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## Ponseti Technique in clubfoot treatment, tertiary center in Riyadh, Saudi Arabia

Mazen Abdullah Alhunaishel<sup>1</sup>, Faris Essa Ahmed<sup>2\*</sup>, Nawfal Alogayyel<sup>3</sup>, Saleh Mohammad Alosimi<sup>4</sup>, Abdullah Aljarboa<sup>5</sup>, Mohammed Abdullah Alomair<sup>6</sup>

<sup>1</sup> Consultant Orthopedic Surgery, King Abdulaziz Medical City, Riyadh, Saudi Arabia.

<sup>2</sup> Orthopedics Surgery, King Abdulaziz Medical City, Riyadh, Saudi Arabia.

<sup>3</sup> Medical Resident, Ministry of health, Saudi Arabia.

<sup>4</sup> Consultant Family Medicine, King Abdulaziz Medical City, Riyadh; Adjunct Professor of Family Medicine, KSAU-HS, Saudi Arabia.

<sup>5</sup> Medical student, College of Medicine, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia.

<sup>6</sup> Internal Medicine, King Abdulaziz Medical City, Riyadh, Saudi Arabia.

### Abstract

**Background:** Congenital Talipes Equino Varus (CTEV) is a common congenital foot deformity that is associated with long term disability. Treatment with Ponseti method has been successful especially for children who present early. We conducted this study between June 2008 and August 2019 at the King Abdulaziz Medical city, Riyadh and it was conducted to investigate the patterns of clubfoot deformity and adherence to ponseti treatment protocol among children with clubfoot deformity and to report the early and late outcome.

**Methods:** It was a retrospective study from one single tertiary institute and all patients were treated with the same surgeon. A total of 93 rigid club foot, age between 1 day to 5 years of both male and female were selected purposively to conduct this study. Face-to face interview method was adopted by using semi-structured questionnaire.

**Results:** Most of the children were boys. More than two third (69.7%) were in the age group less than 12 months. Study found 41 (44.1%) of our sample presented with both feet deformity, 29 (31.2%) had only right foot deformity and the rest of 23 (24.7%) presented only with left foot deformity. (76.3%) of our sample had typical idiopathic clubfoot deformity. The rest of 15.1%(14) and 8.6%(8) had neurogenic and Syndromatic underlying pathology respectively. The mean number of castings was 5 and mean duration of casting was 9 weeks. Majority (81.7%) of the parents were fairly adherent to the Ponseti protocol, where 18.3% reported poor compliance to the instructions for deferent reasons. The initial success rate of 97.9% was reached, with two feet (2.1%) diagnosed as a resistant clubfoot and eventually required posteromedial soft tissue surgery. With mean follow up of 39.1 months. 6 feet (4.4%) developed relapse but were treated with repeated Ponseti method, while 3.7%(5) required re-do TAL , and 3 feet(2.2%) developed late dynamic supination and was corrected by Tibialis Anterior Tendon Transfer to lateral Cuniform bone.

**Conclusion:** This study presents patients with Congenital Talipes Equino Varus (CTEV) deformity which was successfully managed by Ponseti Protocol. Many CTEV patients still present late for treatment. However, the Ponseti method remained very effective with very high initial success rate of 97.9%. Relapsed CTEV can still be treated successfully with repeat casting using the Ponseti method. Strict adherence to the Ponseti recommendations by both treating physician and parents is the golden key to the best final success rate.

**Keywords:** Pattern of Clubfoot Deformity; Adherence to Ponseti Treatment; Foot; Ponseti method; congenital; foot deformity; Tendoachillis Tenotomy.

\*Faris Essa Ahmed- Orthopedics Surgery, King Abdulaziz Medical City, Riyadh, Saudi Arabia; Tel: 0550225336; Email: Faris.e.ahmed@gmail.com.

## **1. Introduction**

Clubfoot is a complex, congenital deformity of the foot also known as ‘congenital talipes Equino Varus (CTEV)’ caused by the abnormal development of a baby’s bones, ligaments and muscles [1]. Clubfoot is characterized by equinus of the ankle, varus of the hindfoot, as well as cavus and forefoot adduction with associated atrophy of the calf muscles [2].

Visually, the foot affected by clubfoot appears to be twisted inwards and downwards. The foot will be shorter than a normal foot and the calf muscles of the affected limb will be smaller [3]. The deformity will feel ‘fixed’ – not able to be corrected manually and will not resolve on its own [4]. Clubfoot is a relatively common birth defect, occurring in about one in every 1,000 live births [5]. Approximately half of people with clubfoot have it affect both feet, which are called a bilateral club foot. It occurs in males twice as frequently as in females [1]. Clubfoot may occur as part of a greater syndrome or as an isolated malformation. A combination of genetic and environmental factors appears to be associated with the congenital clubfoot deformity. Its incidence varies with genetic background, gender and race [6-8]. Risk factors included family history, smoking during pregnancy, not enough amniotic fluid during pregnancy (oligohydramnios) may increase the risk of clubfoot. Getting an infection or using illicit drugs during pregnancy. These can increase the risk of clubfoot as well [9, 10].

Every year in Saudi Arabia an estimated 500 children are born with a clubfoot deformity which is approximately one of every 1000 children born in our country. Such deformity if left untreated, may lead to lifelong individual disability. This causes the children to grow up as burdens of the family and ultimately leads to significant poverty. For the neglected older children and adults, expensive reconstructive surgery is the only option for treatment with less success rate and outcome. However, younger children can be treated simply by the Ponseti Method, which is an effective, non-expensive applicable technique, with usually very good results [11].

Clinicians are constantly seeking for the most ideal option in the management of Congenital Talipes Equino Varus (CTEV), especially among infants.

Pirani score is considered one of the most simple and reliable, quick and easy classification system which determines the severity at the initial presentation and monitors the ongoing progress in the assessment and treatment of clubfoot [12].

## **2. Subjects and Methods**

### **2.1 Study design and setting**

The study was a descriptive retrospective study from one single tertiary institute and all patients were treated with the same surgeon. The study was conducted between June 2008 and August 2021 at the King Abdulaziz Medical city, Riyadh in outpatient department (OPD).

## 2.2 Sampling methods.

A total of 93 child with total of 136 foot who was diagnosed to have rigid club foot, in children age between 1 day to 5 years of both male and female were selected to conduct this study.

## 2.3 Data analysis

The collected data had converted into frequencies and percentage forms. After collecting information from primary source, data were processed and analyzed by following steps:

- Reviewed of collected data and information
- Sorted of revised data and information
- Analyzed for easy explanation

## 3. Results

### 3.1.Clubfeet characteristics:

Among 93 children with 136 club foot, we found about 60 (64.5%) were in boys and 33 (35.5%) were in girls. In case of age distribution, more than one third (38.5%) children were in age group 4 to 12 months, where second most (31.5%) were in the age group < 4 months and rest of (21.6%) and 8.4% children were in the age group 13-36 months and > 36 months respectively (Table 1).

**Table (1)** Socio-economic characteristics of the respondents.

Characteristics	Frequency	Percentage
<b>Gender</b>		
Boys	60	64.5%
Girls	33	35.5%
<b>Age</b>		
< 4 months	29	31.2%
4 to 12 months	36	38.5%
13 to 36 months	20	21.6%
>36 months	8	8.4%
<b>Site</b>		
Right	23	24.7%
Left	29	31.2%
Bilateral	41	44.1%
<b>Type</b>		
Idiopathic	71	76.3
Neurogenic	14	15.1
Syndromatic	8	8.6

Study found about 41 (44.1%) foot was in children with bilateral feet deformity, 29 (31.2%) children had only left foot deformity and rest of 23 (24.7%) children had right foot deformity. Based on the type of club foot underlying pathology, we found that more than two thirds 65(69.9%) of the feet had typical isolated rigid clubfoot deformity. The second highest was 17 (18.3%) foot for those who had neurogenic underlying pathology, and the rest of 11.8% had atypical Syndromatic rigid clubfoot deformity.

### 3.2. Nature of the treatment

All cases were treated in the same clinic strictly following ponseti recommendations. In relation to the duration of casting needed, we found, 15.1% (14) child required only less than 4 casts , while 71 child (67.3%) received 4-6 casts and the rest of children(8.6%) required more than 6 casts.

As per Ponseti recommendations all children were started on home stretching and Dennis Brown bracing for full time bracing in the first 3 months then all where shifted to part time bracing 12-hours/day after that aiming to continue bracing till age of 4 years with minimum bracing of 24 months. In our study the compliance of the family with bracing was evaluated where we found that 8.6% of patients did not complete the recommended bracing period while 19 child (20.4%) received only 12-24 months of bracing, 48child completed 24-36 months of bracing and only 18 child(19.4%) where able to complete bracing for more than 36month(Table 2).

**Table (2)** Nature of the treatment

Characteristics	Frequency(child)	Percentage
<b>Numbers of cast receiving</b>		
< 4 casts	14	15.1
4-6 casts	71	67.3
7-10 casts	8	8.6
<b>Duration of using Brace</b>		
< 12 months	8	8.6
12-24 months	14	15.1
24-36 months	53	57
> 37-48 months	18	19.3

### 3.3. Adherence to Ponseti protocol

Majority of our cases (79.6%) was taking their treatment regularly where 20.4% (19 child) reported that they were irregular in taking treatment. Only about 8.6% (8) children faced problem during receiving their treatment where 91.4% (85) child reported that they did not face any problem while receiving clubfoot treatment. In case of problems faced during plaster casting study revealed that 26.9% suffered from foot swelling after casting. Rest of 11.8% (11) and 9.7% (9) were facing pressure skin sore and plaster get off before next session . About 81.7% (76) of our sample end up with TendoAchillis tenotomy while 17 child 18.3% (17) was corrected completely by casting . More than half (52.7%) of parents followed the advice and exercise strictly where rest of 29% (27) and (18.3%) of parent`s compliance was ranging between fair and poor respectively. In case of the need for extra procedure , study found 5.9% (8 feet) required full job PMR with bone osteotomy, while 4.4% (6 feet) end up with re-casting and 3.7% , 2.9% & 2.2% required redo TAL, selective PMR and Tip Ant transfer, respectively (Table 3).

**Table (3)** Adherence to Ponseti treatment.

Characteristics	Frequency	Percentage
<b>Regular attending clinic</b>		
Regular	74	79.6
Irregular	19	20.4
<b>Problem faced during plaster casting</b>		
pressure skin sore	11	11.8
Swelling of foot	25	26.9
Plaster get-off	9	9.7
<b>Required TA (Tenotomy)</b>		
Yes	76	81.7
No	17	18.3
<b>Following advice and exercise and follow up (compliance)</b>		
Strictly	49	52.7
Fair	27	29.0
Poorly	17	18.3
<b>The Need for Extra Procedure(per foot)</b>		
Re-Casting	6	4.4
Re-do TAL	5	3.7
Tip Ant transfer(TAT)only	3	2.2
Selective posteromedial release(PMR)	4	2.9
Full job PMR with Cuboid Osteotomy+/- TAT	8	5.9

#### 4. Discussion

The choice of techniques for management of CTEV in infants has historically provoked much debate. Since 1998, there is an international swing towards conservative management possibly because the long term results of the surgical procedures are unpredictable [13]. In this paper we tried to show the outcome of Ponseti Technique for the management of an infant who presented to our tertiary center with CTEV. Our Management protocol was strictly following Ponseti recommendations with serial corrective casting +/- Tendo Achilis Tenotomy then to be fitted in Dennis Brown shoes and bar full time for total period of 3 months then it will be during sleeping time 12hours/day till age of 4 years.

In this study, the sample size was n= 136, at the period of interview 91.6 % children was below three years and only 8.4% was above 3 years. Among them 64.5% of our patients where boys and the rest where girls, the male: female ratio was 2:1 which is relative to another study 74% were boys and 47%

had bilateral involvement the male: female ratio is low in comparison with other studies that showed higher ratio (male: female 3:1) as the series of Esbjomsson et al[14], Cowell and Wein [15], and Yamamoto [16]. 44.1% of our patients presented with bilateral club feet, 31.2% with single left foot and the rest was presented with only right foot deformity, the percent of bilateral and unilateral presentation is almost identical to another study where 53% of the children had a unilateral involvement and 47% had bilateral involvement of Esbjomsson et al[14].

In our sample we found that 76.3% was Idiopathic club feet , while the rest upon presentation was having either neurologic spasticity in 15.1% or underlying syndrome like arthrogryposis or Larsen syndrome in 8.6%. all Syndromatic children and 9 of the neurologic patients presented with bilateral club feet.

In almost two thirds (67.3%) have taken 4-6 plasters based on the severity of deformity and their age upon presentation, the early the presentation the easy the correction with less number of plaster. Out of the 93 children 82.4% has taken <6 plasters, 65.2% of them where with age one year or less at presentation while 44.8% was at age more than one year.

The outcome showed clear relationship with various factors related to the initial presenting pathology, like the Age of the child upon presentation, severity of the deformity upon presentation, care at home and regularity of treatment etc. Among studied sample 81.7% required Tendoacillis Tenotomy (TA Tenotomy) immediately after the final corrective cast and before we started the bracing, while the rest was fully corrected by serial casting. With no significant difference in the long-term outcome between the two groups. All children with underlying pathology in our sample end up with TA tenotomy. In this study percentage of tenotomy and number of casts is higher among those patient who has started their treatment quite latter. The family compliance with clinic routine follows up and daily home stretching program and bracing in our sample was acceptable where 52.7% where fairly adherent , 29% their compliance was good and only 18.3% of our sample showed very poor compliance with our treatment protocol secondary to several factors which include social family issues , elder difficult child whose resisting the bracing , families from different far city and children who suffered from other medical issues.

Throughout our treatment protocol which include both casting and bracing stage, 25 foot presented with swelling in one of the follow up visit, 11 feet presented with different degree of cast pressure ulcer which required only local treatment with no need for surgery in any one of them and most of them where over the dorsal aspect of the ankle while we are correcting the equinus deformity aiming to avoid the need for TAT in the final cast; The rate of such problem was significantly reduced by bi-valving the cast after it dry off and elevating the dorsal half of the cast then hold it with another role of fiberglass. In 9 feet the

cast get off and reapplied again with good molding over the popliteal area. Retrospectively the well molded cast over the popliteal area significantly minimize the rate of recasting.

Although there is no universally accepted method of assessing outcome in CTEV the central aim is to restore the patient to the maximum functional ability in the use of the foot. Early commencement of treatment, proper manipulation was followed by cast and intensive follow-up during bracing & exercise. In the treatment of idiopathic clubfeet, the Ponseti method has been successful in reducing the need for major surgery. The purpose of this study was to evaluate the results of this method at our institution. Patients under three months of age with previously untreated idiopathic clubfeet were enrolled. All feet were rated for severity prior to treatment using Pirani scoring system. Outcomes at a minimum of two years were classified as good (a plantigrade foot with, or without, a heel-cord tenotomy), fair (a plantigrade foot that had or needed to have limited posterior release or tibialis anterior transfer), or poor (a need for a complete posteromedial surgical release) [17].

One hundred and thirty-six feet in 93 patients treated with the Ponseti method met the inclusion criteria. The patients were followed for an average of 4.3 years. The initial correction rates were 97.9%. Relapses occurred in 19.1% of the feet that had initially been successfully treated with the Ponseti method. 25% of the relapsed feet were salvaged with further non-operative treatment, but the remainder required operative intervention. At the time of the latest follow-up, the outcomes for the feet treated with the Ponseti method were good for 82%, fair for 12.4%, and poor for 5.6%. the most indicative factor for the recurrence was the poor compliance with protocol and the underlying syndrome. In Dr. Ponseti first published his results in 1963. Of the 93 feet treated, 71% had a good result, 28% had a slight residual deformity, and only 1 had a poor result [18]. The initial correction in many north American studies ranges from 90 – 100% which is comparable to our study which has initial correction rate of 97.9% [18]. The relapse rate in many studies between 5 – 10% but we have higher rates reaches to 20% so we need to closely observe any external variables that affect the outcomes [19].

## **5. Conclusion**

This study presents patients with Congenital Talipes Equino Varus deformity which was successfully managed by Ponseti Protocol. Many CTEV patients still present late for treatment. However, the Ponseti method remained very effective with very high initial success rate of 97.9% and reduce effort and the cost of treatment with better results and less residual deformities or recurrence while ameliorating the psychological burden on both the caregiver and patient's parents. Relapsed CTEV can still be treated successfully with repeat casting using the Ponseti method.

Strict adherence to the Ponseti recommendations by both treating physician and parents is the

golden key to the best final success rate. Finally, there is need to decentralize clubfoot treatment services away from referral hospitals to the people in the community through outreach programs.

## **5.1 Abbreviations**

CTEV: Congenital Talipes Equino Varus,

OPD: Outpatient Department ,

TA: TendoAchillis,

TAL: TendoAchillis lengthening

## **5.2 Conflict of Interest Statement**

The authors have no conflict of interests to declare.

## **5.3 Funding Disclosure**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## **5.4 Ethical Considerations**

Legal approval was taken from our research institute, King Abdullah International Medical research Center (KAIMRC). With fully secured confidentiality of patient records information.

## **5.5 Acknowledgements**

None



## 6. References

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