**ORIGINAL ARTICLE**

# Results of Ponseti Technique in Treatment of Idiopathic Club Foot Deformity Our Experience and Early Results

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## ABSTRACT

**Aim:** To evaluate the results of the Ponseti technique for treatment of Idiopathic Club foot deformity.
**Methods:** 45 children, 32 male (71.11%) and 13 female (28.88%) were selected for study which was conducted from June 2010 to December, 2013 at Allama Iqbal Memorial Teaching Hospital, Sialkot. 28 children (62.22%) had bilateral deformity and 17 children (37.77%) had unilateral deformity. Total 73 feet had treatment using Ponseti Gradual Casting Technique. Total 5 to 8 cast with an average of 5 cast were applied to each feet for a period of 2 weeks except for the last cast when tendoachillestenotomy was done, was applied for three weeks. The assessment was made using the Pirani Scoring scale in all children.
**Results:** The duration of study was 3.5 years with an average follow up of 2.2 years in all children range 2 to 3 years. The total number of cast applied to each feet range between 5 to 8 with an average of 5 cast per feet. The mean Pirani score at the beginning of the treatment was on average 5.3 while at the end of the treatment it was 0.5. We were able to achieve excellent results in 58 feet (79.45%) whereas 15 feet (20.54%) had poor results with recurrence of deformity,out of which three feet (4.10%) responded to cast treatment again, 7 feet (9.55%) required TA-Transfer to lateral cuneiform and five feet (6.84%) require posteromedial release. Tenotomy was required in 60 feet (82.19%). We achieved excellent results in 58 feet (79.54%) whereas 15 feet (20.54%) have poor results requiring either re-casting, TA transfer or posteromedial release.
**Conclusion:** We reached to the conclusion that Ponsetitechnique is a simple, safe and cost effective method of treatment that works in our resource challenged situation.
**Keywords:** Idiopathic Club foot, Ponsetitechnique, Pirani Scoring Sign Scale.

## INTRODUCTION

Congenital idiopathic club foot deformity is a complex foot deformity in an otherwise normal child. It consists of four components; cavus of mid foot, aductus of forefoot, varus of hind food and equinous of the hind food. This deformity can be remembered by the mnemonic (CAVE).

Club foot has been an unsolved clinical challenge for orthopaedic surgeons. The problem is more serious in developing countries on account of poor socio economic conditions, late presentation, superstitious beliefs and high rate of drop out due to illiteracy.

There are different surgical modalities described in the literature from bandage by Hippocrates and plaster cast by Kites to surgical treatment. Yet there is no surgical modality that claims of achieving the ultimate goal of treatment; i.e. to achieve functional, pain free, plantigrade foot with good mobility and without calluses[5,20,21,22].

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Most orthopedic surgeons agree that initial treatment should be non surgical and should be started as soon as possible (treatment of club foot should be started as soon as the foot comes out of breach presentation). Although success with nonsurgical treatment has also been reported, the results have not always been encouraging with many cases of partial correction, reoccurrence and other complications. Those children who underwent surgical correction may develop surgical scaring, residual pain, joint stiffness and sometimes over correction[15,16,17,18,21,23].

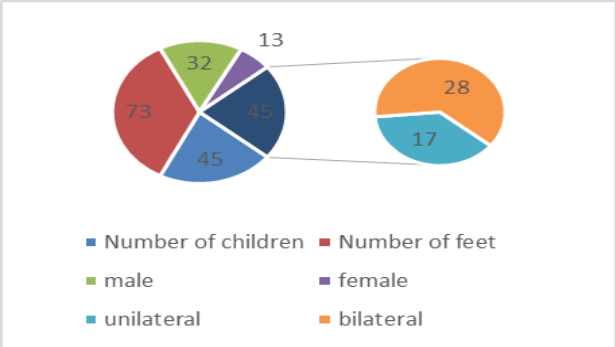
The Ponseti Method is a manipulating technique that corrects the CTEV deformity without invasive surgery. It was developed by Dr. Ignacio Ponseti of the University of Iowa, USA in 1950. But it remained an obscure method until popularized by great American orthopaedic surgeon Prof. Dr. John Herzenberg from University of Maryland Sinai hospital Baltimore USA. This technique involves a series of manipulations, casting, percutaneous Achillistenotomy and bracing. This technique is based on the inherent properties of connective tissue, cartilage and bone, which respond to proper mechanical stimuli created by gradual reduction of deformity. The ligaments, joint capsules and tendons

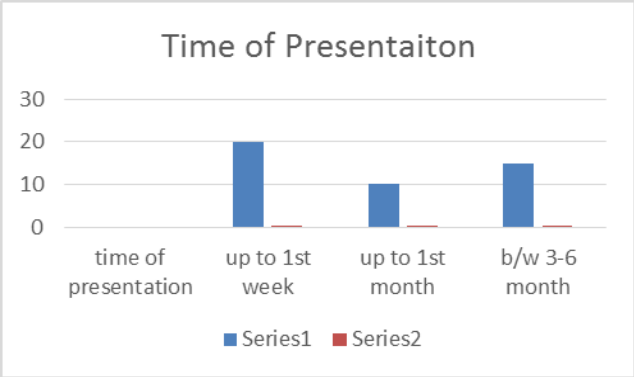
are stretched under gentle manipulation. The plaster cast is applied after each manipulation in order to maintain the correction. Displaced bones are brought into corrected position and are remolded. Ponseti claims to avoid open surgery in 89% of cases by using this technique of gradual manipulation, casting and limited surgery[18,19,20,21,22,24].

Cooper and Dietz reviewed Ponseti's cases with an average, 30 years of follow up and found that 78% had achieved long term excellent or good functional and clinical out come compared with 85% in the control group without congenital foot deformity. Many other authors have also reported 85 to 95% clinical success using this method. Our aim was to study the effectiveness of Ponseti technique in the management of Clubfoot deformity according to our circumstances in Pakistan using the Pirani severity scoring system[4, 23].

## MATERIAL AND METHODS

The study was conducted at Allama Iqbal Memorial Teaching Hospital, Sialkot from June 2010 to December, 2013. Total number of children included in the study were 45, out of which 32(72.11%) were male and 13(28.88%) were female. 28 children (62.22%) had bilateral deformity and 17 children (37.77%) had unilateral clubfoot deformity. Total 73 feet were included in the study which were referred to our hospital from BHU, RHC, THQ and general practitioners for management. Follow up ranged from 6 months to 3.5 years with an average follow up of 2.2 years. Children with the age of 5 months to 2 years were included in the study having idiopathic clubfoot deformity; whereas children more than 2 years old, already operated for clubfoot, secondary clubfoot and those having associated congenital deformities, syndromes, or neurological lesions were excluded from the study. Detailed medical history and physical examination along with initial routine blood tests were done to rule out accompanying medical or surgical problems.



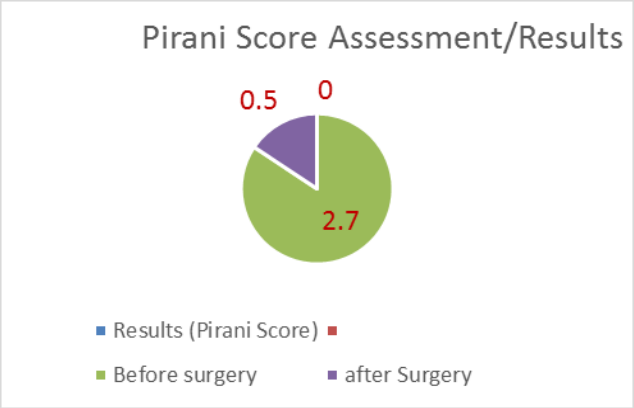



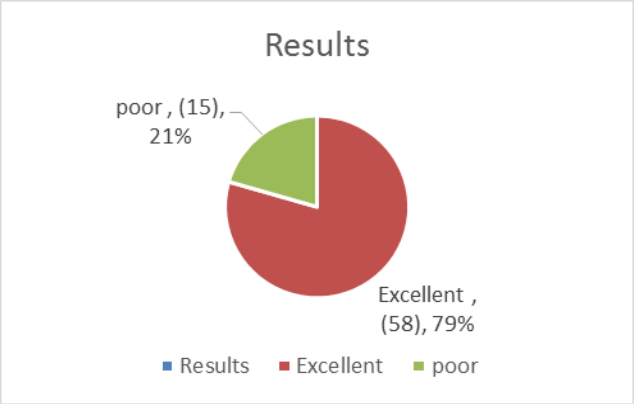

Every clubfoot was evaluated and graded according to the six point Pirani assessment scale.The hind foot contractures were assessed with respect to posterior crease, empty heel, rigid equinus deformity and Mid foot contracture score was assessed with respect to medial crease, curvature of lateral border of foot and lateral part of head of talus. Assessment was made before the start of treatment and after every cast removal untillthe final cast and also in maintenance phase with AFO brace during each follow up visit. Serial manipulation casting was done every two weeks.In the first cast cavuswas corrected and then forefoot adduction and varus was corrected and lastly rigid equinus deformity was corrected in all children. Final cast was applied for three weeks in all children who underwent aseptic Achilles tenotomy and the foot was placed in $15^0$of dorsiflexion and 70 degree of external rotation. Total number of casts applied were 5 to 8 with an average of 5 casts per feet. Final Pirani score was assessed in every patient at the end of treatment phase and also after maintenance phase. During maintenance phase the foot abduction arthrosis (FAO) was applied with advice to wear it full time i.e. 23 hours a day for three months then 16 to 22 hours a day for another three months,then at night and nap time for 14 to 16 hours a day for several months followed by night time only untill the age of 4 years. The results were evaluated for correction of deformity, number of casts applied, the need fortenotomy of tendoAchilles, relapse of deformity and possible further surgery whether require TA transfer or posteromedial release.

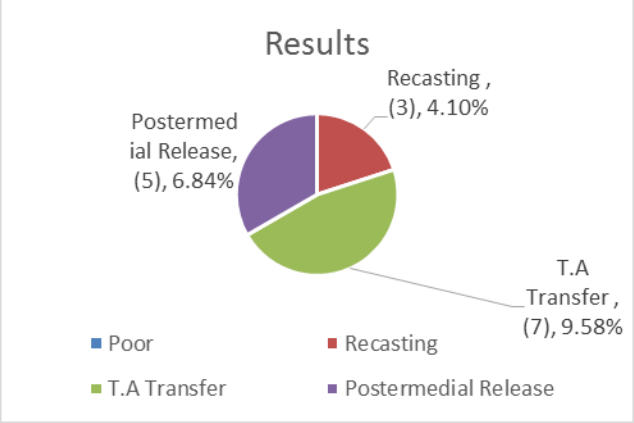
## RESULTS

Total 45 children, 32(71.11%) male and 13(28.88%) female, 28 children 62.22% with bilateral and 17 children (37.77%) with unilateral idiopathic clubfoot deformity, with a total of 73 feet were treated by Ponseti technique in Allama Iqbal Memorial Teaching Hospital from June 2010 to December 2013. 20 cases (44.44%) presented with in first two weeks of

birth, 10 cases (22.22%) after one month and 15 cases (33.33%) after three to six months of age.




The mean Pirani score at presentation for the hind foot contracture was 2.7, (2 to 3) and for the mid foot contracture was 2.6, (2 to 3) with a total score of 5.3. The mean Pirani Score at the end of treatment in 58 feet (79.45%) was for hind foot score 0.5 and for midfoot score it was 0.5. 15 feet (20.54%) had recurrence of deformity out of which 3 feet (9.16%) responded to recasting, 7 feet (9.58%) required transfer of tibialis interior to lateral cuneiform and 5 feet (6.84%) requiredposteromedial release. The total number of casts were 5 to 8 with an average of 5 casts per feet. Each cast was applied for two weeks except the last cast which was applied for three weeks after doing tenotomy. Tenotomy was done in 60 feet (82.19%) whereasin 13 feet (17.80%) tenotomy was not done. The follow up ranged from 6 months to 3.5 years with an average follow up of 2.2 years. The problems in the poor response group were failure to use brace according to given protocol and also superstitious beliefs of the family. We achieved excellent results in 58 feet (79.48%) and poor in 15 patients (20.54%).

## DISCUSSION

The treatment of club foot has been evident from as early as Egyptian painting. In those days the foot was manipulated with Thomas Wranch and casting which caused fracture of several bones in the feet.

CTEV deformity is a complex deformity of the foot and its treatment has been challenging for orthopedic surgeons. It requires meticulous and dedicated efforts not only on part of the treating surgeon but also by the parents for maintenance of correction. Even welltreated club foot can end up with poor result if parents donot follow the instructions of the treating surgeons. The method of serial manipulation and casting was developed by Ponseti in order to achieve plantigrade functional club foot without the need of major surgical interventions. The guideline regarding patient selection and treatment protocol varies between different investigators but in general treatment should be started shortly after birth. [3, 8, 14, 23]

There are different casting technique which have been described in the literature. Kite's in 1964 illustrated his method which has been followed by majority of orthopedic surgeons treating club foot deformity. He recommended abduction of fore foot against pressure at calcaneocuboid joint. Ponseti described this maneuver as Kite error because it blocked the correction of hind foot varus and internal rotation. He recommended that thumb should be placed at the head of the talus instead of calcaneocuboid joint[11,12,18,19].

Zimbler reported poor long term results in 75 patients (90 feet) treated by Kite'smaneuver and stated that only 10% of children have successful treatment whereas the remaining require surgical interventions[30].

The number of casts per feet in our study ranged from 5 to 8 (average 5). We noted that those children who presented earlier with a Pirani score of upto 4 required less number of casts whereas those having Pirani score more than 5 require more number of casts. Ponsetiet al in his series reported 5 to 10 casts (average 7.6). In another study by Laavege et

al the mean number of casts during treatment was7. Morcuende reported that 90% patients requires upto 5 casts only. Many authors have changed plaster casts with shorter interval but this was not possible in our study because of shortage of time and facilities. We noted that at the end of the study the number of casts per feet decreased and this was probably because of the reason that we mastered the technique[10,13,16].

Ponseti et al in their series reported 5 to 12 weeks duration of casts (average 9.5 weeks). Laaveg et al reported average duration of 8.6 weeks. Morcuendeet al reported an average time from the first cast to tenotomyof 16 days for one group and 24 days for another group in the same study. He stated that the duration of cast can be decreased using weekly accelerated Ponseti protocol. Another factor to consider during casting is whether to apply above knee cast as recommended by Ponseti or to below knee cast as recommended by Kite and Zimbler in children younger than 12 months of age. Although before this study we have been using Kite's technique by applying above knee cast as we experienced that below knee cast is not suitable for holding abduction and should be avoided[13,16,18,19,21].

In our series tenotomy was required in 60 feet (81.9%) of cases and these patients had Pirani score of more than five (average 5.4) which shows that tenotomy is indicated in patients having initial severe club foot deformity. Cooper and Dietz have shown that percutaneous tenotomy of tendoachilis performed during the first few months of life is a benign procedure with no long term effect on muscle strength. HoweverDobbset al reported bleeding and damage to neurovascular bundle during tenotomy which requires open exploration, ligation of artery and primary repair of nerve. Pirani carried out tenotomy in over 90% of his club foot patients. Laavege et al did tenotomy in 78% cases[6,13,18,19,25,28].

Various techniques of posteromedial soft tissue release for resistant clubfoot have been reported in literature by Mckay, Turco, Green and Hutchins and excellent to good results have been achieved in 52% to 91%of cases. However most of these cases hadrelatively short followup ranging between 2 to 8 years. The long term results have been disappointing with increasing pain in foot and disability has been reported by Green et al and Hutchins. The short medium term complications of postromedial soft tissue release range from simple wound infection to distal necrosis, over correction, loss of correction and even relapse has been reported by Aplington and Turco. Long term complications include stiffness and weakness leading to premature arthritis, Aronson et all, Kite et al. In our study five patients (6.84%) requiredpostromedial release and their immediate short term results were excellent but we cannot comment about the long term outcome due to short duration of follow up in our study[1,2,7,9,12,17,27].

Transfer of tibialas anterior to lateral cuneiform was performed in 7(9.55%) patients who had residual fore foot adduction deformity. Ponseti reported this in 35% of his patients older than 2.5 years. In our series 15 feet (20.54%) had relapse of deformity and we noted that this was due to poor compliance of brace application in the maintenance phase of treatment.Thakeret al reported that compliance with the foot adduction arthrosis is the key to success for Ponseti's technique[26,27].

Although we are unable to document the long term results of Ponseti's method due to lack of facilities like MRI for every feet but our clinical short term results are encouraging. We believe that Ponseti's method is simple, safe and effective method of treatment especially in developing countries. In low socio economic patients it is the gold standard of treatment. We must trainthe young orthopaedic surgeons, senior trainees, fellows, senior staff nurses and physiotherapists to practice this technique in order to give maximum benefit to the community.

## CONCLUSION

We reached the conclusion that Ponseti's technique is simple, safe, cost effective method of treatment without any serious complications and should be adopted as the first line of treatment in the management of Idiopathic congenital clubfoot deformity.

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