

## Success of Ponseti Method in Idiopathic Club Feet of <2 Years and 2-5 years of age – A Comparative Study

USMAN AHMED<sup>1</sup>, AYESHA SAEED<sup>2</sup>, MIAN MAQBOOL HUSSAIN<sup>3</sup>, MUMTAZ HUSSAIN<sup>4</sup>, ABDUL LATIF SAMI<sup>5</sup>, JAVED IQBAL<sup>6</sup>

<sup>1</sup>Senior Registrar Pediatric Orthopedics, The Children's Hospital and The Institute of Child Health, Lahore

<sup>2</sup>Assistant Professor Pediatric Orthopedics & Head of Department, The Children's Hospital and The Institute of Child Health, Faisalabad

<sup>3</sup>Medical Officer, Pediatric Orthopedics, The Children's Hospital and The Institute of Child Health, Lahore

<sup>4</sup>Assistant Professor Pediatric Orthopedics, The Children's Hospital and The Institute of Child Health, Lahore

<sup>5</sup>Head of Department, The Children's Hospital and The Institute of Child Health, Lahore

<sup>6</sup>Ex Head of Department, The Children's Hospital and The Institute of Child Health, Lahore

Correspondence to Dr. Ayesha Saeed, Email: [drayeshasaeed@gmail.com](mailto:drayeshasaeed@gmail.com); Contact No; +923334834738

### ABSTRACT

**Background:** The Ponseti technique is the gold standard for treatment of clubfoot. However, the data in walking children is still limited and results are ill defined.

**Aim:** We prospectively compared Ponseti method in clubfoot patients aged <2 and between 2 to 5 years in our local scenario.

**Methods:** A total of 40 patients were included in the study through non-probability purposive sampling. The patients were examined, classified (Goldner and Fitch classification) and demographic information was recorded. They were explained about the risk and informed consent was taken. In group A, patients were below 2 years of age while in group B, patients were between 2-5 years of age. Ponseti casting was performed by a designated team. Follow-up was done for 6 months from the correction of feet.

**Results:** We received 27(67.5%) male and 13(32.5%) female patients. The male to female ratio was 2:1. The mean age of patients in group A and B was 0.8±0.70 years and 4.3±2.1 years respectively. There was no statistical difference of severity of deformity of clubfoot in both study groups, p-value>0.05. In group A, 17 (85%) patients had success of procedure while in group B the success was achieved in 11 (55%) patients. The success rate was statistically significantly higher in group-A as compared to group B, p-value<0.001

**Conclusion:** Patient aged <2 years have significantly higher success rate as compared to patients aged between 2-5 years. So we recommend the Ponseti method as standard therapy in clubfoot management for patients with age<2 years and for correction of mild and moderate deformities in patients between 2 to 5 years.

**Keywords:** Clubfoot, Congenital talipes equinovarus, Ponseti method

### INTRODUCTION

Clubfoot or Congenital talipes equinovarus (CTEV) is the commonest musculoskeletal birth defect, with an incidence of 1 per 1000 live births<sup>1,2</sup>. It is bilateral in 50% of cases<sup>3</sup> with twice as male affected than females<sup>4,3</sup>. Untreated, these children may walk on the sides of their feet with inability to wear standard shoes and have significant limitations in mobility<sup>5</sup>. While most clubfeet are idiopathic, it can present secondary to neurological conditions (e.g., myelomeningocele), arthrogryposis or part of syndromes<sup>6-10</sup>.

The Ponseti technique is considered the "gold standard" for treatment of clubfeet. The efficient low cost procedure effectively reduces the need for surgery provided sufficient attention is paid to the details<sup>11</sup>. It is recommended to start ponseti casting, as early as possible after birth, to avoid surgery later<sup>12</sup>. The reported success rate by Ponseti technique initially is 100% but relapse may occur in 30% patients<sup>13</sup>. The relapsed feet may progress from a flexible state to rigid feet if not treated properly and become as severe in deformity as they were when treatment was started<sup>14</sup>. There is strong agreement in literature, that the primary reason for relapse is brace non-compliance<sup>12</sup>. Professor Ponseti has mentioned the efficacy of this method in children up to the age of two years<sup>15</sup>. Recently, different researchers have tried this method for relatively older children (DA Spiegel et al 2009) but the literature on this subject is relatively sparse. Inadequate or no treatment of clubfoot in developing countries has resulted in a high incidence of neglected clubfeet<sup>16</sup>.

Patients frequently present after optimal age of treatment described by Ponseti that is two years. At this time most orthopedic surgeons feel reluctant to treat these feet conservatively and resort to surgery, which is expensive and has complications<sup>17-19,1,16</sup>.

The purpose of this study is to compare the success of Ponseti technique in treatment of congenital talipes equinovarus in two groups comprising of patients less than two years and between two to five years of age.

### METHODS

This prospective cohort study was conducted in the department of orthopedics, The Children's hospital and the Institute of Child Health, Lahore after formal ethical approval from local Institutional Review Board. Non-probability purposive sampling was done. The calculated sample size was 20 clubfeet in each group, with 10% margin of error, 80% power of study taking magnitude of excellent outcome i.e. 89%<sup>20</sup> in <2 year group and 98% in 2-5 year age group<sup>21</sup>. The inclusion criteria was idiopathic clubfeet less than 5 years old including patient with relapsed feet. However, clubfeet with syndromes (e.g., arthrogryposis, Downs Syndrome), neurological conditions (myelomeningocele), patients with bilateral involvement and previously operated were excluded.

Patients were explained about the risk and informed consent was taken. The demographic information was recorded. All patients were examined by a standard team of clinicians who treated them with weekly ponseti castings. The patients were classified according to the deformity type (Goldner and Fitch)<sup>22,23</sup>. According to this classification severity of clubfoot can be graded according to the distance between navicular and medial malleolus into three categories. In normal feet this distance is between 19mm to 24mm.

- Severe: 0mm to 6mm.
- Moderate: 7mm to 12mm.
- Mild: 13mm to 18 mm.

Follow up was done for 6 months following correction of feet. In group-A a foot deformity was considered corrected when clinically 10° of dorsiflexion, 70° of abduction, neutral or slightly valgus heel, and a straight lateral border was achieved [24]. In group-B failure of correction was defined as an inability to achieve a plantigrade foot<sup>25</sup>.

**Ponseti Technique of Clubfoot Casting:** Dr. Ignacio Ponseti, after studying the pathoanatomy of clubfoot, devised a technique of his own, for clubfoot correction. He had been reporting consistent results since 1950, with reported rate of success around 90%<sup>26</sup>, but only recently did he receive the deserved recognition.

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In Ponseti technique, during application of the first cast it is imperative to elevate the first ray. This brings it in line with the hindfoot, reducing the cavus deformity and setting a stage for remainder of correction. During subsequent weekly castings all components of clubfoot are being corrected simultaneously the foot is gradually abducted, applying counter-pressure on the talar head. The last component which in the majority of cases stays uncorrected is foot equinus. To correct this, a percutaneous Achilles tenotomy is performed under local anesthesia<sup>27</sup> in outpatient settings. The last cast after tenotomy is removed after three weeks. Following removal of the last cast Dennis Browne shoes or a foot abduction orthosis is applied. Here 70° of external rotation is maintained for clubfoot and 45° for the normal side. This is worn for 23 hours per day for the initial three months and subsequently during night-time only up to the age of four years<sup>28</sup>.

In the older age group some modifications were made. Parents were trained to perform manipulation for about 10 to 15 minutes before each cast. Those children who were not compliant with abduction brace were switched to ankle foot orthosis (AFO). Failure was defined as an inability to achieve a plantigrade foot<sup>25</sup>. Relapse was defined as children needing another tenotomy or more extensive surgery after initial correction.

The data was analyzed using SPSS 16.0. Pearson Chi-Square or Fisher exact test were applied to observe associations between qualitative variables. A p-value of < 0.05 was considered statistically significant.

**RESULTS**

In this study there were 27(67.50%) male and 13(32.5%) female patients. The male to female ratio was 2.08:1. There were 22(55%) patients who had right side and 18(45%) patients had left side involvement. There was no statistical difference of involvement of gender and side in both study groups, p-value >0.05. The mean age of patients in group A and B was 0.80±0.70 years and 4.3±2.1 years respectively

According to severity of deformity (Goldner and Fitch)<sup>22,23</sup>, 3(7.50%) patients had mild, 20(50%) patients had moderate and 17(42.50%) had severe deformity of clubfoot.

In group A, 2(10%) patients had mild, 8(40%) had moderate and 10(50%) patients had severe deformity of clubfoot. In group B,

1(5%) patient had mild, 12(60%) had moderate and 7(35%) patients had severe deformity of clubfoot. However it was not statistically significant. A minimum number of 3 and maximum of 8 casts were applied to achieve correction in either groups. An average of 4 casts in group A and 5 casts in group B achieved correction. Success of procedure was seen in 28(70%) patients while in 12(30%) patients success of procedure was not achieved. In group A, 17(85%) patients had success of procedure while in group B the success was achieved in 11(55%) of the patients. The success rate was statistically significantly high in group-A as compare to group B, p-value < 0.001

Table 1: Comparison of Success of Procedure in Both Study Groups

Success	Study Group		Total
	Group A(< 2 Years)	Group- B(2-5 Years)	
Yes	17(85%)	11(55%)	28(70%)
No	3(15%)	9(45%)	12(30%)
Total	20(100%)	20(100%)	40(100%)

Figure 1: Severity of deformity of the patients

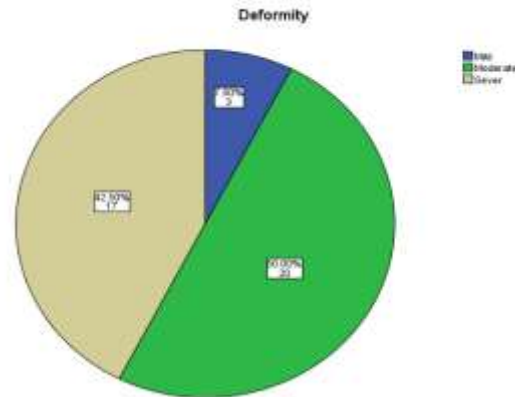


Table 2: Chi-test results

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.286 <sup>a</sup>	1	.038		
Continuity Correction <sup>b</sup>	2.976	1	.084		
Likelihood Ratio	4.435	1	.035		
Fisher's Exact Test				.082	.041
Linear-by-Linear Association	4.179	1	.041		
N of Valid Cases	40				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.00.  
 b. Computed only for a 2x2 table

**DISCUSSION**

Congenital Clubfoot or congenital talipes equinovarus is the commonest congenital musculoskeletal condition. Its etiology or pathogenesis is poorly understood. The less invasive regimen described by Ponseti has become the first line of treatment globally<sup>11</sup>. The advantages of this Method are high success rate and prevention and management of relapse. Ponseti recommended this method for children up to 2 years of age<sup>15</sup>. In developing countries like Pakistan a large number of children present well beyond this age. In managing them, the treating clinician usually resorts to some form of surgery. These techniques are time-consuming, costly and have a high rate of complications<sup>16,29</sup>. The aim of this study was to compare Ponseti method in local setup and evaluate its efficacy in older children (2 – 5 years).

In our study the gender ratio for male to female is described as 2:1 which is similar to Chesney et al<sup>4</sup>, though others have

reported it as 3:1 (Yamamoto et al,1979). The number of casts applied to achieve correction naturally increases in older children due to rigidity of deformity. In group A (i.e one day to <2 years) were 3 to 6 (average 5) which is consistent with literature (Anand et al, 2008) and in group B it was 3 to 10 casts (average 6) which is also similar to report by Spiegel et al in older children (1 to 6 years) where the mean number of casts were 7<sup>25</sup>.

It was observed that 70% of older patients (group b) visiting our centre came for the first time which highlights the lack of awareness and ignorance on the part of caregivers.

In group A tenotomy was required in 75% of cases (15 patients). Laaveg and Ponseti in their study reported this requirement in 78% of cases<sup>7,12</sup>. In group B a plantigrade foot was achieved in 13(65%) patients. In these cases only one patient avoided a tenotomy.

Morcuende et al in a study of neglected idiopathic clubfeet aged between 1 to 9 years reported that after treating patients using Ponseti technique, out of a total of 24 feet, 16 were

successfully treated and all these patients required a tenotomy (100%). In our study 19 (95%) older patients required tenotomy whereas 13(65%) patients were successfully treated. In younger patients 75% of cases (15 feet) underwent tenotomy<sup>15</sup>.

It was interesting to note that amongst group B patients 1 patient had mild deformity and here correction was achieved by 1 cast only. 12 patients with moderate deformity needed a mean of 5 casts to correct. All 7 patients with severe deformity where average of 8 casts were applied none were corrected. However in this group 12 patients were between 2 to 3 years age and 4 each between 3 to 4 and 4 to 5 years. Hence it can be opined that the age in older children is less important than the degree of deformity at presentation.

In this study it was seen that success was achieved in 85% of cases in group A. In another study the reported success rate was 98% (Morcuende et al, 2004). This treatment technique has radically decreased the need for extensive corrective surgery for congenital idiopathic clubfoot<sup>15</sup>. In group B the overall success was 55%. The important fact was that all the patients belonging to the "severe" variety in this group had a failure of correction with 10 casts (mean). In another study the reported success rate with Ponseti method in children aged between 1 to 9 years was 66.6%<sup>30</sup>. It is worth mentioning that the Ponseti method partially improved the deformity after cast application in the severe deformity group. Perhaps what was needed was an increased number of casts for correction. Also before establishing the upper limit for the number of casts applied, it needs to be established whether the advantages of cast applications outweigh the disadvantages of prolonged casting (e.g., osteopenia after prolonged casting). Also in the severe deformity category, perhaps partial correction can result in a decrease in the complexity of surgery ultimately required.

For group A the results are very encouraging. It can be said that this method is effective in our local setup. For group B the results show that Ponseti method can help achieve success in mild and moderate varieties of clubfoot, irrespective of age. As for the severe variety the number of cast for correction can possibly be increased after taking into account its pros and cons. Secondly in planned elective surgery for clubfoot casting can also help in achieving a relatively softer foot which can reduce complexity of the procedure ultimately performed for correction.

During the maintenance phase compliance with the use of orthotics is a key to good long term results especially the use of an AFO for a prolonged period in older children<sup>30,29</sup>. In a study lack of motivation was considered a barrier to compliance<sup>19</sup>. Proper counselling and education will help achieve a satisfactory outcome. On every follow up visit they have to be instructed repeatedly about orthotic compliance. They have to be reassured and briefed about the future course for ultimate long term success.

## CONCLUSION

The Ponseti method of treating clubfoot is very effective method in patients less than 2 years of age and for treating mild and moderate deformities in older children between two to five years of age. However further studies with large sample size and longer follow-up are needed to establish its role for severe clubfoot deformity in older age group. In a limited resource country like ours, this is an easy, efficient and economical method. Proper counselling of parents can assure orthotic compliance for the required period. Public health awareness campaigns can improve both delayed presentation and compliance.

**Conflict of interest:** All authors declare that they have no actual or potential conflict of interest related to this research project. The results of the study were neither presented in any conference/seminar nor published/ submitted in any other journal. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

**Limitations:** The limitations of this study are small sample size and short follow up.

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**Author contribution:** **UA:** major contributions to the conception, design, acquisition, analysis, interpretation of data for the study and drafting of the work. **AS:** substantial contributions to the design, interpretation of data for the study, drafting of the work and final approval of the version to be published. **MH:** substantial contributions to the conception, design, and interpretation of data for the study and final approval of the version to be published. **ALS:** substantial contributions to the conception, design, and interpretation of data for the study and final approval of the version to be published. **Ji:** substantial contributions to the conception, design of work, interpretation of data for the study and final approval of the version to be published.

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