



IDIOPATHIC CONGENITAL TALIPES EQUINO VARUS TREATED (CTEV) BY PONSSETI METHOD

Orthopaedics

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ABSTRACT

Congenital Talipes Equinovarus (CTEV) or club foot is that the commonest congenital pathological condition could be a descriptive term. Frequency is around one to two cases for every thousand live births¹. Club foot is a complex deformity of 4 components: Fore-foot adduction, Hind-foot varus, Hind-foot equinus and cavus. The treatment goal of club foot is to decrease its 4 components of deformity in order to give patient a functional, pain-less range of movements, plantigrade foot with good functional mobility and without calluses and avoidance of need for modified shoes. Non-operative treatment consisted of manipulation of deformity, stretching of surrounding muscles & corrective casts. Operative techniques vary according to the persistent or residual deformity and wide ranging. Early treatment of idiopathic club foot by Ponseti technique results in good correction of the deformity with reduction of surgery. Percutaneous tenotomy of Achilles tendon was required in considerable number of cases to achieve good correction.

KEYWORDS

CTEV, ponseti, Pirani score

INTRODUCTION:

Congenital Talipes Equinovarus (CTEV) or club foot is that the commonest congenital pathological condition could be a descriptive term. The term was initially described by Hippocrates. It was Andry Nicolas in his "Orthopaedicia" described the term "Pedis Equinal" which meant the foot resembling the foot of the horse.

Rotatory subluxation of talocalcaneonavicular joint (subtalar) complex with talus in plantar flexion and subtalar complex in medial rotation and inversion.

The term Talipes and equinovarus derived from

- *Talus- ankle & pes – foot*
- *Equino - like a horse & varus - turned inward*

Frequency is around one to two cases for every thousand live births¹. Boys are affected twice as often as girl's ratio is about 2:1 to 3:1¹. It is two-sided in fourthly percent of cases¹. A higher incidence of CTEV was also noted in patients with a positive family history⁷.

CTEV is a complex deformity of 4 components:

4 clinical components: **CAVE**

C-CAVUS: Exaggerated medial longitudinal arch at midfoot.

A-ADDUCTION: Forefoot in adduction at tarsometatarsal Junction.

V-VARUS: Hindfoot rotated inward at talonavicular joint.

E-EQUINUS: Foot fixed in plantar flexion at ankle joint.

Various aetiologies have been proposed counting mechanical factors in utero, neuro-muscular defect, primary germ plasma deformity, Blastemal defect in the development of tarsal cartilage analogue, Primary retracting fibrosis, fetal development arrest, cytological abnormalities and Hereditary and environmental factors. The genes responsible for clubfoot deformity are actively starting from the 12th to the 20th weeks of fetal life and lasting until three to five years of age. Irrespective of the etiology patho-anatomy remains the same and consists of ankle equinus, calcaneum equinus and inversion below the talus, prominence at dorsolateral midfoot at talar head, navicular kept medial and plantar to talar head, cuboid is medial and in front of calcaneum medially tilting of anterior parts of talus, shortened talar neck. Narrow posterior ankle mortise and talar tilt anterior of ankle mortise. Foot in CTEV is smaller than opposite normal foot when it is unilateral involvement due to small muscle mass and connective tissue fibrosis³.

Idiopathic congenital talipes equinovarus is a complex deformity that is difficult to correct¹.

The treatment goal is to decrease its 4 components of deformity in

order to give patient a functional, pain-less, plantigrade foot with good functional mobility and without calluses and avoidance of need for modified shoes.

Historically initial treatment was non-operative methods and operative methods only in cases of complex deformity, failed correction, relapses or neglected cases of CTEV.

Non-operative treatment consisted of stretching of muscles, manipulation of deformity and corrective casts. Operative methods vary according to the persistent or residual deformity and wide ranging.

The prevalence of complications both immediate and long-term in surgically treated clubfoot has cultivated a renewed interest in nonsurgical treatment².

The methods of J.H.Kite⁶, Ignacio V. Ponseti⁷ and Mass described the French and Bensahel methods⁸ are examples of non-operative methods of correction of CTEV.

Ponseti method was accepted worldwide and supremacy to all other methods. This ponseti technique is of gradual and correction of all 4 deformities of club foot using manipulation of deformity and casting at weekly intervals and a possible tenotomy of tendoachilles.

The key to the Ponseti method: the subtalar joint. The Ponseti technique is effective because it takes advantage of the Kinematics of the Subtalar Joint and described the Kite's method of correction of each component separately in which the abduction of calcaneus under the talus was prevented by applying counter pressure over the calcaneocuboid joint as "Kite's error". This is essential in correction of heel varus as calcaneus cannot be everted unless it is fully abducted under the talus^{6,7,8, and 9}.

The method has been reported to have short-term success rates approaching 90 percent and the long-term results have been equally impressive⁴. The need for surgical treatment due to complex deformities or failure of conservative treatment is rare with ponseti technique. Complications occurring as a result of this technique have not been reported¹⁰.

Aim:

The aim of this study is to analyse the functional outcome and present the author's experience with correcting clubfoot by using the Ponseti technique and importance of percutaneous tendoachilles tenotomy using Pirani score^{11,12}

MATERIALS AND METHOD:

The prospective study was conducted in Sree Balaji Medical College and Hospital, Chennai in between June 2012 to December 2018; we treated 138 patients with idiopathic club foot deformities using ponseti method of management. All the patients had given a written consent for publication of their clinical and radiological data and appropriate clearance was obtained from the institute's research and ethical committee.

Inclusion criteria:

1. Age less than 24 months.
2. Adduction, Supination and varus deformity of the foot with or without wasting of calf muscles.
3. Virgin club foot.

Exclusion criteria:

1. Secondary congenital talipes equino varus types (Postural, Syndromic, Neglected, and Relapsed) excluded from our study.

All the patients were followed up for a period of 2years after the completion of treatment regimen. The severity of foot deformity was assessed by Pirani scoring system and Dimeglio et al grading system.

Pirani scoring system: Each component may score 0, 0.5 or 1 Hind foot contracture score (HCFS): Posterior crease, Empty heel, and rigid equinus

Mid foot contracture score (MFCS): Medial crease, Curvature of lateral border, Position of head of talus

Dimeglio classification: In this system, four parameters are assessed on the basis of their reducibility with gentle manipulation as measured with a handheld goniometer:

1. Equinus deviation assessment in the sagittal plane.
2. Varus deviation assessment in the frontal plane.
3. Derotation assessment of the calcaneal-foot block in horizontal plane and
4. Forefoot assessment in relation to the hindfoot in the horizontal plane.

Score is assigned to each one of the four parameters on a 4 point scale.

Features

Reproducibility Points

90° to 45° 4

45° to 20° 3

20° to 0° 2

0° to 20° 1

0° to -20° 0

Other

Posterior crease 1

Medial crease 1

Cavus deform 1

Poor muscle condition 1

Sum of total points is 20

The feet were graded according to the severity of the deformity.

Grade – I feet had a mild deformity, were >90% reducible and had a score of 0 to 5 points.

Grade – II feet had a moderate deformity, were partially reducible and had a score of 5 – 10 points.

Grade – III feet had a severe deformity, were more resistant than reducible and had a score of 10 – 15 points.

Grade – IV feet had a very severe deformity, were irreducible and had a score of 15 – 20 points.

Ponseti technique:

Initially a layer of cast padding was applied from groin to toe and the surgeon held the foot in corrected position. An assistant applied the cast using fast setting plaster in two sections. The first one comprised of below knee plaster to hold the foot in corrected position. The next section consisted of extending the cast above knee to convert it into a groin to toe plaster cast. During this, the knee was held in 90 degree flexion. After application of the cast the child was observed for about 30 minutes for any signs of limb ischemia. The parents were educated

about possible complications like cyanosis, swelling, excess cry and the contact number in case of emergency were provided. They were then advised to report for the next cast after 7 days. The first cast was aimed at correcting the cavus deformity by supinating the forefoot thereby bringing the forefoot in alignment with the hindfoot.

In the second and subsequent casts, the foot in supination was abducted while the surgeon applied counter- pressure on the head of the talus. The calcaneus abducts by rotating and sliding under the talus. Simultaneously it extends and everts thereby correcting the heel varus. To stretch the medial tarsal ligaments fully, the foot was severely abducted to an angle of about 60 degrees. A maximum of 10 casts were fixed as endpoint for correction of cavus, hindfoot varus and adduction deformity. After correction of the above deformities, passive dorsiflexion of the foot to 15 degree above neutral with the examiner applying a single finger pressure was attempted; If achieved, a final cast was applied in the final corrected dorsiflexed position for three weeks. If dorsiflexion more than 15 degrees was not possible, a percutaneous tenotomy of the tendoachilles was done under general anaesthesia. After this tenotomy, the foot was placed in the final corrected dorsiflexed position for three weeks.

After the last cast was removed, correction was maintained by using Dennis-Browne splint. The brace was worn full time (day and night) for the first three months after the last cast was removed. After that, the child should wear the brace for 12 hours at night and 2-4 hours in the middle of the day for a total of 14-16 hours during each 24-hour period. This protocol continues until the child is 3-4 years of age. The patients were reviewed at 14 days after application of Dennis- Brown splint to assess the compliance of the parents. In subsequent visits patients were reviewed once in three months. The parents were given contact numbers and were advised to contact us regarding the maintenance of Dennis Browne splint.

RESULT:**Table 1: Distribution of age:**

In months	Total number of patient	Percentage
0-6months	51	36.9%
6-12months	30	21.7%
12-18months	39	28.2%
18-24months	18	13.04%
Total	138	100%

The most common age group was 0 – 6 months with 51 (36.9%) patients and most of the patients (58.7%) were less than 1 year of age.

Table 2: Distribution of sex:

Sex	N	Percentage
Female	48	34.78%
Male	90	65.21
Total	138	100%

The male to female ratio was 1.9:1

Table 3: Side distribution:

Side	N	Percentage
Bilateral	22	15.9%
Unilateral	116	84.1%
Total	138	100

Unilateral (84.1%) are more common than bilateral (15.9%) club foot

Table 4: Unilateral (Right or left) distribution

Unilateral distribution	N	percentage
Right	77	66.4%
Left	39	33.6%
Total	116	100

Right: Left ratio was found to be 1:0.5.

Table 5: Pirani score before treatment

Pirani score	N	%
3.0	15	10.8%
3.5	24	17.3%
4.0	33	23.9%
4.5	30	21.7%
5.0	15	10.8%

5.5	21	15.2%
Total	138	100

Table 6: Pirani score after treatment

Pirani score	N	%
0	114	82.6%
0.5	21	15.2%
1.0	3	0.02%
Total	138	100

Table 7: Pirani score follow up

Pirani score	N	%
0	129	93.5%
0.5	9	6.5%
Total	138	100

Table 8: Percutaneous tenotomy done

Percutaneous tenotomy	N	%
Done	104	75.4%
Not done	34	24.6%
Total	138	100

75 % of patients needed percutaneous tenotomy of tendoachilles at the end of casting.

Table 9: Number of cast by ponseti method:

Total number of cast	N	%
2	10	7.2%
3	57	41.3%
4	32	23.1%
5	22	15.9%
6	11	7.9%
7 and 8	6	4.3%
Total	138	100

Table 10: cast complications:

Cast complications	N	%
Pressure sore	9	42.8%
Skin blisters	3	14.3%
Slippage of cast	6	28.5%
Eczema	3	14.3%
Total	21	100

Table 11: Dimeglio score

Dimeglio score	N	%
Moderate	22	15.9%
Severe	92	66.6%
Very severe	24	17.39%
Total	138	100

DISCUSSION:

In 1948, Ponseti proposed reducing the deformity with successive casts. Although treatment with cast is a very old method, Ponseti's method is based on strict rules established from anatomic evidence. The goal is not to correct the apparent deformation, but on the contrary, to impose a simultaneous supination and abduction of the foot. Once the calcaneopodal block has been derotated, percutaneous tenotomy of the achillestendon is performed¹³. Extensive open surgery like posteromedial release is commonly associated with long term stiffness and weakness which is avoided by the Ponseti technique.¹⁴

The treatment options for Club foot has gone a full circle and reached the earlier concept of non-operative treatment, as it is associated with improved results.

As it is evident from our study, the results of deformity correction are better if treatment is started within first month of life and results are statistically significant. Harold¹⁵ and Porter¹⁶ gave similar reports. The visco-elastic properties of infant's soft tissues respond to properly directed mechanical stimuli with gradual remodeling of joint surfaces, resulting in gradual and simultaneous correction of the deformities³.

The sequence of deformity correction was most important to avoid consequence like Rocker-Bottom foot, persistent cavus and locking of the calcaneus under the talus leading to persistent heel varus. Frick¹⁷ 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. During manipulations the foot

is never pronated in order to prevent bean shaped deformity and incomplete correction of heel varus.

The fact that the navicular moves towards its normal position following manipulation was confirmed by Kuhns in his study using Ultrasonography¹⁸. Pirani confirmed similar results in clubfoot treated by Ponseti method¹⁹.

138 children with congenital clubfoot participated in the study. All the patients were of age 0 to 24 months (range: 4 days to 2 years) at initial casting. Morcuende et al. had retrospectively analysed the records of 157 patients (256 clubfeet). In this study also all the patients were of the age group 0 to 24 months. There were 90 male children and 48 female children in the present study and the male: female ratio is 1.9:1. Morcuende et al. reported a male female ratio of 2.13: 1. The male preponderance found in this study is in agreement with other studies.

Ponseti method gives better results compared to other traditional methods of casting which have been proved by comparative studies. Heel varus correction and increased declination angle of the neck of the talus are better with Ponseti method. Three dimensional CT reconstruction of the whole foot also showed that cavus, supination and adduction are corrected much better with Ponseti technique²⁰. Previous studies have shown good results (92-98%).

1. We found the following factors contributed to the success of CTEV correction by Ponseti technique:
2. Earlier the child was started on treatment better were the results.
3. The milder the severity of deformity
4. Strict adherence to the sequence of correction as advised by Ponseti.
5. Removal of the cast just before applying the subsequent cast.
6. Regular follow-up by the patients.
7. The compliance of the parents in maintaining the cast as well as the Dennis Browne splint.
8. Absence of complications.

Our results were successful in 82.6 % of the patients with no major adverse events and the results are certainly encouraging.

CONCLUSION:

Early treatment of Idiopathic CTEV by Ponseti technique results in good correction of the deformity with minimal surgery. Percutaneous tenotomy of Tendoachilles was required in considerable number of cases to achieve good correction. Forefoot adduction was the frequently observed residual deformity at the end of the treatment. Extensive soft tissue release surgeries like posteromedial soft tissue release was rarely required for correction of the deformity avoiding long term complications. The complication which we encountered frequently was pressure sore and was dealt successfully by skipping the casting for one or two weeks. Parent compliance plays an important role in maintenance of the deformity correction. It is an effective and affordable technique. This technique can be used in children up to 2 years of age. This method can be reproducible even by the orthopaedician in remote and rural places. This non operative method of management of CTEV can be successfully implemented in centres where Infrastructure facilities are inadequate to perform operative procedures.

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