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REVIEW ARTICLE

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To Evaluate the Result of Ponseti Treatment after Five Years from Start of Treatment

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Introduction

Congenital Talipes Equino Varus (CTEV) or Clubfoot is one of the most common congenital deformities in orthopaedics. Worldwide approximately 1 x 105 new cases of clubfoot are added each year. The incidence is approximately 1 in 1,000 live births. Males are more commonly affected than females and up to 50% of cases are bilateral. The aim of clubfoot treatment is to have a plantigrade, supple foot in minimum possible time. Treatment history of CTEV ranging from bandages in Hippocrates time; serial plaster cast application of Kite's, time to surgical treatment; no single modality of treatment can boast of complete treatment, not withstanding an average of 25% (range 13% - 50%) of poor results reported after surgical correction of clubfoot by number of authors including Turco, Mckay and others; with most of feet requiring additional surgical procedures [1-6].

Ignacio Ponseti developed and refined his treatment method for clubfoot in the late 1940s. Ponseti's method of club foot treatment is started within the first few weeks of life and consists of gentle manipulation of the foot followed by serial application of a long leg cast, Achilles tendon tenotomy and foot abduction brace. Owing to its excellent short term result and reproducible result in below 2 years, Ponseti's method has become the primary treatment for idiopathic clubfoot around the world [7-10].

Early relapses can usually be treated with repeat casting followed by the use of the foot abduction brace. If there is less than 15 degree of ankle DF after casting, then a repeat TA tenotomy may be needed [11]. Our study aimed at assessing long term result in patients of club feet treated by Ponseti's method and assessment the feet after 5 years completion of treatment in terms of patient/parent's satisfaction, sport activity, gait and comfortness with foot wear and to look or the factors responsible for recurrence or relapse.

Aims and Objective

1. To assess the long term results of treatment of clubfoot by Ponseti's method 5 years after completion of treatment.
2. To evaluate factors influencing early and late recurrence.
3. To assess the satisfaction scores after 5 years of treatment with Ponseti's method.

Material and Methods

This study was conducted in the Department of Orthopaedics GANDHI MEDICAL COLLEGE BHOPAL MP The study is a hospital based treatment records retro-prospective (both retrospective and prospective) conduct between September 2018 to June 2021 53 children (80 feet) of clubfoot who had started their treatment by Ponseti's method or other method five years back and coming to our hospital for regular follow up.

Inclusion criteria

- All children affected with CLUB FOOT treated with Ponseti's method of correction from birth to 5 years in our hospital.
- All children coming for follow up after getting full correction of deformity.
- Parents who allow their child to be a part of study.

Exclusion criteria

- Not willing to be part of study.
- Children being under treatment.

Methodology

Total 53 patients were selected over a period of 22 month. 51 cases were Idiopathic and 2 cases were syndromic which all had been treated 5 years back with Ponseti methods and coming for regular follow up. All children were followed up once in three months. We evaluated performance outcome in form of sports activity, shoe comfort, squatting, ankle DF, toe walking and external rotation in treated clubfoot by Ponseti's method. We also studied the recurrence in these patients after 5 years and their response to Ponseti's treatment. We evaluated these patients with the help of Disease Specific Instrument Roye et al. questionnaire factor score.

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Statistics and Analysis

Software used for analysis is spss version16.0.

Observations and Results

1. Children with clubfeet treatment by gender distribution

Gender	No. of Patients	Percent
Male	41	77
Female	12	23
Total	53	100

2. Age distribution of the children with clubfeet

Age Group	No. of Patients	Percent
5-7Years	27	51
7-9 Years	17	32
9-11Years	5	9
>=11 Years	4	8
Total	53	100

*Total no. does not up to 100 because of rounding off error

3. Types of club feet

	Frequency in no. of feet	Percent
Atypical	14	17
Non atypical	66	83
Total	80	100

*Total no. does not up to 100 because of rounding off error
*Total no. of patients were 53 and total no. of feet were 80

4. Laterality of Clubfeet

Laterality	No of Patients	Percent
Left	13	25
Right	13	24
Bilateral	27	51
Total	53	100

*Total no. does not up to 100 because of rounding off error

5. Recurrence of deformity

Deformities	Frequency in no of feet	Percent
Equinocavovarus	4	50
Equinovarus	4	50
Total	8	100

*Only late recurrences (recurrence after 5 years) were included

6. Treatment of recurrence

Treatment of recurrence	No. of feet	Percentage
Ponseti methods	6	75
TA lengthening*	2	25
Total	8	100

*Tendon of Achilles lengthening

Treatment of 6 (75%) recurrent clubfeet were done by Ponseti methods and 2 recurrent clubfeet required Tendo-Achilis lengthening. Most of recurrence clubfoot (75%) can be treated by Ponseti's method only.

7. Co-relation between recurrence and performance outcomes (in no. of feet)

Performance outcomes		Recurrence in No. of feet		Pearson CHISquare	p-Value
		Yes	Yes		
Squatting	Yes	1	45	5.462	0.0194
	No	7	27		
Toe walking	Yes	8	1	60.595	0.0001
	No	0	71		
Whether supple	Yes	6	72	9.630	0.0019
	No	2	0		

Recurrent clubfoot had poor performance outcomes compared to non recurrent club foot and statistically it is significant with p value <0.01

8. Co-relation between recurrence and performance outcomes (in no. of patients)

Performance outcomes		Recurrence in No. of feet		Pearson CHISquare	p-Value
		Yes	Yes		
Sports activity	Good	0	47	34.043	0.0001
	Poor	5	1		
Shoe comfortness	Good	1	47	23.703	0.0001
	Poor	4	1		

Patients with recurrent clubfoot had more poor performance outcomes like sports activity and shoe comfort compared to patients with non recurrent club foot and statistically it is significant with p value 0.0001.

9. Relation Between Dsi Score and Ponseti's Method

	Ponseti's Method of treatment		
	No. of patient	Mean	Std. Deviation
DSI Score	53	11.92	2.94

*Score 10(best)----------Score 40(worst)
*Initial methods of treatment included

Club foot treated by Ponseti methods had better DSI score with mean score 11.92

10. Relation between Performance outcomes and Ponseti's method (in no. of feet)

		Ponseti's Method	
		Frequency in no. of feet	Percent
Squatting	Yes	46	58
	No	36	42
Toe walking	Yes	10	12
	No	70	88
Whether supple	Yes	78	97
	No	2	3

Club foot treated by Ponseti methods had better Performance outcomes like squatting, supple foot and no toe walking

Discussion

A patient of treated club foot needs long term follow up for functional outcome and late recurrences after 5 years. This study was conducted to assess long term result and performance outcomes of clubfoot treated by using Ponseti's method 5 years back. In our study after modification there were a total of 53 patients and total number of clubfeet were 80. There were 41 males and 12 females patients. These patients were included based on predefined inclusion criteria after explanation of the research protocol to the parents and written consent. All patients were treated by Ponseti's method 5 years back and coming for regular follow up. We evaluated for performance outcomes like squatting, toe walking, supple foot, shoe comfortness and sports activity. We also assessed role of Disease Specific Instrument Questionnaire, Rye et al score and presence of dynamic supination, atypical clubfoot and tenotomy and their roles in long term recurrence.

We also measured dorsiflexion of ankle, external rotation of foot and assessed Disease Specific Instrument Questionnaire, Rye et al score. We also compared functional outcomes and Disease Specific Instrument Questionnaire, Rye et al score in recurrent clubfoot from non recurrent clubfoot

Age and Gender distribution

After modification, total male children were 41 while females were 12 having a ratio of 3.4:1.There are more male children has been reported in literature [2].

In this study, most children were in the age group 5-14 years included with most children in 5-7 years group (51%) and only 4 children (7%) were more than 11 years old child. Out of the 53 patients included in this study, 51 were idiopathic (96%) and 2 (4%) were syndromic clubfoot who were also treated by Ponseti method. Out of 80 clubfeet 14 (18%) were atypical clubfoot and 66 (82%) were non atypical club foot.

Laterality of clubfoot

Out of the 60 patients included in this study, 31children had bilateral (51 percent) and 29 children had unilateral (49 percent), out of which 15 children had Right sided deformity and 14 children had left sided alone.

As per literature suggests half of the children are known to have bilateral deformity [4].

Recurrence of deformity

We assessed recurrence of club foot after 5 years. Out of 80 club feet, 8 club feet had recurrence and out of 8 clubfeet, 4 clubfeet showed Equinocavovarus and 4 clubfeet showed Equinovarus foot deformity

Most common deformity which recurred was equinus and varus. It is also mentioned in literature that equinus is most common deformity which recurred followed by varus. Equinus may be in combination with cavus with varus or with varus alone or equinus alone. This highlights importance of adequate Dorsiflexion and TA Tenotomy for achieving long term correction. So programmes involving public health approaches to Ponseti's method of correction should have a goal of maximizing Tenotomy rate. It is also mentioned in literature that the most important relapses occur in the hind foot, first in the equines and then in the heel varus [12].

Aypical clubfoot

14 club feet were atypical, 4 atypical clubfeet had recurrence. Atypical foot has higher probability of long term recurrence. Children that develop atypical clubfeet need to be carefully followed and their bracing protocol should be adherent strictly. To the best of our knowledge there are no reports of long term result of atypical clubfeet and their recurrence.

Tendo-Achilles tenotomy

The overall TA Tenotomy rate of patients treated by Ponseti's method in the group evaluated was 88 % of idiopathic clubfeet. 3 (27%) clubfeet out of 11 clubfeet that did not have TA Tenotomy showed recurrence.

Dynamic supination

Sign of early recurrence are early heel rise (child walking away from examiner), swing phase dynamic supination (child walking towards examiner) and loss of ankle dorsiflexion to less than ten degrees. Although Dynamic supination was seen in 10 clubfeet but none of them presented with recurrence after 5 years though the number are few, the issue of Dynamic supination needs to be studied further their implication and late recurrence. Tibialis anterior tendon transfer was done in 5 patients having persistent dynamic supination beyond 5 years age. Followed by child was kept in short leg cast for 6 weeks. Significant improvement in gait noticed in these children.

Treatment of recurrences

Majority of recurrence (75%) clubfeet were manageable with redo Ponseti without any surgical intervention. Most of them needed redo TA Tenotomy. 2 clubfeet were treated by Tendon of Achilles lengthening. All clubfeet that had recurred had external rotation less than 7 degree.

Disease Specific Instrument Roye et al. suggested a questionnaire to measure satisfaction and functional outcomes. The factor questionnaire clearly shows parents' satisfaction and functional score treated with Ponseti's method. It was also better in clubfoot treated by Ponseti's method with mean DSI score 11.92 [13]. However recurrent club foot patients had poor mean DSI score 18 compared to non recurred clubfoot that was 11.29. The DSI score was used to look at the functional outcome and satisfaction in children treated with clubfoot more than 5 years after treatment. The best DSI score was achieved in children treated by Ponseti's method. The average score of 11.92 seen in children treated by Ponseti's method.

DSI score also seems to follow closely the degree of correction achieved in terms of 17 degree of DF and 16 degree of external rotation possible. Those children with better ER and DF then found to have better DSI score.

Literature also suggest that Ponseti's method has better DSI score compared to surgical group [14].

Dorsiflexion and External rotation in club foot treated by Ponseti methods

Clubfoot treated by Ponseti methods had better dorsiflexion of ankle and better external rotation. The mean value of dorsiflexion

and external rotation in clubfoot treated by Ponseti methods were 16.70 and 16.02 respectively.

It is also mentioned in literature that club foot treated Ponseti methods has better functional outcomes compared to other methods like surgical procedures [15].

Performance outcome

Children followed up for > 5 years showed best results of ability to squatting (58%) and ability to walk heel to toe (70%) with better degree of suppleness (78%) in those children who were treated by Ponseti's method. However, recurrent clubfeet after 5 years showed feet that were rigid with toe walking and difficulty to squat compared to non recurred club foot. Sports activity and shoe wearing comfortness were good in patients of club foot treated by Ponseti's method but recurrent club feet showed poor sports activity and shoe wearing comfortness compared to non recurred club foot.

Summary & Conclusion

Ponseti's treatment method is considered standard method for management of idiopathic club foot, it has better short term as well as long term outcomes. However there is limited literature on Ponseti's follow up beyond 5 years and their long term result. This dissertation looked at a retro-prospective series of patients that presented to our hospital in the period of September 2018 to June 2021 who had started Ponseti's treatment 5 years back and coming regularly for follow up in our hospital. These children were evaluated for the outcome specifically late recurrences after 5 years .Also evaluated their sports activity, shoes comfort, squatting, toe walking, supple foot, DF and external rotation. There were 10 % recurrence of club feet after 5 years (long term recurrence). 50% recurrence of deformities were equinocavovarus and 50% were equinovarus deformity. Early TA Tenotomy seems to favour maintenance of correction on a long term and avoid recurrence. Achieving good DF 15 degree by primary or even TA Tenotomy is important to prevent late recurrence.

Equinus is the most common component of deformity and recurrences. Emphasising role of TA Tenotomy in achieving long good result. Dynamic supination needs to be evaluated for its role in late recurrence and needs detailed study. The influence of degree of external rotation on long term recurrence needs to be studied further as there seems to be link between recurrence and degree of external rotation. DSI seems to follow up closely the degree of correction achieved in the foot as measured by degree of Dorsiflexion and of External rotation. Long term result of Ponseti shows that feet (97%) remains supple with ability to squat in majority (58%). In short Ponseti's method is the best method for treating clubfoot with excellent long term result. Ponseti's method has better DF, external rotation and functional outcomes compared.

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