Comparing The Outcomes of Patients with Congenital Talipes Equinovarus After Early Treatment (<4 Weeks Old) And Late Treatment (≥ 4 Weeks Old)

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Introduction: The Ponseti method is the standard of care for treatment of congenital clubfoot. It includes a series of manipulations, casts, and a percutaneous Achilles tenotomy, followed by use of foot abduction orthoses. Most literature suggests that casting should be initiated within approximately a week of age for best outcomes. The goal of this study is to determine if there are statistically significant differences between Pirani scores of patients who started Ponseti casting before 4 weeks of age and those who started between 4 weeks and 6 months of age. **Methods:** This retrospective study, approved by the Institutional Review Board (IRB), analyzed patient data collected from 2011 to 2021 at a tertiary children's hospital. Inclusion criteria encompassed patients with idiopathic clubfoot who received treatment using the Ponseti method and had a minimum of 1-year follow-up. Exclusion criteria included children with neuromuscular diseases or complex birth deformities, those over 18 years old, individuals previously treated for clubfoot at other institutions, and those with less than 1 year of follow-up. The study collected information on the number of Ponseti casts, severity of clubfoot deformity (assessed using the Pirani score), and the age at which casting began. Patients were categorized into two groups by age at the time of the first cast: Group 1 (< 4 weeks) and Group 2 (4 weeks to 6 months). The study's outcomes of interest included the number of casts required, recurrence rates, Pirani scores, bracing compliance, Child Opportunity Index (COI), and insurance type. The COI evaluates U.S. neighborhood resources and conditions affecting children's healthy development across three domains: Education, Health and Environment, and Social and Economic factors. COI scores were determined based on each patient's zip code, and patients were divided into two subgroups based on COI: very low or low, and moderate, high, or very high. Statistical analyses included unpaired nonparametric Mann-Whitney U t-tests and chi-squared or Fisher exact tests for categorical variables, as appropriate, with a significance threshold set at $p < 0.05$. **Results:** A total of 77 patients were included in this study, with 56 patients falling into Group 1 and 21 patients in Group 2. The initial Pirani scores, presented as Median (IQR), showed no statistically significant difference between Group 1 (5.5, 4.5-6.0) and Group 2 (5.0, 3.1-6.0) (p=0.2). Likewise, the final Pirani scores, presented as Median (IQR), were 0.5 (0.5-1.0) for Group 1 and 0.75 (0.1-1.8) for Group 2, with no significant difference observed (p=0.4). The total number of casts required, also presented as Median (IQR), amounted to 7 (5-8) for Group 1 and 5 (4-12) for Group 2, with no statistically significant difference between the groups (p=0.41). Furthermore, no significant differences were detected between the groups in terms of the need for TAL or the number of recurrences after casting. There were also no significant differences observed in the three Child Opportunity Index (COI) domains or insurance type, except for a significant distinction in total COI scores(Table1-3).**Discussion:** The results of this study revealed no significant differences among various crucial parameters, including the number of casts required for treatment, the rate of recurrence, Pirani scores assessed at the initial and final follow-up visits, the need for TAL (tendon-Achilles lengthening), and issues related to adherence with bracing. Additionally, when analyzing the Child Opportunity Index (COI) domains encompassing socioeconomic status, health, and education, as well as insurance type, there were no statistically significant differences observed. However, it is noteworthy that a significant disparity was detected in the total COI scores, highlighting variations in the overall opportunities and conditions affecting children's healthy development among different patient groups. **Significance/Clinical Relevance:** Our data suggests that delaying initiation of Ponseti casting by several weeks is unlikely to cause any detrimental effects. However, providers should still take into consideration that a lower COI score may affect treatment.

Table 1: Demographic and clinical treatment data between patients who underwent early and late treatment

	Early Treatment (< 4W) n= 85	Late Treatment (≥ 4 W) n=31	P value
Age at Initial Casting(Week), Mean (SD)	1.81± 0.90	17.79± 21.04	<0.0001
Gender, no. (%)			
Male	32 (57.1%)	14 (66.7%)	0.6
Female	24 (42.9%)	7 (33.3%)	
Total Number of Casts: Median (IQR)	7(5-8)	5(4-12)	0.41
Initial Pirani Score: Median (IQR)	5.5(4.5-6.0)	5(3.1- 6.0)	0.2
Final Pirani Score: Median (IQR)	0.5(0.5-1)	0.75(0.1-1.8)	0.4

Table 2: Clinical outcomes between patients who underwent early and late treatme

	Treatment		
	Early Treatment (<4 W) n = 85	Late Treatment (≥ 4 W) n = 31	P value
Recurrence- no. (%)			0.52
No	55 (64.7%)	18 (58.1%)	
Yes	30 (35.3%)	13 (41.9%)	
Achilles Tenotomy (TAL)			0.09
No	12 (14.1%)	9 (29%)	
Yes	73 (85.9%)	22 (71%)	
Fully Adherent to Bracing			0.29
No	48 (56.5%)	21 (67.7%)	
Yes	37 (43.5%)	10 (32.3%)	
Issues with Bracing			0.99
No	21 (24.7%)	7 (22.6%)	
Yes	64 (75.3%)	24 (77.4%)	
Skin Issues			0.09
No	68 (80%)	29 (93.5%)	
Yes	17 (20%)	2 (6.5%)	
Other Issues			0.63
No	25 (29.4%)	7 (22.6%)	
Yes	60 (70.6%)	24 (77.4%)	

Table 3: Child Opportunity Index scores and insurance type between patients who underwent early and late treatment

	Treatment		
	Early Treatment (<4W) n =56	Late Treatment (≥ 4 W) n = 21	P value
COI - Health, no. (%)			0.2
Low or Very Low	22 (39.3%)	12 (57.2%)	
Moderate, High, or Very High	34 (60.7%)	9 (42.8%)	
COI - Socioeconomic, no. (%)			0.13
Low or Very Low	41 (73.2%)	19 (90.5%)	
Moderate, High, or Very High	15 (26.8%)	2 (9.5%)	
COI - Education, no. (%)			0.56
Low or Very Low	41 (73.2%)	17 (81%)	
Moderate, High, or Very High	15 (26.8%)	4 (19%)	
COI - Total, no. (%)			**0.008**
Low or Very Low	41 (73.2%)	21 (100%)	
Moderate, High, or Very High	15 (26.8%)	0 (0%)	
Insurance, no. (%)			0.59
Public	35 (62.5%)	15 (71.5%)	
Private	21 (37.5%)	6 (28.5%)	