ORIGINAL ARTICLE

Effectiveness of Ponseti Technique in Children with Bilateral Neglected Clubfoot: A Case Report on a 7 Years Old Child

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ABSTRACT

The case is about a male 7-year-old child who was referred to our Ponseti clinic in Lady Reading Hospital for bilateral neglected clubfeet management. The patient was assessed through Pirani assessment form for club foot severity. This patient was treated through Ponseti technique and as a result the Patient went through serial casting in the LRH-MTI Club foot clinic. Tenotomy was also performed for achieving maximum desired correction. At first visit before cast the Pirani score for both feet was 6/6 and after first cast the Pirani score was reduced to 5/6 bilaterally while after 2nd cast Pirani score dropped to 4/6 for the right foot and for the left the score was 5/6. Assessment after 3rd cast revealed that Pirani score reduced to 3/6 for left side and 2.5 for right side while on 4rth cast the Pirani score was 1.5/6 for both side. After removal of the fifth cast the Pirani scoring was, 1/6 for right side and 1.5/6 for the left side. Patient was progressed to tenotomy and the Pirani score interestingly dropped to 0/6 bilaterally. Patient X was then progressed to the preventive phase.

Key Words: *Clubfeet, CTEV, Dennis brown splint neglected,Ponseti, Serial casting.*

Introduction

Clubfoot was first depicted in ancient Egyptian tomb paintings.[1] Congenital Talipes Equino Varus (CTEV) or clubfoot is a common structural congenital deformity in which affected children have abnormal bone structure in their ankle having four components equinus, hind foot varus, fore foot adduction and cavus or medial subluxation of navicular bones.[2,3] Neglected clubfoot comprises feet that had not been treated in the past.[4] Clubfoot incidence varies from about 1 in 1000 live births with approximately 50% of cases bilateral. In clubfoot male to female ratio is 2.5:1 and 24.4 % have family history of idiopathic talipes equino varus.[3] When untreated it can affect patient's mobility, productivity and cosmetic look.[5] Neglected clubfoot deformities in older children is considered a difficult surgical problem as the foot in these patients is stiff with some amount of pain and almost always had already undergone some surgical intervention.[6] Clubfoot treatment was described in India as early as 1000 B.C. The first written description of clubfoot was given to us by Hippocrates (circa 400 B.C.). He described methods for manipulative correction remarkably similar to current non-operative methods. Hippocrates treated clubfoot as soon as possible after birth. His technique involved repeated manipulations of the involved foot with his hands, followed by the application of strong bandages to maintain correction.[7] The next description of repeated stretching comes from Arcaeus, who in 1658 wrote a chapter on the treatment of clubfoot where he describes his stretching technique as well as two mechanical devices for maintaining the correction.[8] In the mid-18th century, Scarpa introduced his treatment which included forceful manipulation, not gentle stretching, and application of a complicated mechanical device, later known as Scarpa's shoe. His treatment method was never successful in other hands and for that reason was not widely accepted.[7] In the year 1806, Timothy Sheldrake published an essay entitled *Distortions of the Legs and Feet of Children.* Sheldrake used bandages like Hippocrates, and claimed that most of his patients could be cured in two to three months.[1] In 1823, Delpech performed subcutaneous tenotomy of the Achilles tendon in two patients with acquired talipes equinovarus.[9] Kite then became the leading advocate of the conservative treatment of clubfoot for many years in the early and mid 1900's.

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Funding Source: NIL; Conflict of Interest: NIL
Received: Jan 12, 2018 ; Revised: Sept 14, 2018
Accepted: Sept 15, 2018

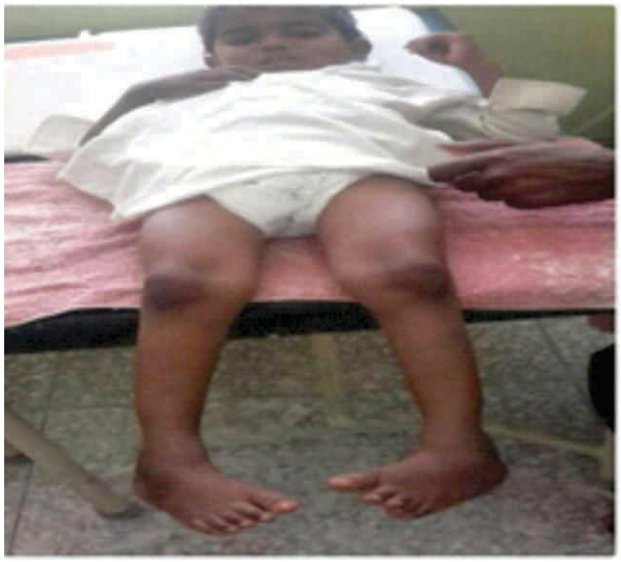
He continued the meticulous clubfoot cast application and molding that he had learned from Hoke. Kite corrected each component of the deformity separately instead of simultaneously. It was through his attempt to understand the pathophysiology of clubfoot, as well as his ability to learn from the mistakes of his predecessor, that Ponseti developed his current method of treatment for clubfoot. His understanding of the anatomy of the tarsus of the normal foot and of the clubfoot was greatly enhanced by the work of Farabeuf's *Precis de Manual Operatoire*, first published in 1872.[10] Since 1996, however, the non-surgical Ponseti method of correction has become increasingly popular.[10,11] Initially reserved for early correction of uncomplicated idiopathic patients, today the Ponseti method is being adapted for complex non-idiopathic patients and for patients presenting up to and beyond 2 years of age.[12] Widely implemented in high-income countries, the Ponseti method has been described as highly suitable for healthcare settings with scarce resources and is being increasingly used in low and middle income countries as well.[13]

The Ponseti technique is flexible because it gives the opportunity to recast patients who lose their corrections.[14] Successful correction of club foot is reported in 90-98% of cases treated by Ponseti method. Ponseti technique consist of intervention phase and maintenance phase, intervention phase consists of serial manipulations and casting to correct the clubfoot deformity and percutaneous tenotomy of the Achilles tendon to correct the ankle equinus. Maintenance phase consist of wearing of foot abduction braces for 2-3 years to maintain the gained correction.[15]

CASE REPORT

Patient Characteristics

Patient X was a 7-year-old child and was referred to our Ponseti clinic for club foot management. The reason behind the neglect was economic status and family support. Later, on presentation to our Ponseti clinic his family was assured that his whole treatment will be sponsored by ICRC. Detailed examination was performed to identify the type of club foot and an associated effect on the body. It was observed that the patient was walking on lateral border of the feet, and forefeet were internally rotated. It was noticed that the hip joints were in slight internal rotation, knee joints in 10 degrees genu valgum and calcaneo-cuboid joint were very prominent. Pirani scoring chart and a clubfoot detail assessment form was used as standard parameters to find the severity of the clubfoot deformity. The Pirani score was 6/6 for both feet with slight rigidity in left foot. While assessing the cavus, it was found that the arch of the foot was higher than normal. While examining for Adductus, it was observed that in both feet the forefoot was abducted towards the midline. In detailed assessment it was noted that the heel of the patient was in varus and angled towards the midline. The foot was in equinus position.



Intervention

Patient was treated through Ponseti technique serial casting with minor surgery (tenotomy). Patient had six visits, went through 5 serial casts with a minor surgery after final cast in the following order

on the head of talus for both feet. Feet were held in press position for 8 seconds to stretch of abductor hallucis longus, tibialis posterior muscles and ligament. Manipulation force was maintained, and POP cast was applied for a week.

At the second visit Pirani score was reduced to 5/6 bilaterally. Patient developed minor skin irritation on medial side of the thigh in left side while the right side was normal. Manipulation was performed again with more stretch bilaterally on the abductor hallucis longus, tibialis posterior muscles to keep feet in little supinated position and maximum abduction. Again, cast was applied but this time the medial side of the cast on thigh of left side kept a bit low from the groin to give room to the affected area of the skin.

1st Serial cast:

Pirani score for both feet was 6/6. Treatment was started with 15 repetitions of manipulation

Left foot

Varus: present

Cavus: Present

Abductus (-30 to 70): -30

Equines®(-50 to 30): -50

Pirani Scores (Hind foot):

- Posterior crease: (1)
- Empty heel: (1)
- Rigid equines: (1)

Pirani Scores(Midfoot):

- Talar head coverage: (1)
- medial crease: (1)
- Curved lateral border: (1)

Total score= 6

Right foot

Varus: present

Cavus: Present

Abductus®(-30 to 70): -30

Equines®(-50 to 30): -50

Pirani Scores(Hind foot):

- Posterior crease : (1)
- Empty heel : (1)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (1)
- medial crease: (1)
- Curved lateral border: (1)

Total score= 6

On third visit Pirani score dropped to 4/6 for the right foot and for the left the score was 5/6. A relapse was observed in the left side due to the damage to POP cast. So the position given in the second cast got recurrent and no improvement was seen in left foot. The right-side foot improved with cavus and adduction corrected.

Manipulation was applied, and more stretch was applied to the abductor hallucis longus, tibialis posterior longus, flexor digitorum longus lateralis and counter pressure was applied to the head of talus for over correction of left foot, for the right side gentle force applied and same procedure done as left side. Cast was applied to maintain correction gained through manipulation.

2nd Serial cast:

Left foot

Varus: present

Cavus: Present

Abductus(-30 to 70): -30

Equines(-50 to 30): -50

Pirani Scores(Hind foot):

- Posterior crease : (0.5)
- Empty heal : (1)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (1)
- medial crease: (0.5)
- Curved lateral border: (1)

Total score= 5

Right foot

Varus: present

Cavus: Present

Abductus(-30 to 70): -30

Equines(-50 to 30): -50

Pirani Scores(Hind foot):

- Posterior crease : (0.5)
- Empty heal : (1)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (1)
- medial crease: (0.5)
- Curved lateral border: (1)

Total score= 5

Upon fourth visit we observed that there was a bilateral mild damage to the pop cast, but the feet position was same not much disturbed, only the toes were in mild adducted position. Old cast was removed, and patient was reassessed and amazingly the Pirani score was reduced to 3/6 for left side and 2.5 for right side with only adduction in big metatarsal in both sides feet.

Manipulation was performed, and pop cast applied, dyanacast applied over the POP cast for the maintenance of the position.

On arrival for of the patient X for the fifth visit position was assessed in dyanacast was found normal. Then the old cast was removed, and patient was reassessed. This time Pirani score was 1.5/6 for both side. We observed only Equinus bilaterally and

3rd serial cast:

Left foot

Varus: present

Cavus: mild

Abductus®(-30 to 70): -10

Equines®(-50 to 30): -30

Pirani Scores(Hind foot):

- Posterior crease : (0.5)
- Empty heal : (1)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (1)
- medial crease: (0.5)
- Curved lateral border: (1)

Total score= 5

Right foot

Varus: present

Cavus: mild

Abductus®(-30 to 70): 0

Equines®(-50 to 30): -30

Pirani Scores(Hind foot):

- Posterior crease : (0.5)
- Empty heal : (1)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (0.5)
- medial crease: (0.5)
- Curved lateral border: (0.5)

Total score= 4

4th serial cast:

Left foot

Varus: present

Cavus: corrected

Abductus: (-30 to 70): 0

Equines: (-50 to 30): -20

Pirani Scores(Hind foot):

- Posterior crease : (0)
- Empty heal : (1)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (0.5)
- medial crease: (0)
- Curved lateral border: (0.5)

Total score= 3

Right foot

Varus: corrected

Cavus: corrected

Abductus: (-30 to 70): 0

Equines: (-50 to 30): -20

Pirani Scores(Hind foot):

- Posterior crease : (0)
- Empty heal : (0.5)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (0.5)
- medial crease: (0)
- Curved lateral border: (0.5)

Total score= 2.5

only mild abduction limitation in left side. On the bases of the above observation on the fifth visit we decided that left side foot will need over correction in post tenotomy POP cast. Right side was only having equinus and empty heel so normal cast applied with maximum equinus release.

Previous POP cast observed which was normal so after removal of the cast the Pirani scoring was done which was, 1/6 for right side and 1.5/6 for the left side. Finally, it was decided to perform tenotomy for the patient X to gain the maximum desired correction.

After proper positioning, knife (BP Blade-15/11 size) was placed parallel to tensed tendoachillis approximately 1 cm above the insertion at calcaneus. Then blade was turned 90 degrees, perpendicular to the tendon. A cut was applied to the tendon from medial to lateral direction. A “POP” sound was felt after the release of the tendon. An additional 10 to 15 degrees of dorsiflexion was gained after tenotomy. POP cast was applied, and more abduction was given on the left side for achieving the best possible result.

Foot Abduction Brace

After 3 weeks the pop cast was removed and Pirani scoring was performed and interestingly the score was 0/6 bilaterally. Patient X was proceeded to another phase of treatment the preventive phase in which abduction brace “Dennis brown splint” was applied. Dennis brown splint was fixed in 70-degree abduction and 20-degree dorsiflexion.

5th serial cast:

Left foot

Varus: corrected
Cavus: corrected
Abductus (-30 to 70): +20
Equines (-50 to 30): -10

Pirani Scores(Hind foot):

- Posterior crease : (0)
- Empty heal : (0.5)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (0)
- medial crease: (0)
- Curved lateral border: (0)

Total score= 1.5

Right foot

Varus: corrected
Cavus: corrected
Abductus (-30 to 70): +20
Equines (-50 to 30): -10

Pirani Scores(Hind foot):

- Posterior crease : (0)
- Empty heal : (0.5)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (0)
- medial crease: (0)
- Curved lateral border: (0)

Total score= 1.5

Tenotomy:

Left foot

Varus: corrected
Cavus: corrected
Abductus: (-30 to 70): +30
Equines: (-50 to 30): -10

Pirani Scores(Hind foot):

- Posterior crease : (0)
- Empty heal : (0.5)
- Rigid equines : (1)

Pirani Scores(Midfoot):

- Talar head coverage : (0)
- medial crease: (0)
- Curved lateral border: (0)

Total score= 1.5

Right foot

Varus: corrected
Cavus: corrected
Abductus: (-30 to 70): +30
Equines: (-50 to 30): 0

Pirani Scores(Hind foot):

- Posterior crease : (0)
- Empty heal : (0.5)
- Rigid equines : (0.5)

Pirani Scores(Midfoot):

- Talar head coverage : (0)
- medial crease: (0)
- Curved lateral border: (0)

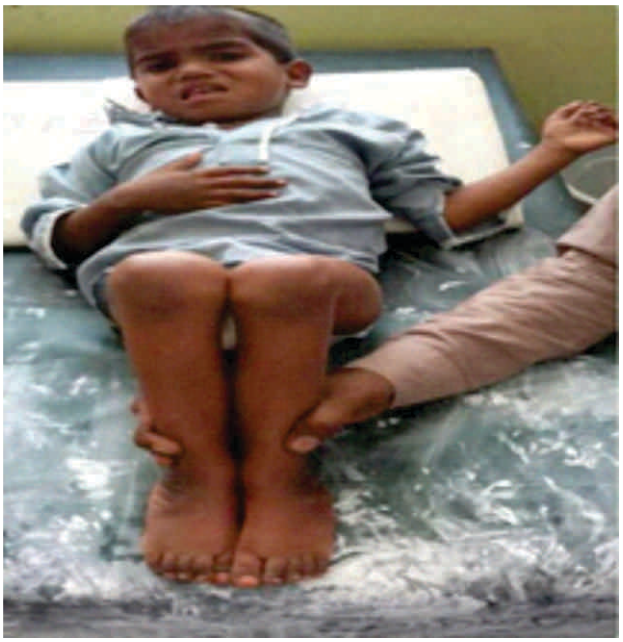
Total score= 1

Discussion

Club foot or congenital talipes equinovarus (CTEV) is one of the most common congenital musculoskeletal deformities.[16] CTEV patients have an inward rotation of the foot, with four components: cavus, forefoot adductus, hind foot varus treatments available can be conservative (such as splinting or stretching) or surgical.[17] It is important that to have a uniform system for diagnosis, classification and follow-up to gauge the success of treatment. Pirani's classification is simpler and more recent. Pirani scoring system has proved to be useful in Ponseti management of clubfeet. Pirani score is widely used in the prediction of tenotomy and number of casts required.[18] Ponseti technique consist of two phases, an intervention phase and a maintenance phase. The intervention phase consists of serial manipulations and casting to correct the clubfoot deformity and percutaneous tenotomy of the Achilles tendon to correct the ankle equinus. Maintenance phase consist of wearing of foot abduction braces for 2-3 years to maintain the gained correction.[6]

Ponseti techniques is proved successful around the world in both developed and developing countries.[19] A study on Ponseti clubfoot techniques reported that this technique has reduced the need for extensive soft tissue release and major clubfoot surgery, and has changed clubfoot operation patterns in Nigeria.[20]

Our study reported Pirani score as (Arrival 6/6, after 1st cast 5/6 bilaterally, after second cast left 5/6 and right 4/6, after cast third left 3/6 and right 2.5/6, after fourth cast 1.5 bilaterally and after fifth cast left



Post tenotomy picture

score was 1.5/6 and right 1/6. After tenotomy Pirani scoring was performed and interestingly the score was 0/6 bilaterally.

A retrospective study which reviewed 17 children (24 feet) with congenital idiopathic club foot who presented after walking age, clinically, 16 feet (66.6%) were considered to have a good result, with a plantigrade foot and no pain, without the need for further surgery. Dynamic supination was present in four feet, but caused minimal disturbance of gait.[12]

Another prospective study by Birhanu Ayana and Peter J Klungsoyr on 22 children aged 2–10 years that the midfoot was corrected to Pirani 0 in all feet after the casts and in patients up to the age of 4 years, hyper abduction up to 60–70 degrees was achieved in the final cast. In the older children, abduction was only possible up to 30–40 degrees.[21] A study on treatment idiopathic club foot through Ponseti reported that the mean Pirani score at presentation was: hind-foot contracture score 2.5 (2 to 3), mid-foot contracture scores 2.5 (2 to 3), and a total score of 5.0 (4 to 6). The mean Pirani score after treatment for the feet which responded to treatment was: hind-foot score 0.5 (0 to 1), mid-foot score 0 and a total of 0.5 (0 to 1). Tenotomy was required in 85 (85%) of feet. A study from Brazil by Laurenco et al. (2007) has also reported successful results in 17 children having average age of 3.9 years.[12] In under developed countries, studies have shown good results of Ponseti techniques in the neglected club feet children. Sufficient deformity correction was gained in age ranging 1.5 years to 4 years children in a study conducted in Malawi.[22] A study conducted in Istanbul, TurkeY favors the results of our study, reported the efficacy of Ponseti technique using Pirani score in children aging more than 20 months.[23]

It is concluded that Ponseti method is safe and effective in managing children with neglected clubfeet. The Ponseti method markedly reduces the need for the operative treatment and the complications associated with operative treatment. In the developing world, where most neglected clubfeet occur, strategies should be formulated to reach every child with clubfeet for early intervention. Hospitals should make it mandatory to perform feet assessment after child birth and to guide the parents about clinics performing clubfeet management through Ponseti technique.

Recommendation

We recommend the use of Ponseti technique in older children with neglected clubfeet. Ponseti technique is safe and effective and it should be the treatment of choice for patients with both early presentation and neglected clubfeet.

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