

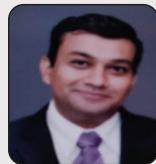
Original Article



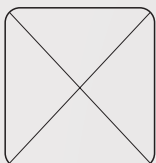
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Walking Age of Infants Treated with Ponseti Method for Idiopathic Clubfoot

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Abstract

Aim: Parents of children affected with idiopathic clubfoot are anxious that motor development should progress normally. Treatment using Ponseti method involves cast immobilization, bracing, and tenotomy which inhibit the normal movement, thereby increasing parental concern. The purpose of this study was to evaluate the age at which independent walking was established in infants with idiopathic clubfoot treated using Ponseti method.

Materials and Methods: There were 70 patients in this prospective longitudinal study. All subjects were full term at birth, less than <12 weeks of age at the initiation of treatment for clubfoot, and no prior outside treatment had been provided. Patients were treated using the Ponseti method. The children were evaluated prospectively for the commencement of independent walking.

Results: The mean age at which independent walking started was 13.64 ± 2.74 months (9 months–22 months). About Fifty percent 50% of the affected children were walking by the age of 14 months. Children with relapse walked later by 2.8 months ($P = 0.017$). Children with a family history walked at 11.7 months ($P = 0.049$) which was significantly earlier than the patients without a family history. Other variables had no significant influence on walking age.

Conclusion: A delay of 1.5 months in independent walking age is expected in children with idiopathic clubfoot, which is helpful while counselling the parents at the start of treatment. Relapse during treatment delays walking age further.

Keywords: Congenital talipes equinus varus CTEV, Motor milestone, Independent walking.

Introduction

Congenital talipes equinus varus (CTEV) also known as clubfoot is the most common congenital orthopedic condition with an incidence of 1–2 in 1000 live births [1]. The aim of the treatment of clubfoot is to achieve a flexible, plantigrade, mobile, and painless foot that is normal in appearance. The technique described by Ponseti is an established treatment method for CTEV [2, 3]. The Ponseti technique involves serial plaster casts every week with a percutaneous tenotomy of the Achilles tendon, when required, at the last cast change. Bracing is started after last cast removal and continued for 4–5 years. Delay in a gross motor development of the child, in particular independent walking, is the first concern of parents of children with clubfoot [4].

The purpose of this study was to determine the independent age of walking in infants treated by Ponseti method in a child diagnosed with idiopathic clubfoot.

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Methods

Patients who were diagnosed with idiopathic clubfoot and having a regular follow-up were included in our study. Children with gestational age of <37 weeks, age of more than 12 weeks at the start of treatment, prior outside treatment, and mild or positional deformity were excluded from the study. The ethics committee of our institute approved the study.

At initial presentation, parents or guardians were informed and counseled about the nature and duration of the treatment. Severity of the deformity was graded using the Pirani score [14]. The total score was recorded at every visit. Relapses were assessed as per criteria by Bhaskar and Patni [15].

After the removal of last cast, a foot abduction orthosis was prescribed for 23 h a day for a period of 3 months followed by night- and nap-time bracing till the age of 4–5 years. Parents were instructed to perform heel cord stretching exercise.

The patients were followed up at 1-month interval. The following data were recorded: Age of start of treatment, gender, bilateral involvement, family history, number of casts applied for the correction, need for percutaneous Achilles tenotomy, non-compliance to the use of brace, and relapse of the deformity. Parents were asked to record the day on which their child walked independently. One of the authors observed the child walking 10 or more steps to support the validity of the parental report [8].

Statistical Analysis

Sample size was calculated using recent literature [8]. Mean age at the start of treatment in weeks, mean number of casts required, and mean age of independent walking was calculated. A parametric unpaired t-test was used to compare the result of healthy infants and infants diagnosed with idiopathic clubfoot.

Parametric unpaired t-test was used to determine the effect of sex, bilaterality, family history, severity of deformity, number of casts, need of tenotomy, non-compliance to the orthosis, and relapse on the mean walking age of infants.

The 50th, 75th, and 90th percentile for the age of achievement was determined. P < 0.05 was considered statistically significant. Grubb’s test was done to detect any outlier. Pearson correlation coefficient was used to measure the strength of linear association, if any, between age at beginning of treatment, number of cast required, and walking age.

Results

A total of 206 (idiopathic and non-idiopathic) patients were registered in the clubfoot clinic, between February 2014 and March 2019. Out of these, 70 patients met the inclusion criteria.

Of the 70 patients, 48 patients were male and 22 were female, with a mean age of 3.7 weeks (1 day–12 weeks) at the start of

| | No. of Patients (%) | Age at walking (months) | P value |
|---------------------------------------|---------------------|-------------------------|------------|
| Total Number of patients | 70 (100%) | 13.64 ± 2.74 | N/A |
| Sex | | | |
| Male | 48 (69%) | 13.35 ± 2.58 | 0.195 |
| Female | 22 (31%) | 14.27 ± 3.02 | |
| Bilaterality | | | |
| Yes | 29 (41%) | 13.44 ± 2.76 | 0.775 |
| No | 41 (59%) | 13.63 ± 2.72 | |
| Family History | | | |
| Yes | 7 (10%) | 11.71 ± 1.11 | 0.049 |
| No | 63 (90%) | 13.85 ± 2.79 | |
| Pirani Score | | | |
| >4 | 58 (83%) | 13.72 ± 2.80 | 0.592 |
| <4 | 12 (17%) | 13.25 ± 2.52 | |
| Number of casts | | | |
| <4 | 17 (24%) | 13.82 ± 2.76 | 0.918 |
| 5 or 6 | 33 (47%) | 13.66 ± 3.08 | |
| >7 | 20 (29%) | 13.45 ± 2.08 | |
| Percutaneous Achilles tenotomy | | | |
| Yes | 40 (57%) | 14 ± 2.77 | 0.206 |
| No | 30 (43%) | 13.16 ± 2.67 | |
| Non-Compliance to brace | | | |
| Yes | 9 (13%) | 13.33 ± 2.95 | 0.723 |
| No | 61 (87%) | 13.68 ± 2.73 | |
| Relapse | | | |
| Yes | 6 (9%) | 16.16 ± 3.43 | 0.017 |
| No | 64 (91%) | 13.40 ± 2.58 | |

Table I: Relationship of variables with independent walking age

| | Present study | Neligan and Prudhan ¹² | Denver II ¹⁰ | WHO Multicentre ¹¹ |
|-----------------------------|---------------|-----------------------------------|-------------------------|-------------------------------|
| Total No. of Patients | 70 | 3554 | 2096 | 816 |
| Age Of walking (month) | | | | |
| Mean ± SD | 13.64 ± 2.74 | N/A | N/A | 12.1 ± 1.8 |
| 50 th percentile | 14 | 12.8 | 12.3 | 12 |
| 75 th percentile | 15 | 14.2 | 13.6 | 13.1 |
| 90 th percentile | 17.9 | 15.8 | 14.9 | 14.4 |

Table II: (Comparing data of independent walking in idiopathic clubfoot compared with normal infants)

treatment. Twenty-nine of the patients had bilateral involvement and 41 patients (59%) had unilateral involvement (right – 21 and left – 20). Seven patients had a family history of clubfoot. Pirani score was >4 in 58 (83%) (Table 1).

The mean number of corrective casts required was 5.75 (2–11 casts). Forty patients required tenotomy for the correction of equinus deformity. All components of deformity were corrected in all patients. Non-compliance with orthosis use was seen in nine patients. A total of 6 (9%) patients relapsed before the independent walking, for which corrective casts were given, followed by foot abduction orthosis. Mean age of walking independent without assistance was 13.64 (9–22 months).

The 50th, 75th, and 90th percentile for the independent age of walking was 14 months, 15 months, and 17.9 months irrespective of severity of deformity, relapse, sex, or any other factors. Three patients attained independent walking after 18 months but there were no differences in terms of severity of clubfoot, number of plaster, or bracing except one patient (walking age: 22 months) who had to undergo repeat casting due to relapse before walking age.

Sex and bilaterality did not influence independent walking age. Patients with family history tended to begin walking 1.9 months earlier ($P = 0.049$). Children with Pirani score < 4 walked 0.5 months earlier than the patients with Pirani score of > 4, but this finding was not significant.

The number of casts required to tenotomy, need for percutaneous Achilles tenotomy, and non-compliance to orthosis use did not affect the walking age of the patients significantly. Relapse was seen in six patients, of which four patients had type Ia and two patients had type Ib type of relapse pattern, and was managed conservatively with recasting and full-time abduction brace. Patients with relapse had the greatest delay in independent walking of 2.8 months ($P < 0.001$).

Discussion

The present study found that independent age of walking in infants with idiopathic clubfoot treated using Ponseti method was 13.6 months (range 9–22 months) which represents a delay of 1.5 months to 2 months. Our results are similar to previously published literature [4, 6, 8, 13, 16].

In a recent study, authors noted a delay of 0.7 months in unilateral as compared to 1.7 months in bilateral cases [13]. Capute et al. [17] determined the independent age of walking in 381 normal children to be 11.7 months. Davis et al. [18]. studied developmental milestones in 351 children without clubfoot and found that subjects who were positioned in supine attained their motor milestones at a later age than children who were positioned in the prone position during sleep. The mean age of independent walking for the entire sample was 12.2 months, 1.4 months earlier when compared to the present study.

The World Health Organization (WHO) [19] reported a mean age of independent walking, in 816 healthy infants, to be 12.1 ± 1.8 months. The age of achievement of independent walking was significantly higher in our present study as compared to the WHO study (1.5 months) ($P < 0.0001$).

Neligan and Prudhan reported the distribution of walking age in their study [20]. Similarly, Denver II is used to evaluate children's development and provide age norms at which 50%, 75%, and 90% of children attain a milestone [20]. Compared to these studies, our patients with clubfoot walked at a later age (Table 2).

Garcia et al. used the Alberta Infant Motor Scale (AIMS) and reported gross motor skills of a group of 26 infants with clubfoot treated with different methods (Ponseti method 12 infants, French method nine infants, and both five infants). These results were compared with a group of 26 controls. Although there was no difference in gross motor development at 3 and 6 months, AIMS score was lower at 9 and 12 months in the clubfoot group. They found that the mean age of walking was 13.9 months for clubfoot group [6].

Sala et al. reported the mean age of independent walking to be 13.9 months in 36 infants with idiopathic clubfoot treated using Ponseti method [4].

Zionts et al. evaluated independent walking age in 94 infants with idiopathic clubfoot and found it to be 14.5 months, 2 months later than healthy infants. The authors noted that severe deformity and relapse had a significant effect on walking age [8].

Zanardi et al. concluded that the mean independent age of walking for both groups was 14.4 months, not affected by severity, bilaterality, or the method of treatment used (Ponseti vs. French) [16]. In our study also, we did not find any difference in unilateral versus bilateral cases. Gundawar et al. reported that walking age was later in bilateral cases by 1 month [13].

Of the other variables evaluated, we found the infants with family history (10%) walked at an average age of 11.7 months, similar to healthy infants. Zionts et al. did not find any significant difference in independent walking age in infants having family history [8]. In view of the relatively small sample of children with a positive family history, this requires further evaluation.

Zionts et al. reported that walking age was affected significantly by the severity of deformity using Dimeglio score [8], but we were unable to confirm this.

We found that early relapse caused a delay in walking. Infants with early relapse require additional casting and thus extending period of immobilization, highlighting the need of early correction of the deformity and maintenance of complete correction in the foot abduction orthosis.

Delay in attainment of independent walking in children with

clubfoot has been claimed to be multifactorial including motor dysfunction, genetic, cultural, and behavioral factors and unrelated to brace use [5, 6, 7, 16]. Gundawar et al. stated that the delayed pre-ambulatory milestones are probably due to immobilization in cast and braces or due to the clubfoot itself [13].

Andriess et al. were the first to report the increased risk of motor activity limitations in children with clubfoot [5]. In addition, deficits in gross motor performance, cognitive spatial skills, and impaired balance have been found in children with CTEV at age of 3 years [9, 10].

However, minimal gait disturbances do not interfere with function or parental assessment of abilities and satisfaction in children with clubfoot [11, 22].

Recently, Gundawar et al. have reported a delay in walking age in clubfoot patients treated by Ponseti technique [13]. We

believe that our data are more accurate because of close follow-up, examination by the treating physician at every visit and parents noting down the development of milestones contemporaneously. Considering that the mean discrepancy in parental recall of their infant's first steps was <0.4 months at 3 and 5 years after the occurrence, recall method holds good for the documentation of walking age [23].

Conclusion

Infants with idiopathic clubfoot treated with Ponseti method experience delays in age at walking of 1.5–2 months. Independent walking age is not affected by the gender, bilaterality, severity of deformity, number of casts, requirement of tenotomy, and non-compliance to brace. Relapse of the deformity can lead to delay in walking age highlighting the importance of early correction and maintenance of correction.

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Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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