ORIGINAL ARTICLE

EVALUATION OF THE SEVERITY AND MONITORING THE PROGRESS OF TREATMENT OF IDIOPATHIC CONGENITAL TALIPES EQUINOVARUS BY PONSETI METHOD.

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Abstract

Introduction: Congenital talipes equinovarus (CTEV), commonly known as the 'club foot' is a developmental disorder of the lower limb that is related with socioeconomic difficulties. Ponseti method is considered as the most popular and successful method of treatment for CTEV children. This study was aimed to evaluate the severity and monitoring the progress of initial treatment of CTEV children. Materials and methods: Forty two patients with 58 idiopathic CTEV feet treated at a hospital outpatient clinic from January 2017 to February 2018 were included in the study. Ponseti method and Pirani score system were used and the results were calculated after wearing brace for three months duration at the end of serial casting. Results: The patients in the study were in the age range of 14 days to 12 months. The mean number of changing of casting was 7.2 times. Casts were changed 1.9 times more in the severe cases than mild cases. Thirty six (85.7%) cases needed percutaneous tenotomy. There was no need to perform tenotomy for the mild cases. The initial achievement rate was 90.5 % and there were 9.5 % relapsed cases because of incorrect wearing of the brace. Statistically significant score differences were seen before and after treatment (P-value <0.000). Conclusion: Ponseti method of treatment was not free from complications but there were no major problems. Ponseti method was observed to be useful and had good outcome in the treatment for CTEV children.

Keywords: Ponseti method, congenital talipes equinovarus, Pirani score

Introduction

Congenital talipes equinovarus (CTEV) is a very common congenital deformity of foot that occurs in 1 in 10,000 live births.[1] Normal feet deliver the static support for walking and running and also satisfy an important aesthetic function.[2]

There could be four deformities of the foot. There could be cavus deformity due to tightness of flexor halluces longus tendon and flexor digitorum tendon. Adduction deformity could be due to tightness of tibialis posterior tendon and intrinsic adductor muscles. Varus deformity of calcaneum and equinus deformity is due to shortening of tendon Achilles. CTEV is common in Myanmar and most of orthopaedic surgeons there preferred to do surgery for treating CTEV before Ponseti method was introduced. In developing countries, there are about 80 % of children with CTEV deformity living in rural area.[3]

For severity and monitoring the treatment of the CTEV, Pirani scoring system is useful. The Pirani system has six categories. The mid-foot deformities consists of curvature of lateral border of the foot, medial crease and uncovering of the lateral head of talus to navicular. Hind-foot categories are posterior crease, emptiness of the heel and degree of dorsi-flexion. Each deformity could have three scores contingent on the severity which are 0, 0.5 and 1. The normal foot has a score of 0 and the worse is 6. [4,5]

Ponseti method is a conservative treatment for clubfoot involving a gentle manipulation of the child's foot and the application of toe-to-groin casts. After casting phase is finished, foot-abduction brace is worn with or without tendon Achilles tenotomy. The treatment phase should begin as early as possible. The first cast is done to correct the cavus deformity only. The heel is never directly manipulated. The gradual correction of the hind-foot and midfoot are such that the heel will naturally move into a correct position. When adduction and varus of the calcaneum bone is corrected, the tight Achilles tendon may be cut with local anesthesia to correct the equinus deformity. Cast is applied for holding the corrected position for 3 weeks. After removal of cast, foot abduction brace is fitted, which consists of a pair of shoes attached to an adjustable bar at 70 degrees abduction and 20 degrees dorsiflexion. [6] Brace protocol is a major problem associated with relapse. Parents are strictly educated to be completely compliant with the brace treatment.[7]

The objective of the study is to evaluate the severity and monitor the progress of treatment of idiopathic CTEV by Ponseti method. This study was taken up because, to the best of our knowledge, there were no similar studies from the Myanmar region.

Materials and Methods

Our study was a hospital based prospective cohort study designed to evaluate the severity and monitoring success of treatment of CTEV children by Ponseti method. Forty-two patients of less than one year of age with 58 feet of idiopathic CTEV deformity from outpatient clinic of Yangon Children Hospital, university of Medicine I, Yangon, Myanmar were included in this study.

Inclusion criteria: Idiopathic CTEV, age under one year

Exclusion criteria: Syndromic CTEV cases, age over one year and recurrent CTEV cases were excluded from the study.

An informed written consent was obtained from the parent or guardian. Ethical approval was obtained from the University of Medicine ethics and research committee. Patients' bio-data, clinical examination and Pirani score at presentation were entered into a structured information sheet. According to the Pirani Score

system, the pre-treatment feet were divided into three groups, namely, severe feet with Pirani score of 6, moderate feet with Pirani Score of 5.5 and mild feet with score of 5.8

Technique

Ponseti method is divided into 2 phases. First, deformity was corrected by serial gentle manipulation and plaster of Paris (POP) casting and tenotomy if required. Then maintenance of correction deformity by wearing the brace 23 hours per day for 3 months duration was done.

There were 4 deformities of CTEV. They were cavus, adduction, varus and equinus. The first step was correction of cavus deformity. Then correction of adduction and varus and lastly the correction of equinus deformity was done.

Three minutes duration of gentle manipulation for stretching the ligaments, joint capsule and tendon was done. Then toe-to-groin POP cast was applied with knee flexed position in 90 degree. Consultant paediatric orthopaedic surgeons assisted by orthopaedic postgraduate students in the paediatric orthopaedic department offered treatment to all cases. Patients were allowed go back home after explaining to take care of POP at home. Patients were not required to be admitted in the hospital. After one week, patients came to hospital for removal of old POP cast. Then manipulation and changing of POP cast was done on a weekly basis till the correction was done. The patients' parents were educated on taking care of the POP at home.

First, one or two time correction was needed for correction of deformity of cavus. Placing the thumb over the lateral part of talar head and elevating the first ray of forefoot, POP cast was applied in this position. After one week, POP cast was removed at outpatient clinic.

Next, adduction was corrected by placing the thumb on talar head and reducing the navicular bone on talar head. Repeated correction and POP casting was done to get 70 degrees of abduction. When adduction and varus correction was achieved and dorsiflexion was less than 15 degree, percutaneous tendon Achilles tenotomy was done by local anesthesia with 1% lignocaine at minor operating theater at outpatient clinic. POP cast was then applied for three week duration after tenotomy. After three weeks, POP cast was removed and locally made foot abduction brace was worn. Patient must wear the brace for 23 hours a day for 3 months duration. The patients' parents were educated about the appropriate ways of wearing the brace as it was important that patient was wearing the brace correctly.

After 3 months, the patients were monitored with Pirani score system. The good result was Pirani score 0, fair result was Pirani score 0.5 and poor result was Pirani score 2.8

During the 3 months, those patients who did not wear the brace correctly and completely, got relapse of the deformity. The relapsed deformity was treated after 3 months follow up. Two of relapsed CTEV patients could be treated with repeated POP casting with Ponseti method. One adducted deformity case was treated with anterior tibialis tendon transfer. Achilles tendon lengthening was done for 1 equinus deformity case.

Results

Background of patients

Total 42 patients were involved in the study with mean age of 4.34 months (SD 3.46), showing that the youngest case was 0.5 months and the oldest case was 1 year. Among them,
17 (40.5%) were females and 25 (59.5%) were males.

Among the patients, 38.1% had deformity in the right foot, 23.8% in the left foot and 38.1% in both feet. Pirani score before treatment was 5.69 in average, showing minimum score as 5 and

maximum as 6. Pirani score before treatment was categorized into mild (5), moderate (5.5) and severe (6). Out of 42 cases, 24 (57.1%) were severe, 10 (23.8%) were moderate and 8 (19%) were mild. (Figure.1)

Number of POP cast changes and Tenotomy

The number of POP cast changes varied from 6 to 10. It was changed for 6 times in 10 (23.8%) patients, 7 times in 18 (42.9%) patients , 8 times in 10 (23.8%) patients and 10 times in 4 (9.5%) patients. Tenotomy was done in 36 (85.7%) cases.

Bonferroni test was carried out as a post-hoc test after ANOVA analysis. There were significant differences in number of POP cast changes between severe and mild cases and also between severe and moderate cases. POP cast changes were nearly 2 times (1.9 times) more in the severe cases than mild cases and it was 1 time more in severe cases than moderate cases. The differences were statistically significant as both p-values were less than 0.05 (CI=1.06, 2.77 for severe vs mild and CI=0.33, 1.01 for severe vs moderate). (Table.1)

Average score after treatment was 0.46
(SD 0.619) with minimum score 0 and maximum score 2. Those who showed good result was 18(42.9%), fair result was 19 (45.2%) and poor result was 5 (11.9%) (Figure 2).

Out of total 42 cases, tenotomy was not done in 6 cases of mild club foot cases and the rest of the cases went through tenotomy. Among the tenotomy cases, 2 (5.6%) were mild, 10 (27%) were moderate and 24 (66.7%) were severe club foot cases (Figure 3).

Highest percentage of good results were seen in mild cases (75%), followed by 40% of good result in moderate cases and 33.3% in severe cases. More poor outcomes were demonstrated among the severe cases compared to moderate cases, showing 16.7% and 10% respectively. However, association between severity before treatment and outcomes after treatment were statistically not significant (p-value>0.05). (Table 2)

Average Pirani score before treatment was 5.69 and after treatment was 0.46. Paired sample t test was carried out to find out any significant mean score differences in between before and after treatment. Statistically significant score difference was seen in between before and after comprising t=53.22, df = 41, p-value <0.000 (CI=5.028, 5.424) (Table 3).

Discussion

Of the study population, there was a male preponderance (1.4:1). It has been reported that CTEV is 2-2.5 times more common in males than females. The study of Cowell and Wein and Yammoto had showed a male and female ratio of 3:1. [9, 10]

In our study right foot and left foot ratio was 1.6:1. The right foot is being affected slightly more often than the left. Among the patients, those with both feet affected were 38.1%. In our study one third of total cases had bilateral involvement. According to a study by Rasit et al., there were 33% bilateral cases.[11] Wallander study also showed that 46% were bilateral cases.[12]

In our study, average number of changing the POP cast was 7.2 times. Laaveg et al., reported that the average times of changing the cast was 8 times[14]. In our study severe cases had changed the POP cast 1.9 times than mild cases. Total time of changing of cast was correlated with the severity of the Pirani scoring system. When the case was more severe, there was more the need to change the cast. Agarwal et al showed positive correlation between the initial Pirani score and the number of casts to achieve full correction.[13]

In our study, the tenotomy was done for 85.7 % of cases. In a study carried out by Laaveg et al,

tenotomy was done on 78% of total cases. [14] In our study, the severe cases and moderate cases tenotomy was done and in 6 mild cases was no need to do tenotomy. Scher et al showed that the more severe the foot deformity, the more probable that a tenotomy could be needed.[15]

In our study, the pre-treatment Pirani score in mild cases showed good results in 75% of cases. Severe and moderate cases had poor results. However, association between severity before treatment and outcome after treatment were statistically not related. CTEV treatment was done in two phases. Wearing the brace is important for getting the relapsed deformity. Matuszewski reported that the children who did not use the orthosis had high recurrence rate.[6] Göksan showed that bracing period is very effective and potentially demanding phase of treatment of CTEV.[16]

Out of 42 cases, success was achieved in 90.4%. Morcuende and Kulambi reported 90% of success rate.[17, 18] Parents' education and taking care of patients had a key role in achieving good result of treatment. Pirani scoring system had been shown to be of prognostic importance in the initial conservative management of CTEV patient.

We noticed that patient who did not use the brace as prescribed, experienced recurrence. During the treatment, only four got back the residual deformity. But 2 cases responded with repeated POP casting. In other 2 cases only minor soft tissue surgery was done.

The limitation of this study was the small number of patients and short follow up. Our outcome is only initial phase of the treatment. It is needed to study the long term outcomes and follow up in the bracing phase.

Conclusion

Ponseti method is an excellent conservative method for treatment of CTEV deformity. Current treatment of CTEV has moved away from operative treatment to conservative treatment. The patients who have lower Pirani score at initial visit respond better and faster. This study showed that Ponseti method was useful and applicable treatment of idiopathic CTEV children.

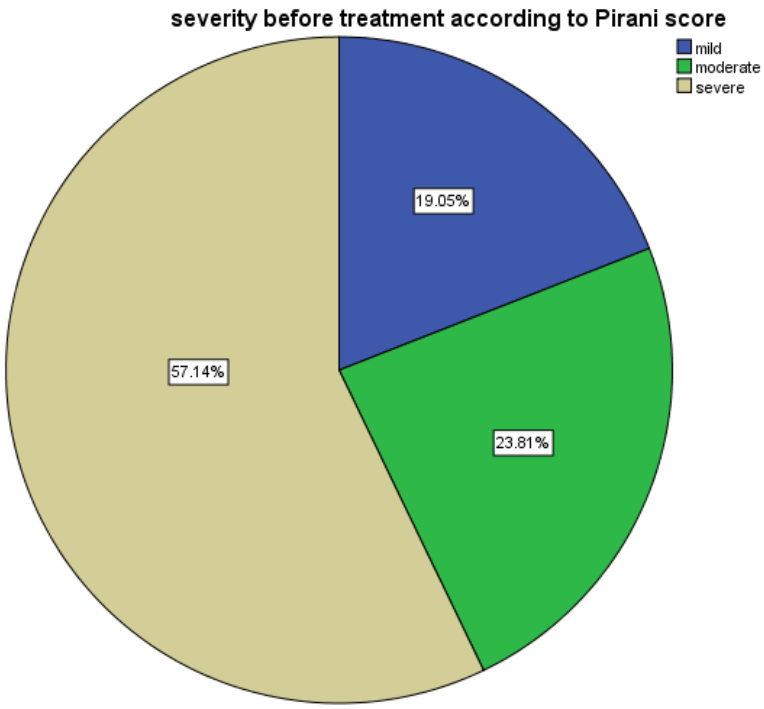

Figure 1. Severity before treatment

Table 1. Severity before treatment and the number of cast changes

(I) severity before treatment according to Pirani score	(J) severity before treatment according to Pirani score	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
severe	mild	1.917*	.342	.000	1.06	2.77
	moderate	1.117*	.316	.003	.33	1.91

* The mean difference is significant at the 0.05 level.

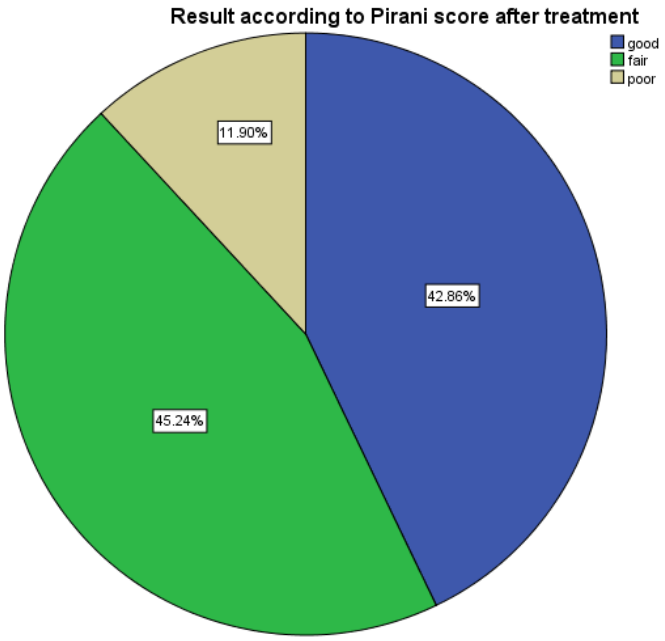

Figure 2. Result after the treatment

Table 2. Score comparison between before and after treatment

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Score before treatment - Score after treatment	5.226	.636	.098	5.02	5.42	53.23	41	.000

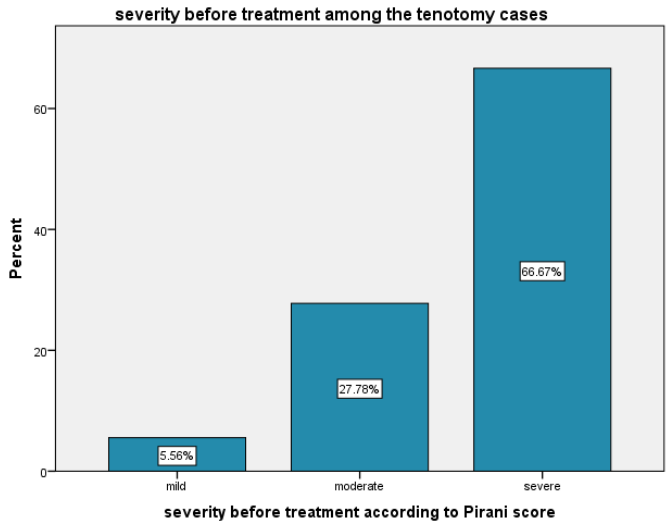

Figure 3. Severity before treatment

Table 3. Severity before treatment vs Pirani score after treatment

			Result according to Pirani score after treatment			Total	X^2 (p-value)
			good	fair	poor		
severity before treatment according to Pirani score	mild	Count	6	2	0	8	4.790 (.309)
		% within severity before treatment according to Pirani score	75.0%	25.0%	0.0%	100.0 %	
	moderate	Count	4	5	1	10	
		% within severity before treatment according to Pirani score	40.0%	50.0%	10.0%	100.0 %	
	severe	Count	8	12	4	24	
		% within severity before treatment according to Pirani score	33.3%	50.0%	16.7%	100.0 %	
Total		Count	18	19	5	42	
		% within severity before treatment according to Pirani score	42.9%	45.2%	11.9%	100.0 %	

References

1. Dobbs MB, Gurnett CA. Update on Clubfoot: Etiology and Treatment. Clin Orthop Relat R. 2009; 467(5):1146-1153.
2. Ostrowski J, Karski T, Matuszewski L. The role of the modified skin incision, the range of tendon lengthening and capsulotomy for the results of operative treatment of the congenital clubfoot. Pol J Environ Stud. 2006; 15(6B):296-298.
3. Salzman HM. Foot focus: International initiative to eradicate clubfeet using the Ponseti method. Foot & Ankle International. 2009; 30(5):468-471.
4. Scher DM, Feldman DS, Van Bosse HJ, Sala DA, Lehan WB. Redicting the need for tenotomy in the Ponseti method for correction of clubfeet. Journal of Pediatric Orthopedics. 2004; 24(4):349-352.
5. Pirani S, Hodges D, Sekeramayi F. A reliable and valid method for assessing the amount of deformity in the congenital clubfoot deformity. Journal of Bone & Joint Surgery, British Volume. 2008; 90-B (SUPPI):53.
6. Matuszewski K, Gil L and Karski J. Early results of treatment for congenital clubfoot using the Ponseti method. Eur J Orthop Surg Trauatoi. 2012; 22(5):403-406.
7. Zhao D, Liu J, Zhao L and Wu Z. Relapse of clubfoot after treatment with Ponseti method and the function of the foot abduction orthosis. Clin Orthop Surg. 2014; 6(3):245-252.
8. Changulani M, N.K. GargN.K, Rajagopal T.S, Bass A. Treatment of idiopathic club foot using the Ponseti method. J Bone Joint Surg [Br] 2006; 88-B: 1385-1387.
9. Cowell HR, Wein BK. Genetic aspects of clubfoot. J Bone Joint Surg Am. 1980; 62(8):1381-1384.
10. Yamoto H. A clinical, genetic and epidemiologic study of congenital clubfoot. Jinrui Idengaku Zasshi 1979; 24(1):37-44.
11. Rasit A, Azani H, Zabidah P, Merikan A, Nur Alyana B. Clubfoot: The treatment outcome using Quantitatie Assessment of deformity. Malays Orthop J. 2012; 6(Suppl A):2-5.
12. Agarwal A, Gupta N. Does initial Pirani score and age influence number of Ponseti casts in children? International orthopaedics. 2014; 38(3):569-572.
13. Wallander H, Hovelius L, Michaelsson K. Incidence of congenital clubfoot in Sweden. Acta Orthop. 2006; 77(6):847-852.
14. Laaveg SJ, Ponseti IV. Long-term results of treatment of congenital clubfoot. J Bone Joint Surg Am. 1980; 62(8):1381-1384.
15. Scher DM, Feldman DS, Van Bosse HIP, Sala DA, Lehman WB. Predicting the need for tenotomy in the Ponseti method for correction of clubfeet. J Pediatr Orthop 2004; 24:349-352.
16. Göksan SB, Bilgili F, Eren L et al. Factors affecting adherence with foot abduction orthosis following Ponseti method. Acra Orthop Traumatol Turc 2015; 49(6):620-626.
17. Morcuende JA, Dolan LA, Dietz FR, Ponseti IV. Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method. Pediatrics. 2004; 113:376-380.
18. Kulambi V, Shetty S, Ghantasala V, Bhagavati V. Treatment of idiopathic clubfoot by Ponseti method: a prospective evaluation. Int J Res Orthop. 2017; 3(4):800-804.