

Management of congenital talipes equino varus by ponseti method: Our experience

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ABSTRACT

Congenital talipes equino varus (CTEV) or club foot is a common congenital condition encountered for treatment by orthopaedic surgeons. The incidence of which is around 1-2 per 1000 live births. The treatment of Club foot in the 20th century saw a seasaw of events starting from conservative line to surgery & then again returning to conservative line with the advent of ponseti technique. We at Hassan institute of medical sciences treated 50 idiopathic club feet in 38 patients with ponseti technique. The study was conducted between August 2012 to September 2014 – with a total follow up of 24 months. Aim of the study was to correct the deformity, achieve plantigrade, painless foot, prevent usage of special shoes & avoid callosities. Children from 2 days to 12 months were included in our study. Pirani scoring was used to note the severity of the condition. They were all treated with manipulations & above knee plaster casts with 38 feet needing tenotomy. Total number of casts ranged from 4 to 11 in these patients. Average duration of treatment was about 2 months. Maintenance of correction was with foot-abduction orthosis – Dennis brown splint. We concluded that this technique is simple, economical, easy and effective with a high success rate & patient was happy with an aesthetically acceptable plantigrade look of the foot.

Key words: CTEV, conservative management, ponseti technique.

Abbreviations: CTEV: Congenital Talipes Equino Varus; MFCS: MidFoot Contacture Scores; HFCS: Hind foot Contracture Scores; OT: Operation Theatre; OPD: Out Patient Department.

Introduction

Idiopathic clubfoot or congenital talipes equino varus is a common congenital condition encountered in orthopaedic practice. Incidence is about 1-2 per 1000 live births. The reason of its occurrence is still not clear. However many theories have been put forth but non were conclusive enough. This condition has

basically four deformities namely – Hindfoot equinus, hindfoot varus, midfoot cavus & forefoot adductus{Figure-a}. The terminology was derived from latin where pes means foot & ankle is talus, so practically it means a patient who walks on the ankle. The initial treatment dates back to Hippocrates who has described this deformity [1].

All orthopaedicians universally would agree in managing club foot by conservative method. It was J. Hiram Kite in 1939 who first presented his work as a “plea of conservative treatment” which predominantly highlighted the serial cast technique to correct the deformity with the fulcrum at calcaneo-cuboid joint [2]. However as some patients did not achieve full correction surgical approaches increased & in the subsequent decades surgical treatment predominated largely to obtain full & lasting correction. All the adopted methods were forcible manipulations. Later in the early 1940 Ignacio Ponseti

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studied in detail about the pathoanatomy of the club foot in still born babies & developed a mechanism of correction [3]. This was adopted world wide after 1990 & still is the mainstay in treatment of CTEV. This method has been reported to have short term high success rate upto 90% & long term results were equally impressive. Ponseti himself followed up 45 patients for thirty years &

found 35 patients (78%) with excellent to good results [4]. Long term follow up in complete soft tissue release surgeries showed unsatisfactory results whereas ponseti showed good success rate without surgery & thus renewed special interest in orthopaedic surgeons [5]. The purpose of this study was also to evaluate the effectiveness of the ponseti method.

Materials and Methods

The study was conducted at Hassan institute of medical sciences between August 2012 and August 2014. A total of 38 patients with 30 male & 8 female were being treated. One day in a week (Tuesday) was fixed as CTEV clinic day & all babies were treated on the same day. This helped us to organise & follow up the cases with ease. Idiopathic club foot both unilateral & bilateral was selected for our study. Babies between 2 days to 12 months were included in the study. Also previously treated cases with residual deformities were included. Clubfeet due to other causes like polio, muscular deficiencies, constriction bands, neurological weakness etc., were excluded. Pirani scoring was used to assess the severity of the deformity for all patients

before the start of the treatment {Figure- e,f}. 0 was considered normal, 0.5 moderate while 1 as severe deformity This includes midfoot & hindfoot component scoring. Each component has 3 parts. Midfoot component has Curved lateral border, Medial crease & position of lateral part of talar head each having a minimum score of 0 to maximum score of 1 (0, 0.5 & 1). So the maximum total midfoot score would be 3 {Figure-e}. Similarly Hindfoot component includes Posterior crease, rigid equines & empty heel. Again each of these have a minimum score of 0 to maximum score of 1 (0, 0.5 & 1). So the maximum total hindfoot score would be 3 {Figure-f}. Total score of severity of the foot would be 6 (MFSC+HFSC=3+3=6). Once the severity of the score was assessed the correction is started.



Fig (a): CTEV baby initial presentation followed by



Fig (b): casting (3rd cast) & later



Fig (c): complete correction of deformity achieved

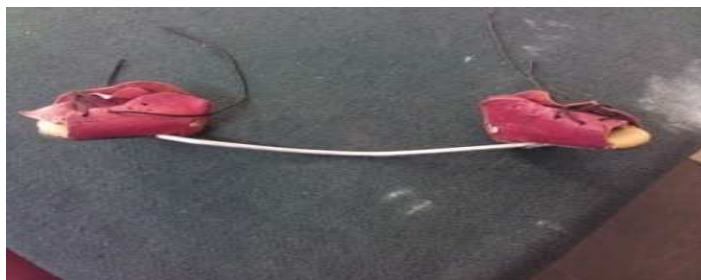


Fig (d): Foot abduction orthosis picture is also seen



Fig: (e): MFCS

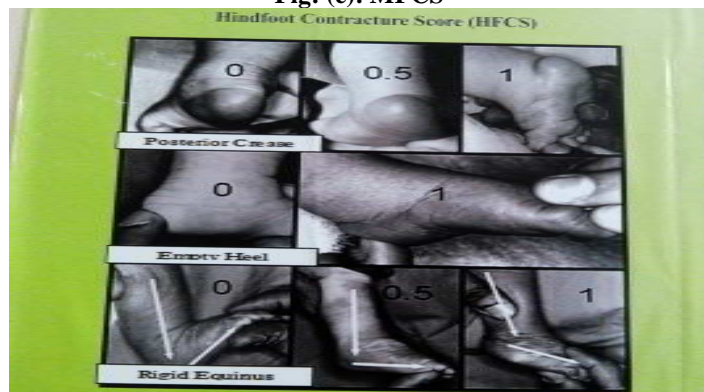


Fig: (f): HFCS

Method

In the first cast the 1st ray is elevated & forefoot is supinated so as to align the forefoot in relation to hindfoot. This is to correct the cavus. As the foot in newborns are supple it is easy to achieve the normal medial longitudinal arch and align forefoot with hindfoot. In this position cast is put. In reality the cast appears in exaggerated deformed position & parents are apprehensive about the same. However with adequate counselling it can be overcome.

In the second cast the head of the talus is located first by palpating the head of the talus which lies below & in front of the lateral malleolus in one hand while with the fingers of the other hand the forefoot is held & gently abducted. This corrects the adductus & hindfoot varus.

In the successive corrective casts similar procedure is repeated to further displace the calcaneum, navicular & cuboid laterally such that the adductus, hindfoot varus & equinus is corrected. Key is following correction of cavus forefoot abduction should be done with foot in slight supination to maintain the colinearity of metatarsals, thereby producing an efficient lever arm for abduction. Thus heel is not constrained here by premature dorsiflexion {Figure-b}. Unlike other methods the heel is not touched here. It is also important to avoid forceful dorsiflexion before correction of hindfoot varus or else a rocker-bottom foot could develop.

Finally attempt is made to correct equinus. The hindfoot should be in neutral to slight valgus & foot is abducted at least 70° in relation to the leg. Equinus may be corrected by progressively dorsiflexing the foot after the varus & adduction has been corrected. The foot is dorsiflexed by applying pressure under the entire sole & foot, not just under the metatarsal heads to avoid a rocker-bottom deformity. Equinus may be completely corrected by further progressive stretching & casting {Figure-c}.

However, to facilitate more rapid correction, a subcutaneous heel cord Achilles tenotomy is done. In our series 38(76%) {Figure-2} feet underwent Achilles tenotomy comparable to Ponseti study [1,6]. All our cases were done in Major OT. However it can be done in minor OT or OPD depending on the set up & surgeons preference. A small amount of local anaesthesia usually about 2ml is used under strict asepsis. An 11 or 14 number blade is used & stab incision is done parallel to the tendon usually 1 cm

above tendon insertion. The knife is then turned perpendicular to the tendon & it is cut from anterior to posterior. The assistant holds the leg in complete extension at the knee & ankle is as fully dorsiflexed as possible. Following complete tenotomy the foot snaps up & dorsiflexion is achieved. We have used a simple stitch using vicryl suture (absorbable) & with adequate cast padding a long leg cast is applied with foot in at least 15° dorsiflexion. A stitch is not required but as the parents are apprehensive about the mild soakage which occurs on the cast we routinely suture the incised wound. The cast was maintained for 3 weeks.

Following removal of the cast the corrected position of the foot was maintained with foot abduction orthosis. The orthosis consists of two straight long open-toe shoes connected by a bar that allows the shoes to be placed at shoulder width {Figure-d}. The bar should hold the shoes at 70° of external rotation & 10° dorsiflexion. In unilateral cases the normal foot should be in 40° of outward rotation. The bar is usually angulated away from the body downward so as to keep the foot maintained in dorsiflexion. The orthosis is worn full time for at least 3 months. Later once the deformity is completely corrected the orthosis is worn only during nights upto 5 years so as to avoid relapse. During daytime CTEV shoes is advised.

Regular follow up at weekly intervals during casting & every 3 weeks after brace application was done upto 2 years & is a must to avoid recurrence & complications. Results were tabulated and was statistically analysed applying paired T-test.

Observations and Results

38 patients with 50 feet were treated in our institute. 30(79%) were male & 8(21%) were females. 26(68%) were unilateral cases while 12(32%) were bilateral. Out of 26 unilateral cases 20(77%) were males while 6(23%) were females. 10(83%) males & 2(17%) females had bilateral involvement (Table-1). 20(53%) patients were in the age group of 0-3 months, 8(21%) were in the age group of 3-6 months, 6(16%) were of 6-9 months while 4(10%) were between 9-12 months (Figure-1). Midfoot scoring severity for curved lateral border was seen in 44(88%) feet, medial crease for 38(76%) & no talar head coverage was seen in 45(90%) patients while moderate curved lateral border was seen in 6(12%), medial crease in 12(24%), while 5(10%) had some talar head coverage. Hindfoot scoring severity was noted in 40(80%) in posterior crease, 42(84%) in rigid equinus & 43(86%) in empty heel while moderate deformity was seen in 10(20%)

for posterior crease, 8(16%) for rigid equinus & 7(14%) for empty heel cases. Thus the average total pirani score was 5.7 {Table-2}. Least number of casts used were 4 while maximum number used were 11 in two patients. Average number of casts used were between 5 to 6. 38(76%) needed tenotomy to achieve 15° dorsiflexion. Average duration of treatment was 2 months. We took a longer time to achieve correction in the initial phase of our study due to the steep learning curve. The total duration of treatment from application of cast to foot orthosis was 5-6 weeks in 28(74%) patients while it was 7-10 weeks in 10(26%) patients. Longer duration was noted in older patients >6 months of age. We were able to achieve dorsiflexion of >15° in

29(76%) patients while 9(24%) had 10-15°. Abduction of >70° was noted following correction which would decrease to 20-30° at the end of 12 months of treatment. However further decrease was not noted. Oldest child to begin treatment was 9.5 months. However the deformity was fully corrected in him. 34(90%) patients had no limitation of activity like running, squatting, sitting cross legged, playing outdoor activities or even doing normal day to day activities while 4(6%) complained of pain or limitation of activity at the end of 2 years follow-up.

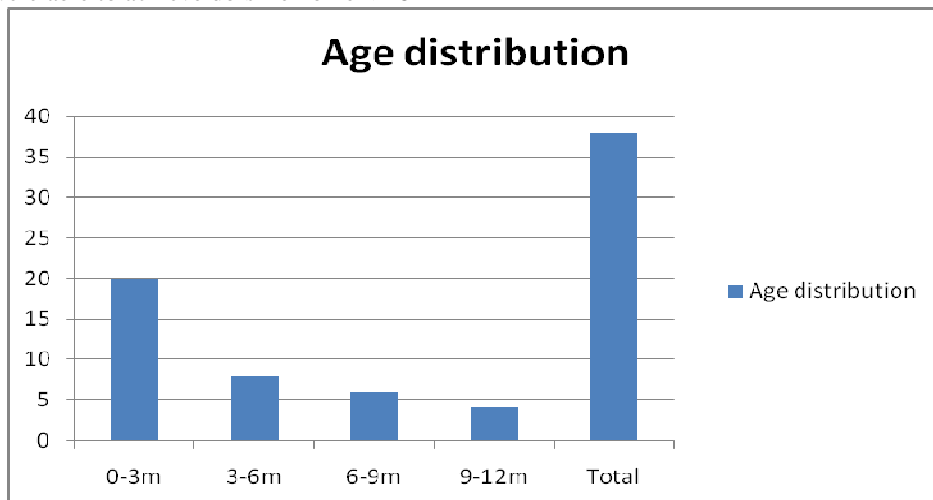


Fig. 1: Age distribution

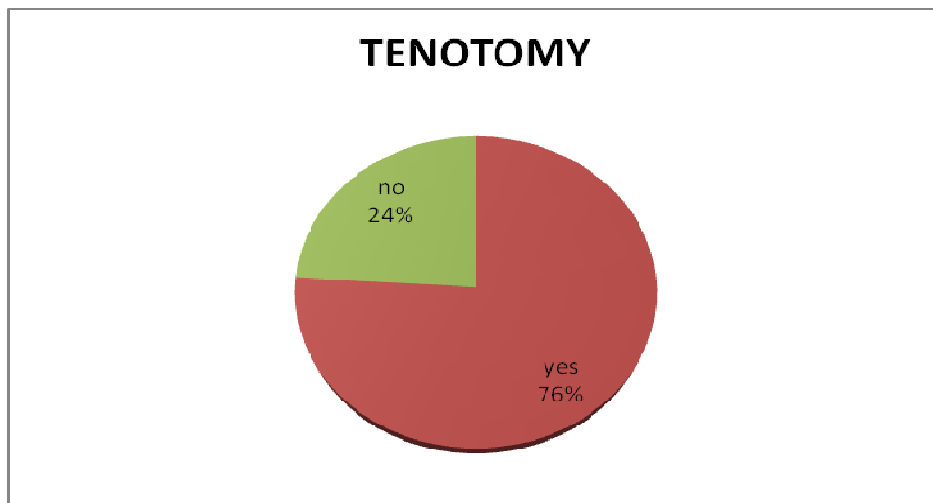


Fig 2: Pie chart depicting percentage of feet who underwent Tenotomy

Complications were noted in 4 patients. 2 had recurrence of deformity while 2 had pressure sores. Pressure sores were noted in our initial phase of treatment protocol & could be attributed to poor or faulty plaster technique. In both these patients casts were withdrawn, sores were adequately treated allowed to heal & then repeat plaster cast technique from the beginning was done. However one did not fair well & was grouped into atypical idiopathic club foot with poor result. The second one also had a poor result owing to its small size & chubbiness of the feet. Both ended up with a pirani score of 2 at the end of

treatment. Recurrence of equines deformity was noted in 2 patients. One was attributed to non application of brace properly (earlier tenotomy was not done) & the other due to improper tenotomy. Both the cases underwent repeat tenotomy & they fared well at subsequent follow ups. At the end of 2 years the final pirani score was recorded with an average of 0.59 {Table-3}. Paired T-test showed the difference in initial & final scores was highly significant with p value <0.001 {Table-4}.

Table 1: Sex distribution and type of foot involvement

| Sex | unilateral | Bilateral | Total |
|--------------|------------|-----------|-----------|
| Male | 20 | 10 | 30 |
| Female | 6 | 2 | 8 |
| Total | 26 | 12 | 38 |

Table 2: Initial score

| | frequency | percent |
|--------------|-----------|------------|
| valid 5 | 8 | 16 |
| 5.5 | 14 | 28 |
| 6 | 28 | 56 |
| Total | 50 | 100 |

Table 3: Final score

| | Frequency | Percent |
|--------------|-----------|------------|
| valid 0 | 25 | 50 |
| 0.5-1 | 14 | 28 |
| 1.5-2 | 9 | 18 |
| >2 | 2 | 4 |
| Total | 50 | 100 |

Table 4: Paired T-test

| Paired differences | Paired differences | | | | |
|---------------------------------|--------------------|---------------|--------|----|---------|
| | mean | std deviation | t | df | p value |
| Pair initial score- final score | 5.11 | 0.5915 | 61.085 | 49 | <0.001 |

Discussion

Congenital talipes equino varus should be treated as opined by many orthopaedicians by conservative method. The initial 3 months of life is the golden period for treatment. Treatment in the early days of infancy starting as early as possible after birth has good results. Kite [7,8] first initiated the traditional sequential correction of CTEV by plaster cast technique. It gained popularity initially, however the force applied & appearance of residual deformities made Ponseti think of an alternate technique. Ponseti studied the pathoanatomy of idiopathic club feet in still born infants & noted that the deformity could be corrected gently, without the use of force or surgery & also most importantly all the components could be corrected simultaneously. He took the example of how a boat moves in water simultaneously – it pitches, sways & propels forward similarly all deformities could be corrected at once & need no sequence for the correction of deformity. Kite's method was derived from the concept of three-point pressure, such as might be used to correct a bent wire. The technique consisted of grasping & distracting the forefoot with one hand while holding heel from the back with the other hand. After elongating the foot, a laterally placed thumb pushed the talus in a medial direction, & the medial placed index finger pushed the navicular in the lateral direction. The heel was everted & forefoot was abducted. This was followed by application of a slipper cast with abduction of the forefoot against a fulcrum over the calcaneocuboid joint. Ponseti described this as "Kite's error". Gradually the cast extended above with foot in eversion & gentle external rotation. After correction of forefoot adduction & hindfoot varus, the foot was gradually dorsiflexed to correct the equines [2]. In ponseti technique weekly manipulations and cast application to hold correction of the deformity allowed relaxation of the collagen & atraumatic remodelling of the joint surfaces without fibrosis or scarring which usually occurs from surgical release. He noticed that the idiopathic clubfoot is severely supinated, but the forefoot is still adducted & pronated relative to the hindfoot, which is in varus & in equinus. The basic four deformities include cavus, adductus, varus & equinus. To stretch the ligaments & gradually correct the deformity the foot is manipulated for 1 to 3 minutes & plaster cast is applied from toes to upper third of the thigh with knee at around 90° flexion. Gradual correction of deformities is noted as discussed earlier. Here the key is allowing the calcaneum to abduct freely under the talus & evert to neutral position without pressure on the heel [9]. Several studies have found the efficacy of this technique [10]. After

correction the maintenance is equally important & needs adequate bracing. Various foot abduction orthoses such as Dennis Brown splint, Steenbeek foot abduction orthoses & Dobb's brace have been suggested as essential orthotic management for prevention of recurrence [11].

We in our institute evaluated 38 patients with 50 feet to note the efficacy of ponseti technique in treating idiopathic CTEV. Of them 30(79%) were males & 8(21%) were females. Kite in his series of 1509 cases has reported 70% males & 30% females which is comparable to our study [11]. In Turco's series of 468 patients 71.36% were males & 28.63% were females [12]. This is to understand that CTEV is common among male children. We noted 26 children had unilateral involvement while 12 had bilateral feet involved. However Chung [13] observed 50% bilateral involvement & Turco's noted 56% bilateral involvement which is contradictory to our study. However the size of our study is small compared to their large series. All the patients selected were within 12 months & initial ponseti casting also took younger children < 12 months. The initial pirani scoring was 5-6 comparable to ponseti study. Average no of casts ranged from 4-11 comparable to RH Chavadki *et al.*, [14]. An average duration of 2.5 months for treatment was reported by Stephen MD in 37 patients comparable to our study of 2 months average duration of treatment for 38 patients. Percutaneous tenotomy done in the first few months of life has been shown by Cooper & Dietz to have no negative long term effects on muscle strength & complete regeneration of the tendon [4]. Zibler reported poor follow up results in 75 patients in whom he treated with kite's technique. He noted only 10% responded to kite's conservative line of treatment & the rest needed surgery [9]. Use of long casts is a must in CTEV to hold the foot abduction & prevent slippage of casts. Kite used below knee cases in <12 months old children [9]. Aronson & pushkarisch studied that patients treated with cast & only heel cord lengthening had least disability with full range of motion without pain as compared to those who underwent PMR with reduced plantar flexion & diminished push off strength [15, 16,17]. Ponseti also noted a relapse of 35% in his cases after 3 years of follow up & advised tibialis anterior tendon transfer [4]. However we did not come across the same. Derotation splinting after the cast correction seems to be crucial to avoid relapse of the deformity. Bensahel *et al* and others from France have also described a conservative technique to treat CTEV. It needs well trained physiotherapists with daily serial manipulations & strapping [18]. However it is a lengthy procedure,

cumbersome, costly with relatively low success rate compared to ponseti technique [19].

Conclusion

To conclude from our small series of 38 patients with idiopathic congenital talipes equino varus deformity, correction with ponseti technique offers a easy, simple, effective & economical method of treatment. The first 3 weeks of the newborn is the golden period which offers good correction of deformity with minimal complications. Treatment started later in the life needs

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