

## Original Research Article

# An evaluation of congenital talipes equinovarus patients treated by various methods

Navneet Goel, Ashish Goyal, Mohit Sharma\*

Department of Orthopaedics, Dr Baba Saheb Ambedkar Hospital, Rohini, New Delhi, India

**Received:** 02 July 2019  
**Revised:** 14 March 2020  
**Accepted:** 23 March 2020

**\*Correspondence:**

Dr. Mohit Sharma,  
E-mail: [drmohitsharma1989@gmail.com](mailto:drmohitsharma1989@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Idiopathic congenital talipes equinovarus is one of the commonest congenital anomaly. Although treatment provides many options, near universal agreement exists that initial management should consist of gentle manipulation of the affected foot. In developing country like India presentation is extremely variable from soon after birth to very late childhood and irregular follow up makes treatment more difficult.

**Methods:** 100 cases of congenital talipes equinovarus who attended the Orthopedics OPD of our hospital (March 2013 to 2016) were taken up. In neonates with delicate skin, the passive manipulation was demonstrated to the mother which they did 5-6 times daily. The application of plaster of Paris cast and passive manipulation was done every 15<sup>th</sup> day upto 3 months of age. After the 3-month age, passive manipulation was done every 3 weeks. If no normalization, surgery was advised and done to correct the resistant component accordingly. All the analyses were performed in R-programming language (R- 3.0.0).

**Results:** 6 cases, 10 feet were lost during follow-up. Results were assessed in 134 feet, 128 cases managed conservatively, 13 surgically. Results were assessed according to clinical, radiological criteria of Beatson and Pearson. 13 feet were operated of 144 feet, 11 cases posteromedial soft tissue release (PMSTR) was done. In two Joshi's external stabilizing system (JESS) fixator was applied.

**Conclusions:** Majority of cases can be treated successfully by conservative means and only in 11 cases PMSTR was done, 2 cases of relapsed feet JESS was applied.

**Keywords:** Congenital talipes equinovarus, Plaster of Paris, Posteromedial soft tissue release, Joshi's external stabilizing system, Lateral border second toe angle, Operation theatre

### INTRODUCTION

Idiopathic congenital club foot is one of the commonest congenital anomaly and is variable three dimensional deformity of a complex system of a joint, but still remains an unsolved problem.

The deformity in clubfoot consists of equines of ankle joint. Adduction of forefoot and varus of hind foot. Incidence of clubfoot is 1:1000 live births. The condition is bilateral in 50% cases.

In general, worse the original deformity, more difficult is to obtain correction. Clinically deformity can be of rigid type in which deformity is severe, with an elevated small heel, deformity in the talus is present since birth and it resists conservative treatment. In non-rigid type however deformity is milder, foot is mobile, no deformity is present in talus at birth and it responds to conservative treatment.<sup>1</sup>

Another important factor which has gained the attention of orthopaedic surgeons treating this deformity is, problem of

relapse or recurrence. Probably due to persistence of some element of the original deformity.

It is generally agreed now that the initial treatment should be conservative and should start in first week after birth.<sup>2</sup>

While most of the mild and moderately deformed feet get clinically corrected, these should be assessed radiologically, to see if true correction is achieved. The remaining feet which resist conservative treatment, usually require surgical correction.<sup>3</sup>

The present study will analyse the results from different procedures undertaken for the treatment of congenital talipes equinovarus (CTEV), Study the value of early management and means for the maintenance of correction achieved, study the sex distribution, laterality and associated anomalies, and Enlighten the possible causes for the development of CTEV.

## METHODS

In the present study one hundred cases of congenital talipes equinovarus who attended the orthopedics out patients department of Bhagwan Mahavir Hospital, Pitampura Delhi (during March 2013 to March 2016) were taken up. All the patients were registered in OPD and detailed maternal history was taken regarding the place of delivery, age of mother at the time of delivery, parity, drugs taken during pregnancy for illness, term presentation and the nature of delivery.



**Figure 1: Clinical image before corrective casting.**

A clinical examination of the foot and leg was done to find out the exact nature of the deformity (Figure 1).

Serial foot impression of every cases were taken at each visit and correlated from clinical findings and X-ray to decide the line of treatment and evaluate the results.

Every patient was examined radiologically before and after treatment by taking standard radiographs AP view and lateral view in dorsiflexion and planter flexion.

Treatment was started soon after the diagnosis was established. In neonates with delicate skin, the passive manipulation was demonstrated to the mother which they did 5-6 times daily.

Ponseti corrective cast treatment done with a serial follow up after every 15 days. All the analyses were performed in R-programming language (R-3.0.0).

## Method of serial manipulation and POP cast

This part of treatment did not need general anaesthesia but in some cases some form of sedation was given after calculating the dose. Patient was allowed to lie down supine on a table with the legs freely suspended. The assistant grasped the flexed knee by one hand and great toe and second toe in the other hand. Maleolli and abnormally prominent head of talus were protected by putting extra cotton. Plaster of Paris (POP) bandage of three inches breadth was soaked in water till air bubbles come out. The deformity was corrected automatically to some extent by this manner of POP cast application.

After this the serial manipulation was done till the cast is fully set, in the same manner as it was done for young and delicate babies for passive manipulation, pressure by the tip of fingers to derotate the prominent head of talus was avoided to prevent the development of plaster sore. The pulp of the middle and ring fingers was used for the same. There was no hurry to correct all the components of deformity in the same sitting. First of all the fore-foot adduction was corrected than heel varus and lastly the equines. Again, for one component if not permitted the complete correction was not tried in one sitting. Manipulation was gentle and firm, and all the components were methodically over corrected if permitted.



**Figure 2 (A-D): Clinical image of performing percutaneous tenotomy.**

Tenotomy was needed in almost 80% of cases (Figure 2 and 3).



**Figure 3: Post tenotomy cast above knee kept for 3 weeks.**

Above knee cast was applied in extension, after the below knee cast is set. Even if it was decided that the surgery is indicated in a particular case one or two above knee POP casts were applied after manipulation and changed every fifteenth day to make the soft tissues stretched which facilitated the surgery.

Soft tissues releases were done after taking decision from clinical gradings, radiological investigations, feet impressions and the age of the patient.



**Figure 4: Intra operative image performing a posteromedial soft tissue release in a rigid clubfoot.**

### **Posteromedial release**

The aim of the procedure is to excise or release all of the pathologically contracted soft tissues that prevent complete correction of the deformity. Turco advised that the optimum age of a candidate for this procedure is one to two years, and the upper age limit should be approximately six years.

#### *Technique (Turco procedure)*

Make a medial incision 8 to 9 cm from the base of first metatarsal to the tendocalcaneus curving it slightly just inferior to the medial malleolus (Figure 4).

Next expose and mobilize by careful dissection the tendons of the tibialis posterior and flexor digitorum longus and flexor hallucis longus and posterior tibial neurovascular bundle, also expose the tendocalcaneus.

Next free the posterior tibial neurovascular bundle and retract it posteriorly. Now by continuing the incision in the sheathes of the flexor digitorum longus and flexor hallucis longus divide the master knot of Henry beneath the navicular. Divide the calcaneonavicular (spring) ligament and the abnormal origin of the abductor hallucis.



**Figure 5: (A) Intra operative image showing tendoachilles before formal tendoachilles lengthening, (B) intraoperative image showing formal tendoachilles lengthening done.**

Of the remaining contractures, release the posterior ones first. Lengthen the tendocalcaneus by Z plasty technique detaching the medial half of its tendinous insertion on the calcaneus (Figure 5 A and B).



Now retract the neurovascular bundle and the flexor hallucis longus anteriorly and expose the posterior aspect of the ankle and subtalar joints. Incise the posterior capsule of the ankle joint, subtalar joint talofibular ligament, calcaneal ligament and tibiocalcaneal ligament.

Next release the deep medial structure. Retract the neurovascular bundle and lengthen by Z-plasty the tibialis posterior tendon just proximal to the medial malleolus. Incise the talonavicular capsule and part of the deltoid ligament that inserts on this bone. Release the superficial layer of deltoid ligament from the calcaneus posteriorly under direct vision

Now observe the foot and correction achieved on the table. Repair the tendocalcaneus with one or two interrupted suture after it has been lengthen enough to allow dorsiflexion of the ankle.

Apply a well padded long leg cast with the knee slight flexion and the ankle dorsiflexion the neutral position.

#### **After treatment**

At 2 weeks cast and suture removed and new long leg cast applied with the foot held in full correction. This cast is worn until 3 months after surgery. After 3 months of surgery ankle foot orthosis used full time for 6 to 9 months.

Bone surgery and tendon transfers were not done in any case.

The Indications of surgery in our study was restricted to Resistant foot not responding to passive manipulation and corrective cast treatment, recurrent cases and untreated old cases.

Procedures that involve bone are usually done in older children and sometimes may be regarded as salvage procedure. Some of the procedures are ostectomy of the metatarsals, ostectomy of the calcaneus, triple arthrodesis and ostectomy of the medial cuneiform.

#### **Follow-up**

After the conservative treatment was started some patients attended the clinic every 15<sup>th</sup> day for re-application of POP. Patient attended the clinic feet impressions, measurements were taken and were compared from previous records.

After the full correction was achieved patients were followed up every month for first six months for any recurrence or other complication, shoes and splints were repaired or changed if found defective.

## **RESULTS**

In the present study, 6 cases with 10 feet were lost during follow-up. Results were assessed in 134 feet, 128 cases

managed conservatively and 13 surgically. The results were observed after 3 months of conservation treatment or surgery.

**Table 1: Age distribution.**

| S. no.       | Age group  | No. of cases |
|--------------|------------|--------------|
| 1.           | 0-1 month  | 35           |
| 2.           | 1-3 months | 37           |
| 3.           | 3-6 months | 13           |
| 4.           | 6-9 months | 7            |
| 5.           | 1-2 years  | 1            |
| 6.           | >2 years   | 7            |
| <b>Total</b> |            | <b>100</b>   |

In this series of 144 CTEV feet of 100 children it was observed that the maximum patients who attended O.P.D. were under one year of age 98 (98%) (Table 1). The female patients were brought to the hospital at an earlier age than the male patients. The patients who attended the clinic late were mostly from rural areas. the illiteracy, poverty and lack of transport facilities were the main factors for this delay. The early the patient attended the hospital the better was the result obtained after regular treatment. Cases with late presentation required surgery.

In this series of 100 cases there were 3 times as many boys as girls. In this region it is a tendency in parents that when the female child is born deformed, she is brought to the hospital for correction very early, for the fear of problems in later life. At the same time male children born with anomaly are mostly neglected and they are brought to the hospital late.

In this series of 100 cases, Hindu children were more 95% than the Muslims 5%. It may be attributed to the population ratio. Patients from rural areas were more than the urban area.

Out of 100 cases reported, 56 (56%) cases were unilateral and 44 (44%) were bilateral. There is no difference in right and left foot affected in unilateral cases suggesting the absence of predilection to any particular side.

To have a better prognostic value the various clinical findings were recorded in details which gave a clue to its severity. In cases where deep medial skin crease and indrawing of toes was found, the talonavicular subluxation was certainly present which was proved by radiographic measurements and feet imprint measurements. In cases where the deep planter crease running transversely was notice, the X-ray suggested high longitudinal arch, evaluated by calcaneo-metatarsal angle which is formed between long axis of calcaneum and fifth metatarsal suggesting the extent of fore foot equinus.

In our study of feet imprints the extent of heel varus can easily be denoted because during taking the foot

impressions both legs were kept paralled together and feet were in their natural position.

**Table 2: Relationship between radiographical and foot imprint measurements.**

| Radiographpic                        | Foot imprint measurements                       | Inference  |
|--------------------------------------|---|--|
| Talocalcaneal angle (AP view) <15°   | Heal angle <60°                                 | Hind foot varus                                    |
| Tarsometatarsus angle (AP view) >15° | Lat BST angle >50°                              | Forefoot adduction                                 |
| Talocalcaneal angle (AP view) <15°   | Heel angle <60° with tarsometatarsus angle >15° | Talonavicular with lat BST subluxation. angle >50° |

Lat BST: lateral border second toe.

Talonavicular subluxation could be assessed by feet imprints if heel angle is below 60° with lateral border second toe angle above 50° (Table 2). In this way it is evident that the feet imprint measurements are the best substitute of radiographs when taken methodically in selected cases. The errors in feet impressions arise when the internal rotation of tibia is also present along with CTEV to assess the exact extent of heel varus.

The feet imprints measurements denoted the same finding if the lateral border second toe angle was more than 50° with the heel angle less than 60° as described previously.

**Table 3: Results of conservation treatment.**

| S. no.       | Result    | No. of feet | Percentage |
|--------------|-----------|-------------|------------|
| 1.           | Excellent | 74          | 55.22      |
| 2.           | Good      | 40          | 29.55      |
| 3.           | Poor      | 20          | 14.92      |
| <b>Total</b> |           | 134         |            |

This present series 134 feet were treated by manipulation and POP cast (Table 3). It is evident that the result of treatment depends upon earliness of starting the treatment type of foot (thick foot or thin foot), severity of deformity and plaster technique is of prime importance and the treating surgeon must be well conversant with child's feet. As we have practiced the method of manipulation by both the hands is better because the identical techniques can only be better if a surgeon is able to work equally by both the hands.

The results after posteromedial soft tissue release (11 cases), excellent 8 (72.72%), good (9.09%) and poor in 2 feet (18.18%) (Table 4).

In our series post treatment pirani score was excellent (0) in 55.22%, good (0.5-1) 29.55% and poor (>1) 14.92% (Table 5).

**Table 4: Results after posteromedial soft tissue release.**

| S. no.       | Result    | No. of feet | Percentage |
|--------------|-----------|-------------|------------|
| 1.           | Excellent | 8           | 72.72      |
| 2.           | Good      | 1           | 9.09       |
| 3.           | Poor      | 2           | 18.18      |
| <b>Total</b> |           | 11          |            |

**Table 5: Post treatment Pirani score (n-134).**

| Post treatment Pirani score  | No. of feet | Percentage |
|------------------------------|-------------|------------|
| <b>Excellent (0)</b>         | 74          | 55.22      |
| <b>Good (0.5-1)</b>          | 40          | 29.55      |
| <b>Poor (&gt;1)</b>          | 20          | 14.92      |
| <b>At 6 months follow up</b> |             |            |
| Excellent (0)                | 60          | 44.77      |
| Good (0.5-1)                 | 65          | 48.50      |
| Poor (>1)                    | 9           | 6.71       |

## DISCUSSION

In our series of 100 cases comprising of 144 feet, 13 feet were operated upon either for recurrence after conservative treatment or for resistant foot for conservative means. Deformity recurred in 2 feet (with heel varus and forefeet adduction) after posteromedial soft tissue release (PMSTR) operation.

The views of Kuhlmann RF that the successful treatment of club-feet depends upon early and adequate correction followed by the prevention of recurrence has been observed, in our study also.<sup>3</sup> Kite et al were also in favour of starting the treatment as early as possible and noticed that earlier the treatment started better the chances of correction.<sup>4</sup>

Browne suggested that the causative factor for clubfeet is mechanical because of abnormal intra uterine position and attitude of foetus.<sup>5</sup> Wynne-Davis also noted the same.<sup>6</sup>

Calcaneal movements can be better assessed by calcaneal arc which is the traversed by calcaneum from planter flexion to dorsal flexion.<sup>7</sup>

All types of operations were accompanied by tendoachilles elongation (Z plasty). After the Z-plasty with or without capsulotomy of ankle and skin closer plaster was applied accordingly. Stewart et al also described the same technique of Z-plasty of tendoachilles. Ankle capsulotomy described by Smith et al appears to be of great importance in selected case along with tendoachilles elongation.<sup>8</sup>

The genetic factors in the etiopathogenesis of club-feet appear to be important as in the present series 2 patients had similarly affected blood relatives. Wynne-Davis noted that in 2.9% cases, siblings are also affected.<sup>5</sup> Palmor (1964) after the study of 108 families found that 43 had

one or more affected relatives, thus concluded that polygenic factors probably autosomal dominant inheritance with reduced penetrance are present in positive family groups. It is evident that the deformity when combined with other anomalies is in its severe form, Duthie was in favour of this view.<sup>9</sup>

For the medial release we find that one cannot make a hard and fast rule for a particular operation but decision should be taken during surgery according to the findings observed.

Kite et al stated that the 90% cure is definite if treatment is started early by enthusiastic conservative treatment by POP cast, but he did not correlate the clinical evaluation by radiographs through he took the X-rays of feet and deviced various angles.<sup>9</sup>

In cases the tendoachillis is medially inserted and tough and if correction by manipulation and cast appears resistant early posterior releases should be the choice of treatment. This view was accepted by Main et al, Smith et al 1976.<sup>10</sup>

The location of resistant directions are the important means to decide the appropriate line of treatment at the earliest opportunity.

Gartland et al gave his results of tendon transfers (purely qualitative) in to three categories excellent, satisfactory and unsatisfactory based on the appearance and function of feet. For the satisfactory results he said that minor residual deformity may be present but he did not measure these residual deformities.

The unsatisfactory results were in those feet which were not included in excellent and satisfactory group. The results were in those feet which were not included in excellent and satisfactory group. The results of posterior tibial tendon transfer for the clubn-feet in his series of 20 feet was excellent in 50% satisfactory in 30% and unsatisfactory in 20% feet. Hersh et al gave a better assessment of the results obtained after treatment by gradings of passive motion of all the components but he could not correlate them together of with radiographic measurements.<sup>11</sup>

Main et al evaluated the results of early operation in CTEV by clinical and radiological assessment but again he did not correlate them. his results which were purely quantitative, were satisfactory (excellent and good) and unsatisfactory but no definite demarcation was made between these two. Some wokers, Kuhlmann et al, Das et al based their assessment on clinical findings alone. The results were assessed after 3 months of conservative treatment of operation when plaster was discarded.<sup>12-14</sup>

The results in our series were assessed according to clinical criteria of Beastson et al. The results graded into three categories: excellent, good and poor or failure.

The results were assessed after manipulation and POP cast in 128 feet, excellent in 72 (56.25%), good in 38 (29.68%) and poor in 18 (14.06%). The feet with poor results were on continuous watch and were given surgical treatment in most of the cases. The results were poor is due to severe deformity, recurrence of deformity during or after treatment (relapsed), and late reporting to the centre (neglected) or irregular follow up. Many patients requiring surgery were not operated because of limited operation days and some unfavorable circumstances.

In my series only 13 feet were operated (about 10%). The poor results in 2 feet, in one case was due to inadequate posteromedial release, and at the same time other foot was thick and resistant for passive manipulation and POP cast. Though the patient was brought at earlier age than other case. In some patients after the conservative treatment, mild in toeing was present but did not make problem in walking and appearance of foot and wearing of shoe. The decision of surgery taken according to clinical grading and resistant to manipulation and POP cast application.

Joshi's external stabilizing system was applied in two cases with excellent result. Both the cases were relapsed type after PMSTR.

For older children, who start walking, the tarsopronator shoe is of great importance, because when they walk the residual deformity after treatment automatically disappears. The children who are at the stage when they learning the act of walking shoe are to be used and splint when they lie down on the bed.

Aloisio et al stressed for a "rigid criteria" to be employed (which is accepted worldwide) in the radiographic techniques of club-feet and proved that the change in the direction of central rays will produce a marked difference in the radiographic measurements. Even after that, the recent work of Simons et al on analytical radiography (which is still in progress) appears to be most accurate.<sup>15</sup>

The proper size of splint and its correct positioning is of value in prevention of recurrence, careful watch and follow-up is necessary in these cases who are at border line.

In this way it becomes evident that the regular follow-up programme is the main part of management of CTEV and cooperation between the parents of children affected and surgeon is the must.

The development of complication depends upon the skill of surgeon treating the cases and the OT conditions for the post operative infection. In our series infection or wound gaping. In the CTEV the plaster sore and postoperative infections are not so hazardous and can be treated on usual line of treatment by antibiotics and dressing. During conservative management no major complication was observed except excoriation of skin over posterior aspect of knee, leg and lateral aspect of foot.

Post operative complication was noted in two cases (out of 11 cases), inform of gapping of wound and infection which were managed by dressings and oral antibiotics. The cases healed within one week. No incidence of over correction or any other complication was noted.

## CONCLUSION

The present study of 100 patients comprising of 144 feet of CTEV revealed the following conclusions. As the deformity is present since birth, parents, are worried for the future of child so the patients are brought to the hospital very early for the treatment. Patients from rural areas are brought comparatively late. Predominance of disease is observed in males, the incidence of disease is more in Ist child.

Though the number of cases with unilateral feet are more but the number of feet with bilateral affection are more than unilateral.

These all suggest that some abnormal genetic biochemical factor is responsible for its causation which predominates to the male genes and this intrinsic factor may be initiated or exaggerated by some eclipse in first trimester of pregnancy or X-ray exposure.

Prognosis depends upon the age at which treatment is started. Feet imprints are of great value, in deciding the line of treatment and knowing the severity of deformity.

Clinical grading of deformity is not only useful in the evaluation of treatment but also in assessing the stage of deformity. Majority of cases can be treated successfully by conservative means of treatment, the passive massage and manipulation.

In 11 cases posteromedial soft tissue release operation was done to achieve full correction and functional foot. If previous manipulation and POP casts are given before surgery the results obtained after it are better. In 2 cases of relapsed feet JESS fixation were applied with good results.

## Recommendation

Regular follow-up of patients is necessary to observe for any recurrence and/or other complications. Maintenance of correction achieved by conservative treatment or after surgery, Denis Browne splint or taraspronator shoes is of real importance.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

## REFERENCES

1. Beatson TR, Pearson JR. A method of assessing correction in Club-foot. J Bone Joint Surg. 1966;48:40-50.
2. Anand A, Sala DA. Clubfoot: etiology and treatment. Indian J Orthop. 2008;42(1):22-8.
3. Kuhlmann RF. Conservative management of congenital clubfoot deformity. Ama Am J Dis Child. 1954;87(4):440-7.
4. Kite JH. Non operative treatment of congenital Club-foot – a review of one hundred cases. South Med J. 1930;23:337.
5. Brown D. Congenital deformities of mechanical origin. Proc Roy Soc Med. 1936;29:1409-31.
6. Wynne-Davies R. Family studies and the cause of congenital Club-foot. J. Bone Jt Surg. 1964;46:445-63.
7. Joseph B, Chacko V. Radiology in Club-foot. Int J Orthop. 1981;15:136.
8. Stewart SF. Club-foot: its incidence, cause and treatment. J Bone Jt Surg. 1951;33:577-90.
9. Duthie, R.B; Townes, The Genetic of Orthopedic Condition. J Bone Joint Surg. 1967;49:229-48.
10. Smith WA Jr., Campbell P. Bonnett C. Early posterior ankle release in the treatment of congenital Club-foot. Orthop Clin N Amer. 1976;7(4):889.
11. Hersb A. The role of surgery in the treatment of Club-foot. J Bone Joint Surg. 1967;49:1684-96.
12. Main BJ, Crider RJ, Polk, Lloyd Roberts GC, Kamdar BA. The results of early operations in talipes equino-varus (preliminary-report). J Bone Joint Surg. 1977;59:337-41.
13. Kuhlman RF. A survey of clinical evaluation of the operative treatment for congenital talepes equinovarus. Clin Orthop. 1972;84:88-92.
14. Das B, Jain JP. Role of radiography in CTEV. Int J Orthop. 1981: 150-152.
15. Simons, GW. Analytical radiography of Club-foot. J Bone Joint Surg. 1977;59:485.

**Cite this article as:** Goel N, Goyal A, Sharma M. An evaluation of congenital talipes equinovarus patients treated by various methods. Int J Res Orthop 2020;6:480-6.