life. The controversy around CTEV has existed and been known to mankind since the beginning of existence. These topics have been the focus of several studies, all of which have helped us comprehend the pathoanatomy and choose the best course of action. However, according to the literature, treatment for clubfoot is often successful in all cases. We documented the functional results of the Ponseti method's serial cast repair of CTEV in our study.

KEYWORDS :

Introduction

Congenital Talipes Equinovarus is the most common congenital condition first described by Hippocrates. The term —"Talipes Equinovarus" is derived from the Latin: Talus means ankle; pes means foot and equinus meaning —"horse-like" (plantarflexed) and varus meaning inversion plus adduction.¹ Congenital talipes equinovarus (CTEV), commonly known as congenital clubfoot, is one of the most prevalent birth disorders affecting the musculoskeletal system and is found in one out of every 1,000 live births.² The individual deformities include : Equinus at ankle, Varus and internal rotation of heel, Cavus of midfoot and Adductus of the forefoot on the midfoot.³ Over the past century, two major concepts have guided the development of CTEV management. The first is the widespread adoption of the serial manipulation, strapping, and plaster treatment tenets, while the second comprises a variety of surgical techniques for clubfoot correction. In the 1960s Dr Ignacio Ponseti came up with his method of conservative management of CTEV which starts from day one of age which is established on the fundamentals and patho-anatomy of the clubfoot and successfully treated in all infants without any form of extensive surgeries. Ponseti's method has correct biomechanical basis for realigning deformed foot and ankle joints and corrects deformity based on the properties related to soft tissue structures which undergo stretching utilizing the crimp.⁴ Therefore, the primary focus of management at the moment is to detect the deformity as soon as feasible, followed by prompt treatment to realign the foot biomechanically. Parental involvement and illness education are crucial, but frequently overlooked, factors in achieving positive outcomes.

Aims and objectives

- Evaluate functional and clinical outcomes in clubfoot that were treated by Ponseti cast through serial cast application.
- Analyse the efficacy of Ponseti method by the modified PIRANI scoring system.
- Compare the educational status of the parents and their compliance in bracing and follow up.

Materials & Methods

A prospective observational study done in our Orthopaedics Department and the study was conducted from August 2021 to October 2022 on 20 cases are selected from the registered patients in the "CTEV Clinic with untreated deformed foot and age at presentation less than 12 months. Each patient was registered and detailed personal history was recorded including the age, sex, father's & mother's name, address, date of first reporting, age of reporting, detailed history of previous treatment etc. All were assessed for associated syndromic

pathology and only those infants with idiopathic CTEV were selected. A thorough clinical examination was carried out and the deformity was scored according to Pirani's classification at each visit before applying a cast.

Selection criteria

Inclusion Criteria:

- 1) Infant from birth to 1 year of age with clubfoot deformity.
- 2) Infants with congenital CTEV.

Exclusion Criteria:

- 1) Infants with non-idiopathic clubfoot like myelodysplasia complex, paralytic clubfoot.
- 2) Previously operated for clubfoot
- 3) Age more than 12 months.

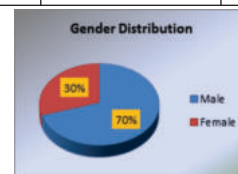
Results

All 20 patients were managed by serial cast correction by the Ponseti technique using the modified Pirani scoring for assessing the results. The following were the observations made during the study.

1. GENDER DISTRIBUTION:

Table 1: Showing Gender Distribution of cases

Gender	Male	Female
No. of Patients	14	6
Percentage	70 %	30



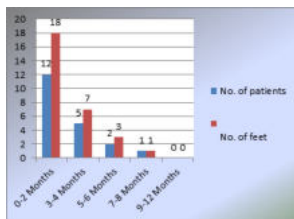
Graph 1: Gender Distributin

2. AGE DISTRIBUTION

Table 2: Showing Age Distribution of cases

Age at Presentation (In months)	No. of patients	No of feet
0-2	12	18
3-4	5	7
5-6	2	3
7-8	1	1

9-12	0	0
Total	20	29

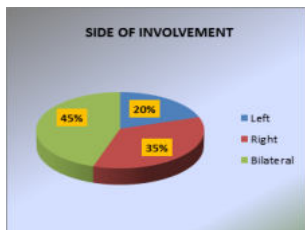


Graph 2: Of the children who presented to us, 60% (12 out of 20 babies) were below 2 months of age and 40% above 2 months.

3. SIDE OF INVOLVEMENT:

Side	Right	Left	Bilateral
No. of Patients	4	7	9
Percentage	35%	20%	45%

Table 3: Showing Involvement of side of foot.



Graph 3: In our study, predominant bilaterality was seen in 45% of cases. 20% were left-sided and 35% were right-sided.

4. CONSANGUINITY:

Table 4: Showing Consanguinity of parents of child

Consanguinity	Consanguineous	Non-Consanguineous
No. of Patients	5	15
Percentage	25%	75%

5. RELATIONSHIP BETWEEN AGE AT PRESENTATION AND FINAL RESULTS:

Table 5: Showing Relationship of Age at presentation and Final Results.

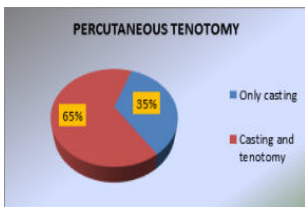
Age at Presentation (In months)	Mean pirani score	Final pirani score
0-2 months	4.30	0.17
3-4 months	3.6	0.4
5-6 months	4.80	0.75
7-8 months	5.10	1.1
9-12 months	-	-

The younger age (<2months) group had better results comparing the mean initial pirani score and the mean final pirani score.

6. PERCUTANEOUS TENOTOMY:

Table 6: Showing Percutaneous Tenotomy done in cases.

Treatment	No. of cases
Only casting	7
Casting and tenotomy	13



Graph 5: In our study, we were able to achieve correction in 35% of the cases without the need of heel cord tenotomy.

7. CORRELATION BETWEEN PERCUTANEOUS TENOTOMY AND SEX:

Table 7: Showing Correlation between percutaneous tenotomy and sex.

Tenotomy	Sex		Total
	Male	Female	
Done	9	4	13
Not done	5	2	7
Total	14	6	20

8. COMPLICATIONS:

Table 8: Showing Complications post casting

Complication	No. of cases
Pressure sores	2
Slippage of casts	1
Crowding of toes	1

Minor complications were noted in 13.15% of our cases. The superficial sores were managed with further castings with adequate soft padding and allowing the skin to heal. The crowding of toes was managed by allowing enough space for the toes for free movements.

Representative Case- 1 At Presentation



Third Visit



Tenotomy Followed By Brace Application



At 5 months follow up



Representative Case- 2 At Presentation



Third visit



Fourth visit followed by tenotomy



6 months follow up



Discussion

Clubfoot was defined as congenital subluxation of talocalcaneonavicular (TCN) joint by Scarpa. Brockman defined it as congenital atresia of the astragalo-calcaneal scaphoid joint (TCN joint).

Kite in 1939, presented his method of cast correction of clubfoot with a plea for gentle non-surgical management. His method required a lengthy period of immobilization until 2 years. Ponseti and Smoley in 1973 developed a casting method which differed from kite. Lovell et al in 1979, reported long term follow up results using kite's method where the average duration of casting was 20.4 months.

Dr Ignacio Ponseti at the University of Iowa, continued to study the efficacy of his method and was successful in achieving excellent results. Cooper and Dietz (1995) used pedo-barographic and electrogoniometric analyses in addition to clinical and radiographic assessment. This study along with other studies concluded Ponseti method as gold standard for conservative management.

The viscoelastic properties of infant's soft tissues respond to properly directed mechanical stimuli with gradual remodelling of joint surfaces, resulting in gradual and simultaneous correction of the deformities.⁴

In our series, we have treated 20 babies with idiopathic clubfoot by serial casting using Ponseti method. Of the 20 babies 9 had bilateral affection and 11 had unilateral. 14 of the babies were male and 6 were female.

Out of the 20 babies, 12 presented within the first 2 months with 18 feet, 5 babies presented between 3 to 4 months with 7 feet and 2 of them presented.

Later at 5-6 months with 3 feet. One unilateral CTEV baby presented late around 8 months of age.

Ponseti has reported 78% rate of recurrence in patients noncompliant with the straight-last shoe and abduction bar regimen and 7% recurrence rate in compliant patients. All of the noncompliant patients in Ponseti's series were corrected with re-casting. We had recurrence of forefoot adduction in 3 of our patients (15%) probably reflecting a better compliance with brace.

Porsche et al⁵ described a recurrence rate of 28% in his study. These feet required additional castings but finally all the feet were supple and fitted properly within the Dennis Brown splint.

Study group	Relapse rate (%)	
Ponseti	Brace compliant	7
	Non-brace compliant	78
Porsche et al		28
Our study		15

The rate of posteromedial soft tissue release can be reduced by Ponseti method and hence the complications which occur due to surgery can be avoided. Colburn reported similar finding following treatment of CTEV by Ponseti method.

GENDER DISTRIBUTION:

In our series the male to female ratio is not very high (Male: female = 2.3:1) in comparison to the series of JM Flynn et al⁶ (male: female, 3:1), H Sano et al⁷ (2:1). YT Huang et al⁸ found the sex correlation to be insignificant.

Study	Males: Females
JM Flynn et al	3:1
H Sano et al	2:1
YT Huang et al	Insignificant
Our study	2.3:1

The casts required per feet in our study was 4 to 7 (average 6.15 casts per foot). In another study by M G Uglow et al⁹ the mean number of casts during their treatment was 7.

Morcuede et al¹⁰ reported that 90% of the patients required 5 or fewer casts. Those feet which required a greater number of casts in our study had a high Pirani score at the onset of treatment. Also we found correlation between late presentation and the higher number of casts. The duration initially was high which decreased over time reflecting a steady learning and started getting faster correction.

Of the children who presented to us, 60% (12 out of 20 babies) were below 2 months of age and 40% above suggesting a probably deficient referral system in our area and ignorance of the parents.

TENOTOMY:

Ponseti used an ophthalmic scalpel blade for a percutaneous tenotomy.

Dobbs MB et al¹ used a shorter ophthalmic blade to minimize the risk of damaging the structures around the tendon.

Tenotomy was required in 65.5% of the cases (19 out of 29 feet). Pirani carried out tenotomy in over 90% of his clubfoot patients.

Laaveg et al¹¹ did tenotomy in 78% cases. In the study by Dobbs et al¹ tenotomy was required in 91% cases. He reported serious bleeding complications following the percutaneous Tendo-Achilles tenotomy in four patients; three due to presumed injury to the peroneal artery and one due to injury to the lesser saphenous vein. A percutaneous heel tenotomy was performed in 31 of 34 patients in Herzenberg's¹² series. However, in the current study, tenotomy was not done under ultrasound guidance and completeness of tenotomy was ensured only on the basis of clinical findings.

The rate of posteromedial soft tissue release can be reduced by using Ponseti technique and hence the complications of surgery were avoided.

RELAPSE/ RECURRENCE:

The sequence of deformity correction was most important to avoid complications.

Frick et al¹³ concluded that maximum supination of forefoot in the initial casting can lead to persistent rigidity and incomplete correction of the deformity.

Bhaskar et al and Patni et al¹⁴ reported that relapses are common in clubfoot when treated by the Ponseti technique and will become as severe as the initial deformity if left untreated.

Ponseti believed that in the absence of good bracing program, there is up to 70% rate of recurrence. In such cases, surgical treatment might be required. The parents are asked to perform ankle dorsiflexion exercises for atleast 1 minute, three times a day because equinus is not only the last deformity to achieve correction but also the first to recur. Of the 20 cases 4 feet (13.79 %) had recurrence of forefoot adduction, which required additional castings but finally all the feet were supple and fitted properly within the Dennis Brown splint. 2 babies had developed pressure sores due to cast which healed uneventfully. Padding in the shoe proximal to the heel can prevent the foot from rising out of the shoe and can help to provide relief to the calcaneus so the blisters does not occur. Repeat correction and casting was done after 2 weeks for them.

CONCLUSION

The ponseti method of serial cast correction for CTEV is an excellent method as per our study. In a developing nation like India, the method is very safe, economical, easy and result oriented method.

The earlier the child presents the quicker will be the correction and better will be the result. The less severe types with low pirani scores achieves a quicker correction with less number of casts.

Correction initiated by Ponseti technique at an earlier age and adhered to regular weekly casting protocol tends to give better functional and cosmetic results. Even relapses can be managed with further castings alone.

As it is evident from our study, the results of deformity correction are better if treatment is started as early as possible. The visco-elastic properties of infant's soft tissues respond to properly directed mechanical stimuli with gradual remodelling of joint surfaces, resulting in gradual and simultaneous correction of the deformities.

Thus we conclude that the Ponseti method will be safe and effective treatment for the correction of clubfoot that drastically decreases the need for larger surgeries.

The results are excellent when the treatment is begun in children less than 2 months.

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