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A comparative study on outcome of ponseti method of clubfoot management in infants and children of more than 1 year of age

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Abstract
Background: CTEV (Clubfoot) is the most common congenital orthopaedic condition of lower limb and being treated worldwide by the Ponseti method. The treatment is started as soon as possible after birth. Still many children come to clinics at relatively higher age. The aim of the study is to compare the effectiveness in terms of outcome of Ponseti method of clubfoot management in infants and children of more than 1 year of age (1 year to 2 years).
Methods: It is a prospective, non-randomised follow-up study conducted on outpatient basis at Department of orthopaedics, Bokaro General Hospital during the period of March 2016- September 2017. The method used for the management was serial manipulation and long leg plaster of Paris casting after getting the Pirani score at every visit.
Results: A total of 40 children (20 infants and 20 children more than 1 year) with idiopathic clubfoot were selected and treated with Ponseti method. Patients from both the groups showed a significant decrease in the mean Pirani score.
Conclusion: Ponseti method in management of clubfoot in older children (1-2 years) gives a good result which is comparable with infants.

Keywords: clubfoot, ponseti method, pirani score, tendoachilles tenotomy, foot abduction brace

Introduction
Congenital idiopathic clubfoot is a common but complex deformity of foot in an otherwise normal child. It is the most common congenital deformity of lower limbs [1]. It is characterized by a complex three-dimensional deformity of the foot [2]. It is estimated that more than 100,000 babies are born worldwide each year with congenital clubfoot. Eighty per cent of the cases occur in developing nations. Globally, neglected clubfoot is the most serious cause of physical disability among congenital musculoskeletal defects [3]. Clubfoot is an obvious deformity which is easily recognized with its four components: forefoot adduction, mid foot cavus, hind foot varus and ankle equinus [4-6].
The deformity in idiopathic club foot (CTEV) is both cosmetic and functional. It has become a general rule to start treatment as soon as possible after birth with the initial treatment being non-surgical (serial manipulation and casting) [4, 7-13]. Still many children come to clinics at relatively higher age. The method and its results have been extensively studied in children in their first few months of life [1, 7, 14-19]. However few studies have evaluated this method in children of slightly older age group.
The aim of the study was to compare the effectiveness of Ponseti method of clubfoot management in terms of outcome in infants and children of more than 1 year of age (1 year to 2 years) and to find out answers of

a. Does the late presentation influence the outcome?
b. Does the delay in treatment commencement pose any risk of relapses?
c. Do the patients of different age groups respond differently to the Ponseti method of treatment?

Materials and Methods

A prospective, non-randomised, observational, comparative study was conducted on 40 children (20 infants and 20 children more than 1 year) with idiopathic clubfoot on outpatient basis at Department of orthopaedics, Bokaro General Hospital during the period of March 2016- September 2017.

Group A: Infants (< 1 Year)
Group B: Children of age 1-2 Years

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• Children with idiopathic clubfoot • Infants (Group A) • Children of age 1-2 years (Group B)	• Children with secondary clubfoot ○ Postural clubfoot ○ Syndromic clubfoot ○ Neuropathic clubfoot • Cases with history of previous surgeries

The method used for the management was serial manipulation and long leg plaster of Paris casting by conventional Ponseti method after getting the Pirani score at every visit. Children were followed up weekly (till Tendoachilles tenotomy done), then after 3 weeks of tenotomy, they were put in Foot abduction brace. After application of foot abduction brace, children were further followed up at 1 month, 3 months and 6 months and Pirani score was recorded.

Parameters for evaluation

- Number of casts applied
- Improvement in Pirani score
- Recurrence pattern (if any) developing or not
- Prognosis of recurrence pattern
- Skin changes (if any)

Statistical tool

Statistical analyses were conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables was presented as mean ± SD or median (IQR) for non-normally distributed data. Categorical variables were expressed as frequencies and percentages. The comparison of normally distributed continuous variables between the groups was performed using Student's t test. Nominal categorical data between the groups was compared using Chi-squared test or Fisher's exact test as appropriate. Non-normal distribution continuous variables were compared using Mann Whitney U test. For all statistical tests, a 'p' value less than 0.05 was taken to indicate a significant difference.

Observation and Results

Age distribution and mean age

In Group A most patients were of 0-3 months age group – 15 (75%) with mean age 1.85 months, while in Group B the mean age was 17.75 months with maximum number of patients in 19-21 months age group.

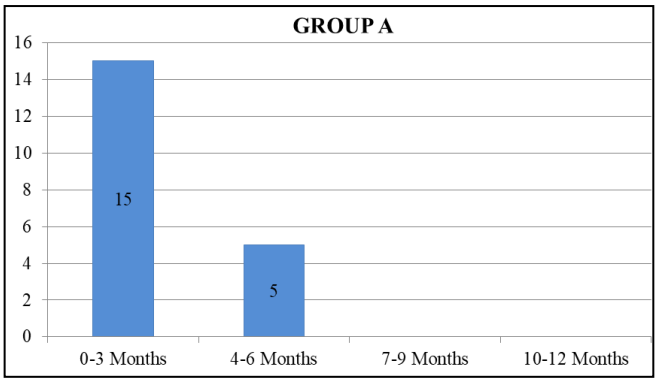

Fig 1: Age distribution of patients in Group A

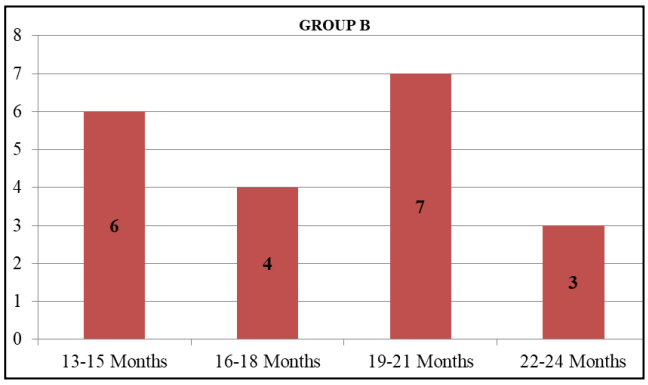

Fig 2: Age distribution of Patients in Group B

Sex distribution

There were 8 (40%) & 2 (10%) female patients in Group A and Group B respectively.

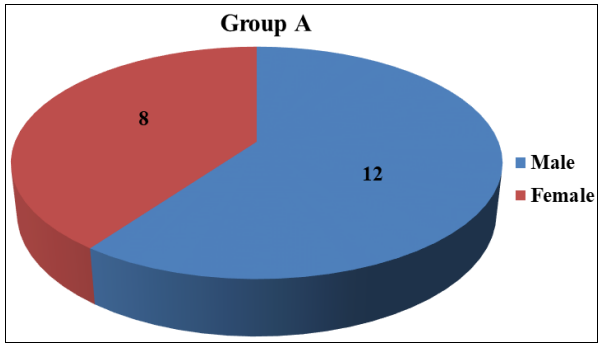

Fig 3: Sex distribution of patients in Group A

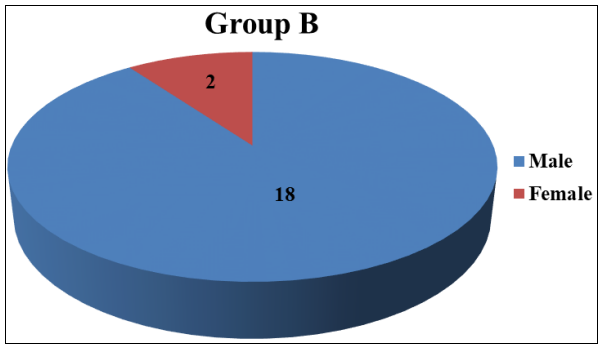

Fig 4: Sex distribution of patients in Group B

Laterality

There were 14 bilateral and 6 unilateral (4 Right, 2 Left side) cases in Group A and 11 bilateral and 9 unilateral (6 Right, 3 Left side) cases in Group B respectively.

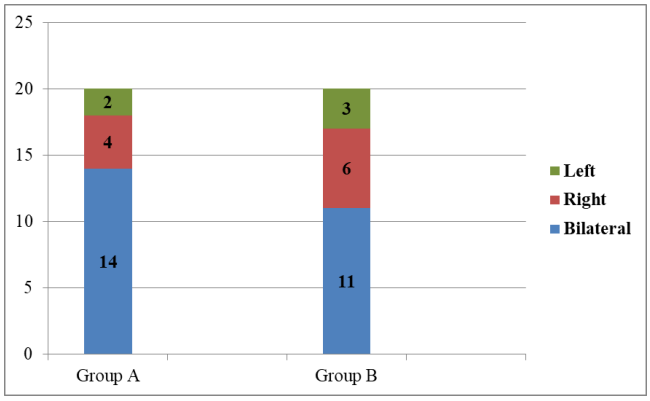

Fig 5: Sides affected in clubfoot patients

Number of casts required

The total number of casts applied until final correction (at the onset of bracing) among Group A and Group B patients ranged from 3 to 7 (Mean = 5.55) and 6 to 12 (Mean = 8.95) respectively.

Table 2: Average No. of cast required in both Groups

Age Group	Number of casts (avg.)
<1 year	5.55
> 1 year	8.95

1 patient of Group A did not required tenotomy, while all the patients of Group B required tenotomy.

Table 3: Average age at tenotomy

Age Group	Tenotomy Rate	Avg. Age at Tenotomy
<1 year	95%	3.7 months
> 1 year	100%	20.25 months

Pirani score

Table 4: Mean Pirani score in both groups

Mean Pirani Score	Group A	Group B
At the time of Presentation	4.425	3.8625
After Tenotomy (At the onset of Bracing)	0.3 (Change = 4.125)	0.225 (Change = 3.6375)
At 1 Month of FU	0.25	0.225
At 3 Month of FU	0.20	0.2625
At 6 Month of FU	0.25	0.2625

Changes in Pirani score

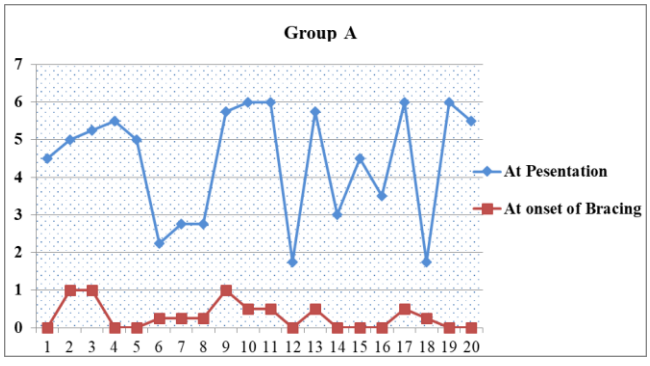

Fig 6: Mean Pirani score of patients in Group A

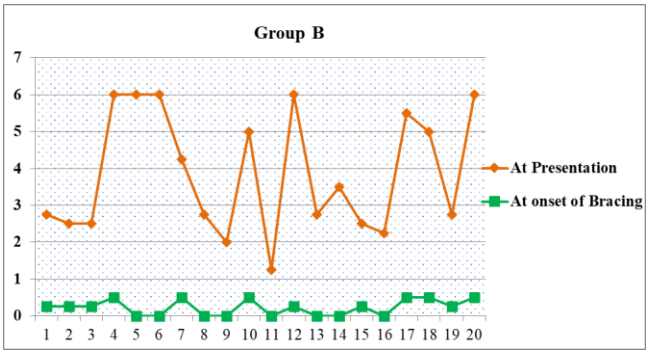

Fig 7: Mean Pirani score of patients in Group B

Cast complications

There were cast related complications in 6 cases.

Table 5: Cast related complications in both groups

Complication	Group A (No. of cases)	Group B (No. of cases)
Skin Abrasions	5	1
Skin Blisters	0	0
Slippage of casts	2	4

Recurrence of deformity

During the follow-up visits, some patients showed an increase in the Pirani score in spite of having plantigrade, painless foot. In Group A, both the patients developed forefoot adduction during the follow-up and was managed with manipulation and cast application. In Group B, one patient required repeat TA tenotomy for decreased dorsiflexion of his one foot and manipulation and cast application for his other foot. Other two patients were managed with manipulation and cast application for their forefoot adduction.

Table 6: Patients developed recurrence during treatment

Group	No. of Patients with increase in Pirani score
< 1 Year	2
> 1 Year	3

Discussion

We used the classic two hands Ponseti technique for casting but the initial stretching was prolonged to at least five minutes as the soft tissue in elder children were less yielding. End point of manipulation and casting was achieved when no further correction on scoring was noted with CLB (curved lateral border of foot) and LHT (lateral head of talus) score became 0 (the mid foot and hind foot scores seemed corrected enough for tenotomy).

The outcome in Group A is comparable with Lehman *et al.* [15] who found the Pirani score changed from 4.6 to 0.6 in mean 5.3 casts. In the study by Lourenço AF, Morcuende JA [20], with 17 patients aged 1.9 to 9 years of age, 16/17 corrected. The correction was obtained with a mean of nine casts (7 to 12), but they used a modified Ponseti method with fortnightly change of casts, hence there average duration of immobilization in a cast (3.9 months) was higher than our study.

Cavus was found to be more resistant for correction in older children, in the age group more than one year. We applied up to 3 casts for cavus in full supination. Despite this, cavus could not be corrected fully in all the feet with 3 casts. After 3 casts, cavus was corrected serially with abduction in supination.

The average pre-treatment Pirani scores for medial crease and

posterior crease was less in children of age group > 1 year than in children of age group < 1 year. Hence, despite severe adduction and cavus deformity the average score for medial crease was lower in the children of older age group. Similarly despite severe equinus in the children of older age group the scores for posterior crease were lower. This remains to be one of the fallacies of Pirani scoring in the older age group. It correlated well with the correction of adduction and equinus deformity. The final Pirani for medial crease and posterior crease were 0 in all the cases post correction. The change in Pirani score between pre and post treatment values was found to be statistically significant.

Parents reported irregular use of the foot abduction orthosis in Patients with increase in Pirani score during the follow-ups. The real impact of this fact was not quantitatively assessed but might have contributed significantly to relapse of the deformity. Recently the bar design of Steenbeek foot abduction brace (SFAB) has been changed and is made straight to reduce the loss of dorsiflexion in the SFAB which can occur when a child happens to stand up in the brace whereby the weight of the child causes the abduction bar to bend flat (losing the dorsiflexion).

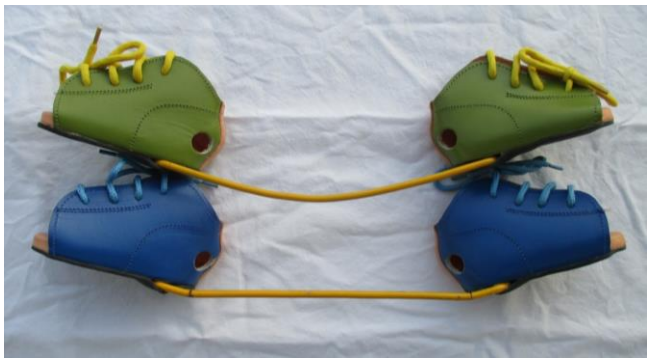

Fig 8: Steenbeek foot abduction brace

Conclusion

The use of Ponseti method in management of club foot in older children (1-2 years old) gives a good result which is comparable with infants. Strict adherence to the casting technique helps in successful correction. Higher age of the patient does not mean that they are resistant to correction but may necessitate more prolonged casting period i.e. the number of serial casts may increase. Tendoachilles tenotomy may be needed in a significant no. of these cases and can be safely done in older children with no apparent adverse effect at six-month follow-up. Pirani scoring is an easy method to assess the deformity but its use may be limited in older children as in spite of severe deformity its value may be low. Compliance on the parents' part in the use of foot abduction orthosis is essential to prevent the relapse of deformity.

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