



Factors affecting outcome after the use of the Ponseti method for the management of idiopathic clubfoot, a retrospective study in an orthopaedic referral institute

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In the last few decades Ponseti method has replaced soft tissue releases as the gold standard in the management of idiopathic clubfoot. However, the recurrence of the deformity is common without post tenotomy bracing. The purpose of this study was to retrospectively see various attributes of the patients associated with poor outcome after use of Ponseti method in idiopathic clubfoot management.

Seventy nine consecutive patients with one hundred and twenty three idiopathic clubfeet treated with Ponseti method by single orthopaedic surgeon were followed for a period of two years and recurrence of the deformity was studied in relation to age of patient at presentation (< 3 months or more), sex of the patient, severity of the deformity (moderate to severe verses (Vs.) very severe), compliance to post tenotomy bracing (compliant Vs. non compliant), educational level of parents (high school or less) and access of parents to internet (Yes or No) and odds ratio for recurrence and level of significance determined for each using Fisher's exact t-test.

Non compliance in seventeen patients (17.7%) with post tenotomy bracing was the most important factor related to the recurrence, with an odds ratio of 6.22 (P =0.0059). Educational level (less than high school) of parents (36.7%) was the second most important factor with odds ratio of 5.5 (P=0.0073). Fifteen patients with severe Demiglio scoring feet had an odds ratio of 5.3 (P= 0.0097) for the recurrence of the deformity. Inaccess of the parents to the internet had an odds ratio of 6.33 (P =0.011) for the recurrence of the deformity. Age and sex of the patients was not found to have a significant effect on the recurrence of the deformity.

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In conclusion, the risk factors associated with recurrence of the idiopathic clubfoot deformity except severity of the deformity are modifiable and extra minutes can be spent with risk group parents during follow up visits to prevent a recurrence by making them understand natural history of the corrected foot without post tenotomy bracing, encouraging them for regular follow up visits, arranging interactive sessions with other patients who are regular in their follow up and compliant with bracing, and encouraging the literate parents to update their information about clubfoot from internet.

Keywords : clubfoot ; tenotomy ; Ponseti method ; deformity.

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INTRODUCTION

Idiopathic clubfoot is the most common musculoskeletal birth defect affecting one per 1000 live births (17). The component deformities of clubfoot include equinus, cavus, and heel varus and forefoot adductus. Most orthopaedicians agree that initial treatment should be non-surgical and started soon after birth. In the past two decades, several reports have demonstrated successful correction in >95% of the clubfeet using the Ponseti method (3,13,14,16). The unsatisfactory results associated with complete soft tissue release at 10 to 15 years of follow up (2) and the long term success related to Ponseti method (14) have led to renewed interest in this method among pediatric orthopaedic surgeons. Despite this interest, success with Ponseti method has not been reproduced by others consistently (8).

The purpose of this study was to see retrospectively the factors associated with an increased risk of recurrence of deformity or a poor result in seven nine infants with 123 idiopathic clubfeet.

MATERIALS AND METHODS

Seventy-nine consecutive patients with 123 idiopathic clubfeet had been treated by a single orthopaedic surgeon at government hospital for Bone and Joint surgery Srinagar. Children with Syndromic, neurogenic and grade I Dimeglio (5) and or previously manipulated clubfeet and patients with age more than 6 months had been excluded. The severity of the deformity was assessed with grading system of Dimeglio et al at the time of presentation (5). In this system 4 parameters are assessed on the basis of their reducibility with gentle manipulation as assessed with hand held goniometer: (1) equinus deviation in sagittal plane, (2) varus deviation in frontal plane, (3) derotation of the calcaneopedal block in horizontal plane, and (4) adduction of forefoot relative to hindfoot. Each attribute is given a score of 4 (maximum) for reducibility from 90° to 45°, score of 3 for reducibility from 45° to 20°, score of 2 for reducibility from 20° to 0°, and a score of 1 for reducibility from 0° to -20°. Four additional points consisting of 1 point each for posterior crease, medial

crease, cavus and poor muscle condition. The feet are then classified into following four grades. Grade I feet have mild deformity that is 90% reducible, with a score of 0 to 5 points. Grade II feet have moderate deformity with a score of 6 to 10 points. Grade III and IV feet have severe and very severe deformity with a score of 11 to 15 points and 16 to 20 points respectively.

All patients had been treated strictly according to the Ponseti method by manipulation and casting. The manipulation was done with the fulcrum at the talar head (11). Manipulation was followed by retention casts which was applied in two settings, first a short leg cast was applied and molded and later converted into a long leg cast up to the upper thigh with knee in 90° of flexion. The cavus was corrected first by elevation of head of the first metatarsal. This occurred easily or sometimes needed several minutes of manipulation. This was followed by the correction of forefoot supination by gradually abducting the forefoot with counter pressure applied at the talar head without pronating the foot. After 2 to 3 minutes of manipulation a retention cast was applied. This weekly manipulation and casting gradually corrected the fore foot supination and heel varus in 4 to 6 settings. After adequate abduction, which meant that the foot was abducted 60 to 70 degrees or heel was in neutral or slight valgus, or the anterior process of calcaneus was felt (best sign), a percutaneous tendo Achilles tenotomy was done under local anaesthesia as an outpatient department (OPD) procedure and a long leg cast applied with foot in 70 degrees abduction, 15 degrees dorsiflexion and knee in 90 degree flexion for three weeks (7,11,12).

After three weeks, the post tenotomy cast was removed and foot abduction orthosis was applied to the patients and the importance of the bracing was explained to the parents. The brace was worn day and night for the first three months except 1 hour per day for cleaning purpose. This was followed by night time bracing. The patients were followed weekly for the first 2 weeks, then monthly for three months. Then three monthly follow up was done till the final follow up at 2 years. Any relapse was treated with repeat manipulation and casting.

FINAL ASSESSMENT

Each patient was again assessed at the end of 2 years with the help of three scoring systems, which included Dimeglio grading, modified Catterall/Pirani method and modified functional rating system. The result was labeled good if a foot met any two of the following three criteria (9);

- 1) Dimeglio score of 6 or better
- 2) Modified Catterall/ Pirani score of 1.5 or better
- 3) Modified functional rating score of 30 or better.

Outcome of the treatment at 2 years was studied retrospectively in relation to the following factors;

- 1) Age of the patient at first cast, 3 months and less and more than 3 months.
- 2) Sex of the patient
- 3) Severity of the deformity; moderate to severe Dimeglio Vs very severe.
- 4) Educational level of the parents; high school or less.
- 5) Compliance to bracing; good or poor. Patients were labeled good for compliance of bracing if they wore brace strictly or had days without brace. Those labeled poor brace users did not either use the brace or had weeks to months without brace.
- 6) Access of parents to internet; yes or no.

RESULTS

Seventy nine infants (123 clubfeet) had been treated, all patients six months or less in age. Sixty three (80%) patients were under the age of three months. Fifty five (70%) were males. Sixty five percent of the patients were first born. Family history was present in 4% of the patients. Forty four patients (55.7%) had bilateral involvement, and twenty two patients (28%) had right side affected. 100% bilateral feet had similar grade of initial deformity. Sixty four patients (81%) had moderate and severe grade Dimeglio classification (group I) and 15 feet (19%) had very severe grade of Dimeglio classification (group II). Parents of 29 patients (37%) were having educational qualification below high school. Only 32 parents (40.5%) had access to internet and

out of them 25 (31.6%) parents told that they had read about Ponseti method. On an average 5.55 casts were required to correct all the deformities except equinus. Tenotomy of tendo Achilles was done in 84% of the feet. Initial correction was obtained in 98.3% feet. Ninety four percent of the parents had reported compliance with bracing. Each patient had been followed for 2 years before final assessment was done. Deformity had relapsed in 13 patients, more than once in two patients. Most common relapse was with equinus in 6 feet, forefoot adductus and heel varus in 5 feet, seven feet had relapse of all the deformities. Relapse had been treated with repeat manipulation and casting, percutaneous tendo Achilles tenotomy in 3 patients in whom it had not been done earlier. One repeat tenotomy and one open lengthening of tendo Achilles had also been done. At the end of 2 years final assessment was done and the results were labeled as good or poor on the basis of criteria already mentioned. The poor results were retrospectively studied in relation to age and sex of the patient, severity of the deformity, compliance to bracing, internet access to parents and, educational level of parents and odds ratio and level of significance determined for each using Fischer's exact t- test (Table I).

From the statistical analysis it was found that significant risk of recurrence or poor result is associated with non compliance with bracing with odds ratio 6.22 (p= value 0.0059), lower educational level of the parents with an odds ratio of 5.5 (p-value 0.0073), severity of the deformity Dimeglio grade IV with an odds ratio of 5.34 (p-value 0.0097), no internet access to the parents with an odds ratio of 1.33 (p value 0.0112). Age with an odds ratio of 0.7 (P =0.72) and sex with an odds ratio of 1.39 (P = 0.76) are not significantly associated with poor result.

DISCUSSION

Rightly quoted by many authors the follow up of the patients with congenital clubfoot doesn't end until the child joins the school whether it is treated conservatively or surgically. Ponseti method of clubfoot management ensures successful treatment of most congenital clubfeet but at the same time,

Table I — Final Results related to various patient characteristics

Characteristic	variable	Final result		Odds ratio	p- value	95% confidence interval
		Poor	Good			
Age	<3 months	12	51	0.70	0.72	0.19 to 2.57
	>3 months	4	12			
Sex	Male	12	43	1.39	0.7642	3.99 to 4.87
	Female	4	20			
Severity	very sever	7	8	5.34	0.0097	1.55 to 18.39
	Mod- sever	9	55			
Compliance to bracing	Poor	7	7	6.22	0.0059	1.76 to 21.99
	Good	9	56			
Educational level of parents	Less than high schol	11	18	5.5	0.0073	1.673 to 18.o8
	High school and above	5	45			
Parent Access to internet	No	14	33	1.335	0.0112	1.334 to 30.353
	Yes	2	30			

a relapse cannot be prevented. Relapse, a problem inherent with clubfoot without prescribing a foot abduction brace is the most disliked aspect of the Ponseti management, both by the parent and the infant as no one likes him or his nearest to be enslaved. The relapse rate has been reported to varyingly in different studies (1,10,13,15). Morcuende et al (10) reported relapse rate of 6% in compliant patients and over 80% in non compliant patients. Non compliance is more often seen in patient with severely affected feet which are small, and chubby, or in those feet which are relapsing, a factor which is the first response to removal of brace and non compliance.

There is also trend towards higher rate of relapse in patients whose parents have a low educational qualification, below high school. It may be separate risk factor even for non compliant attitude of parents to bracing, inability of the parents to understand the natural course of the disease without the use of a foot abduction brace. Mathew B. Dobbs et al found a higher rate of relapse in patients whose parents have educational qualification of high school or less (6). Internet which has been one of the main sources of information dissemination about Ponseti method in the west is inaccessible to parents who have low educational qualification or are illiterate in our setting.

Severity of the deformity was also a significant risk factor particularly when very severe grade Dimeglio was compared with moderate and severe grade Dimeglio as one group. There is interplay between bracing compliance and severity because complications due to bracing such as a slipping brace and pressure sores are more common in children who have more severely affected feet, which can explain non compliance. Stephen Richard's reported significant difference in the outcome of patients with severe and very severe deformity at end 2 years while comparing Ponseti with French method (13).

Although the introduction of Ponseti method at our institute has markedly decreased the number of clubfoot soft tissue releases, there remain a significant proportion of patients with the above mentioned risk factors most of which are modifiable, which need special attention like giving extra minutes with the parents explaining them the importance of their understanding about the disease, impressing upon them the importance of bracing and regular follow up so that they lessen morbidity of their children. Regarding severity of deformity, a non modifiable risk factor, we believe that Ponseti method definitely reduces the amount of surgery that is to be done on a foot after it has relapsed, which ultimately reduces the stiffness of these feet.

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