



# A Study of Percutaneous Tendoachilles Tenotomy under Local Anesthesia for Residual Equinus in Management of Primary Club Foot by Ponseti Technique

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## ABSTRACT:

**OBJECTIVE:** To correct the residual equinus deformity of the ankle after correcting the cavus, varus, forefoot adduction, and equinus (partially) by casting using the Ponseti technique<sup>1</sup> and evaluation of correction of equinus deformity by Pirani scoring<sup>2</sup> before and after tenotomy. **METHODS:** In this prospective study, 25 patients with idiopathic clubfoot (33 feet) were treated with the Ponseti method<sup>1</sup> of serial casting, tendoachilles tenotomy, and bracing of clubfoot. Pirani scoring<sup>2</sup> is done weekly during the casting phase, before and after tenotomy (after the final cast), and during the bracing review schedule. **RESULTS:** In this study of 33 feet after treatment with the Ponseti method<sup>1</sup> there is a significant reduction of Pirani scoring<sup>2</sup> and there is a significant reduction of equinus deformity before and after tendoachilles tenotomy. **CONCLUSION:** Tendoachilles tenotomy is a crucial part of the ponseti method<sup>1</sup> of treatment and it is a safe minor day-care procedure performed under local anesthesia which will correct residual equinus and decrease the need for extensive corrective surgery. The Pirani score<sup>2</sup> is used to assess the severity of club foot, to monitor the progress of the treatment by Ponseti technique<sup>1</sup>, to know the need and timing of tenotomy, and to recognize relapse during the bracing protocol.

## I. INTRODUCTION:

Club foot, also known as congenital talipes equinovarus (CTEV)<sup>3</sup> India's most common congenital deformity. Club foot is the most common congenital physical disability of the foot worldwide<sup>3</sup>, known to occur in 1-3 of every 1,000 births worldwide with evidence of higher rates in developing nations and 8,000,000 adults worldwide who are physically disabled with CTEV who could have been cured if treated. In India, every day, 150 children are born with Clubfoot. In Asia 75,000, and in India, it is estimated that more than 53,000 children in Andhra Pradesh on average

659 children are born with Clubfoot every year<sup>3</sup>. Among all, idiopathic Clubfoot is the most familiar presentation that occurs in normal infants<sup>4</sup>. The female-to-male ratio is 1:2, and 40% of cases are bilateral<sup>4</sup>. Many are having a positive family history. 1% chance in 10 relatives, 10% in siblings, 35% in monozygotic twins, and 2% in dizygotic twins<sup>4</sup>. The Ponseti method<sup>1</sup> is now considered the gold standard for treating primary clubfoot. It is a conservative method that consists of the correction of deformities by manipulation, serial casting, tendoachilles tenotomy, and maintenance of correction by foot abduction brace. The Pirani Score<sup>2</sup> is a reliable method for assessing the amount of deformity in congenital Clubfoot and is used to grade and document the deformities weekly, before and after ponseti treatment, before and after tenotomy. Tenotomy is a simple and crucial step in the Ponseti method<sup>1</sup> of treatment of clubfoot.

## II. MATERIALS AND METHODS:

This study was conducted in our institute. This study was done from January 2021 to November 2022, and cases were selected on an orthopaedic OPD basis on Tuesday/Wednesday in our institute. The cases were confirmed to be idiopathic Clubfoot by ruling out any other congenital anomalies example, spinal abnormalities, Arthrogyrosis multiplex congenita<sup>5</sup>, or history of exposure to radiation or any teratogenic drug intake during pregnancy.

Pirani scoring<sup>2</sup> is done weekly during the casting phase, before and after tenotomy (after the final cast), and during the bracing review schedule.

### Inclusion Criteria:

- To correct residual equinus after full correction of cavus, adduction, varus, and partial equinus deformities in children under 4 years when midfoot score < 1 and hindfoot score > 0.5 (Pirani score<sup>2</sup>).
- Primary clubfoot.



#### Exclusion Criteria:

- a. Syndromic club foot (spina bifida, arthrogryposis<sup>5</sup>).
- b. Recurrent club foot.
- c. Neglected club foot.
- d. Atypical club foot.
- e. Complex club foot.
- f. Postural club foot.
- g. Children > 4 years of age.

A total of 33 feet confirmed by experts to have Untreated Idiopathic Clubfoot were enrolled in the study. The severity of the deformity for each foot was graded according to Pirani scoring<sup>2</sup>. Treatment Regimen – The Ponseti Way<sup>1</sup>: The treatment was the correction of the deformity by weekly serial casting, tendoachilles tenotomy, and maintenance of that correction by bracing. Serial above-knee casting is applied every week after manipulation until forefoot adduction, cavus, varus, and part of equinus deformity also get corrected due to kinematic coupling<sup>4</sup>. Kinematic coupling<sup>4</sup> is the term given to the manner in which the movement of one tarsal bone affects the movement of others in the subtalar joint. Then residual equinus deformity is corrected by percutaneous tendoachilles tenotomy under local anesthesia and above knee cast applies for 3 weeks.

Tenotomy is done as soon as Pirani's score<sup>2</sup> indicates the MFCS is 1 or less, the score for the lateral head of the talus is zero, the heel is in valgus and the foot is in abduction. In the tenotomy procedure, a competent assistant holds the limb firmly at the knee, knee straight. The other hand holds the toes and dorsiflexes the foot to stretch the Achilles tendon. The tendon feels most prominent 1-2 cm above the calcaneus. A very small amount of lignocaine is injected into this site, not more than 0.5cc is required. And the assistant applies dorsiflex stress. The scalpel blade is inserted immediately anterior to the tendon from the medial side with the orientation of the blade in line with the tendon. The blade is rotated posteriorly and the tendon cut is complete. A small amount of bleeding is normal, a piece of clean gauze is placed over the incision and the orthopedic surgeon applies a new above-knee plaster cast. The plaster cast should be in 70-degree external rotation and 10-degree dorsiflexion. The plaster cast should stay on for 3 weeks and is usually the last plaster cast required in the treatment program. The child and mother can go home immediately with some pain relief medication for the child. Pirani scoring<sup>2</sup> is done weekly during the casting phase, before and after tenotomy, and during the bracing review schedule.

### III. RESULTS:

In this prospective study total, 33 feet (25 patients) were treated by the Ponseti<sup>6</sup> method, the endpoint of casting treatment is taken as ten casts. 17 unilateral and 8 bilateral cases among 25 cases. After deformity correction (casting, heel cord tenotomy), then started on the bracing protocol with foot abduction braces.

The mean initial Pirani<sup>2</sup> severity score before treatment by castings for 33 feet was 4.409. After correction by the Ponseti technique<sup>1</sup>, the final mean score at end of castings was found to be 1.1364 and the mean change in score was found to be 2.773. This was analyzed by the paired t-test and the p-value was <0.0001 which is significant.

In our present study out of 33 feet, 28 feet (84.85%) required tenotomy and 5 feet (15.15%) did not require tenotomy. In the present study, the Pirani scoring<sup>2</sup> just before, and after tenotomy is noted. Tenotomy is indicated when the midfoot score is < 1 (0, 0.5) and the hindfoot score is 1. Achilles tendon tenotomy is unnecessary when both the hindfoot score and the midfoot score are < 1. Achilles tendon tenotomy is contraindicated when the midfoot score is > 0.5, then the child still needs correction by casting.

In our present study, Tendoachilles tenotomy was performed on 28 feet and their Pirani scores<sup>2</sup> before and after the tenotomy were noted. Before tenotomy, all the cases have a hindfoot score of 1 and a midfoot score of either 0 or 0.5. Out of 28 feet, 17 feet (68%) have a Pirani score<sup>7</sup> of 1.5 and 11 feet (32%) have a Pirani score<sup>2</sup> of 1.

Out of 17 feet with 1.5 Pirani scores<sup>2</sup> before the tenotomy, 11 feet (64.70%) have Pirani scores<sup>2</sup> of 0.5 after the tenotomy, and 6 feet (35.29%) have Pirani scores<sup>2</sup> of 1 after the tenotomy. Out of 11 feet with Pirani scores<sup>2</sup> of 1 before the tenotomy, 7 feet (63.37%) have Pirani scores<sup>2</sup> of 0, and 4 feet (36.36%) have Pirani scores<sup>7</sup> of 0.5.

In our study out of 33 feet, tendoachilles tenotomy was performed in 28 feet. The mean initial Pirani score<sup>2</sup> before tenotomy for 28 feet was 1.3036. After tenotomy, the final mean score was found to be 0.4821, and the mean change in score was found to be 0.893. This was analyzed by the paired t-test and the p-value was <0.00001 which is significant.

Out of 28 feet in which tenotomy was done, 17 feet have a midfoot Pirani score<sup>2</sup> of 0.5, and 11 feet had a midfoot Pirani score<sup>2</sup> of 0 before the tenotomy. The mean initial midfoot score before tenotomy for 17 feet was 0.5. After tenotomy, the final mean midfoot score was found to be 0.1765, and the mean change in score was found to be 0.338. This



was analyzed by the paired t-test and the p-value was  $<0.00001$  which is significant. This means there is an increase in foot abduction in some cases after tenotomy which was significant.

The mean value of Pirani score<sup>2</sup> on regular follow-up at 6 months was 0.106, which shows a change of 4.303 from the mean initial score of 4.409 before casting. This change also has a p-value of  $<0.0001$  which is significant.



**Fig1: case images of a treated case**



AGE DISTRIBUTION:

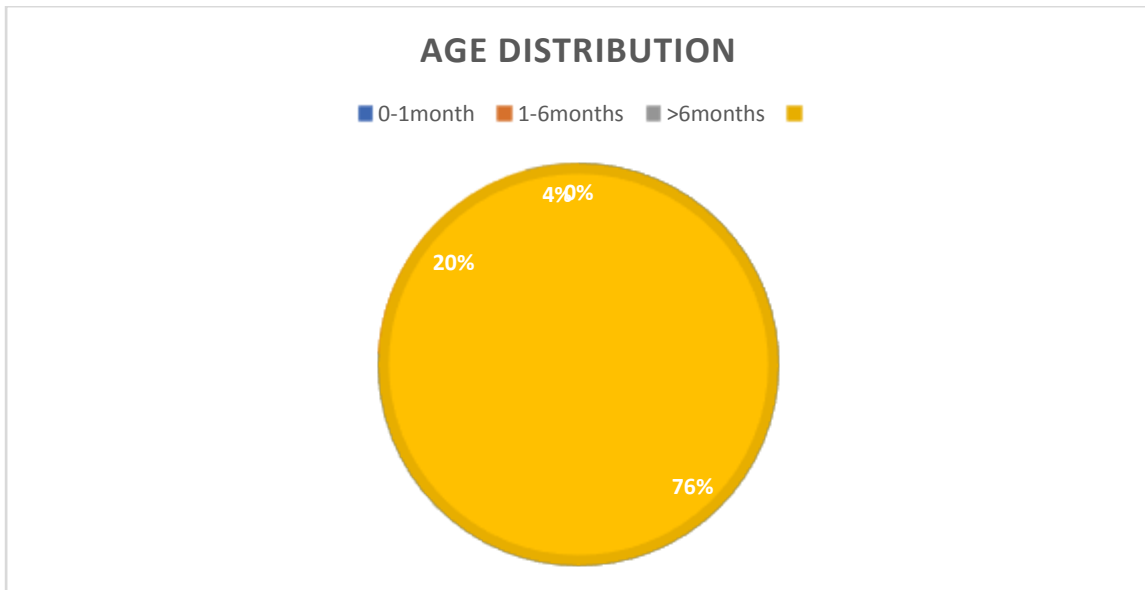


Fig 2: Age distribution in the present study

SEX DISTRIBUTION:

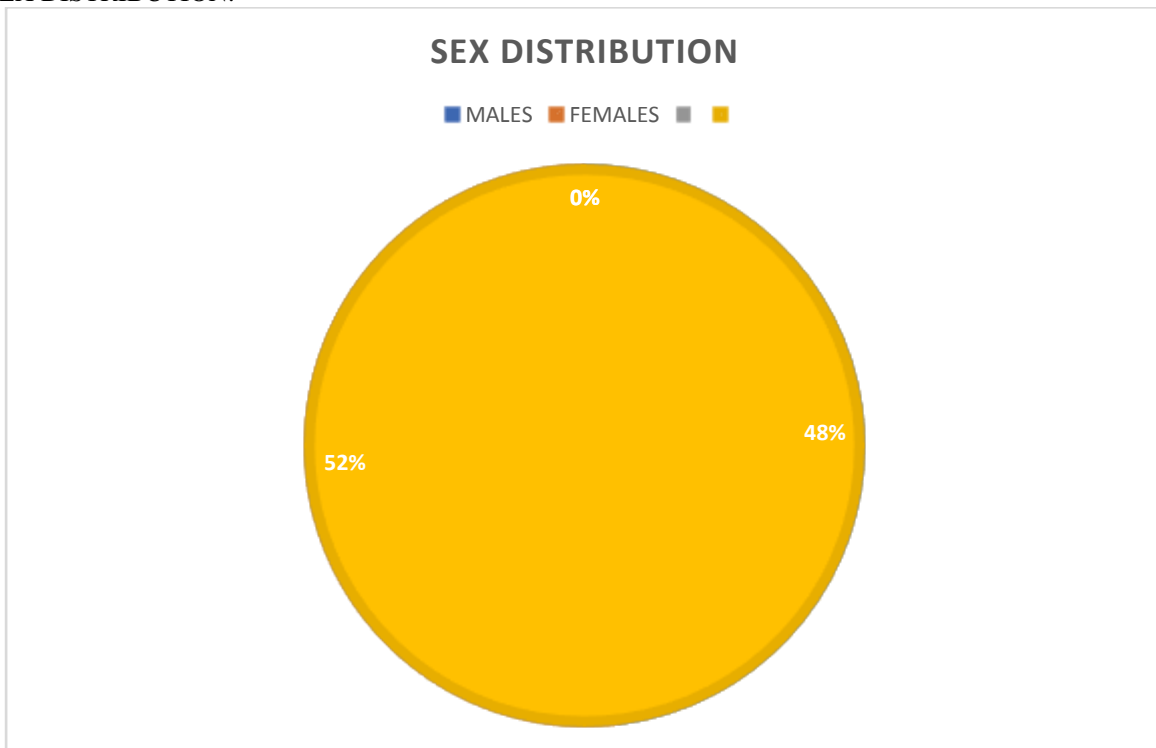


Fig 3: Sex distribution in the present study



SIDE OF INVOLVEMENT:

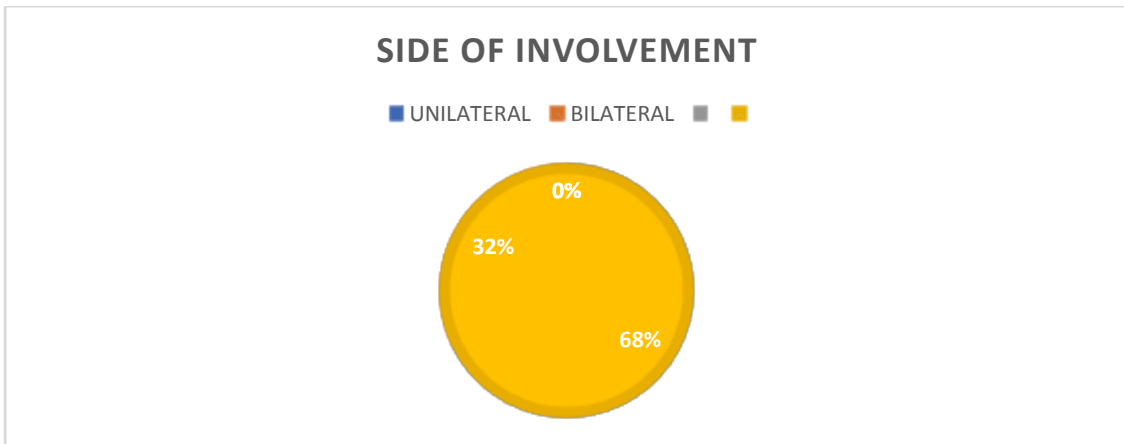


Fig 4: Side of involvement in the present study

DETAILS OF PERCUTANEOUS TENOTOMY DONE:

Tenotomy	Frequency	Percent
Done	28	85
Not done	5	15

Table 1: Number of tenotomies done in the present study

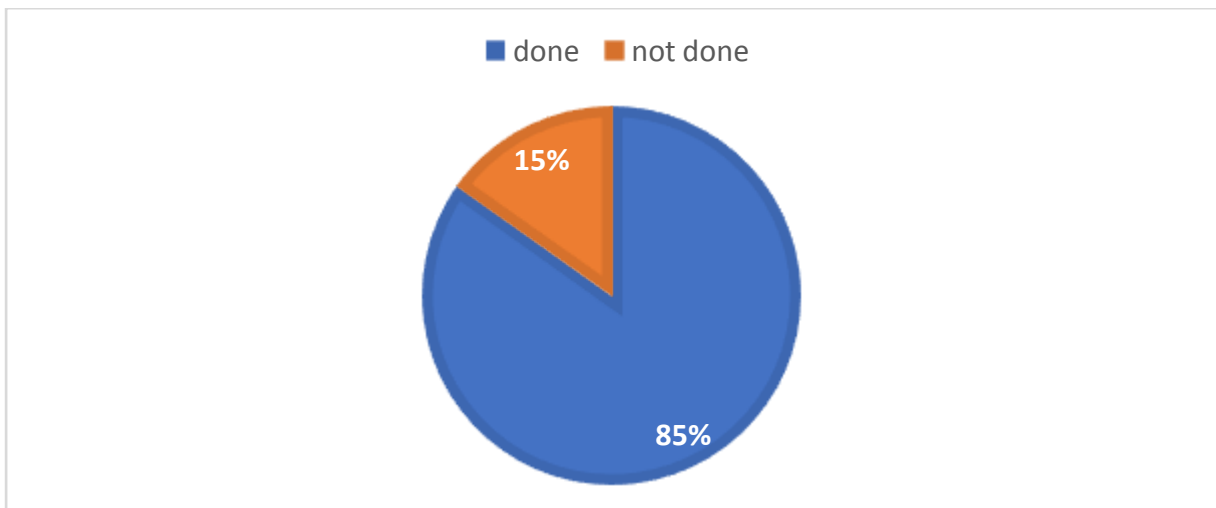


Fig 5: Number of tenotomies done in the present study

**IV. DISCUSSION:**

The Ponseti<sup>1</sup> approach of clubfoot care is now widely accepted as the gold standard for treating deformity and achieving a plantigrade, painless, and flexible foot. The Pirani Clubfoot Score<sup>2</sup> assessing the severity of the deformity and scores are an excellent way to monitor the progress of treatment.

**The present study in comparison with other studies:**

**AGE DISTRIBUTION:**

V. Pavone et al,<sup>6</sup> in their study with 82 patients (114feet), there are;

76 children – between 0-12 weeks with a mean age of 14 days.

4 children – between 13-24 weeks with a mean age of 5 weeks.



2 children – between 25-36 weeks with a mean age of 34 weeks.

Mohammad Hallaj, Moghaddam, et al,<sup>7</sup> in their study with 85 patients mean age at the time of first casting is 8 days ranging from 1 to 60 days.

In the present study when the feet were divided by age of the child at first presentation, it was discovered that the majority of the children

were under one month old, with children less than a week-old accounting for the majority of them. The present study's youngest patient was 2 days old, while the oldest was 193 days, with a mean age of 23.8 days. The age of the child at first presentation in comparison with other studies in the literature does not correlate with our present study due to the small sample size of the present study.

**SEX DISTRIBUTION:**

study	Sex ratio (male: female)
Kite's series <sup>8</sup>	2.07:1
Wyne Davis series <sup>9</sup>	2.17:1
Jose A. Morcuende et al. series <sup>10</sup>	2.02:1
Harnet et al. series <sup>11</sup>	1:1
J.O. Mejabi et al. study <sup>12</sup>	1.7:1
Present study	1:1.08

**TABLE 2: SEX INCIDENCE COMPARISON**

**LATERALITY COMPARISON:**

STUDY	BILATERAL	UNILATERAL
Wyne Davis study <sup>9</sup>	44%	56%
P. Harnett et al. <sup>11</sup>	52.5%	47.5%
Jose Morcuende et al. <sup>10</sup>	38%	62%
J.O. Mejabi et al. study <sup>12</sup>	67.2%	32.8%
Present study	32%	68%

**TABLE 3: LATERALITY COMPARISON**



PIRANI SCORES<sup>7</sup> VS. THE NUMBER OF CASTS REQUIRED:

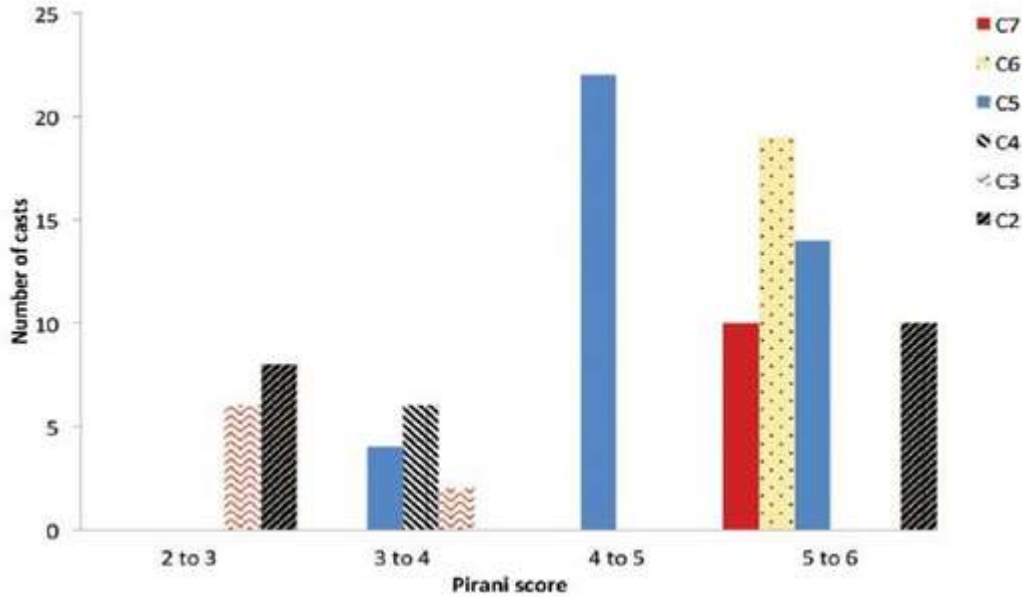


Fig 6: Sharma et al. study<sup>13</sup>- Pirani scoring<sup>2</sup> vs. no. of casts.

The above image shows the Sharma et al. study<sup>13</sup>Pirani score<sup>2</sup> versus the number of casts required and C represents the number of casts.

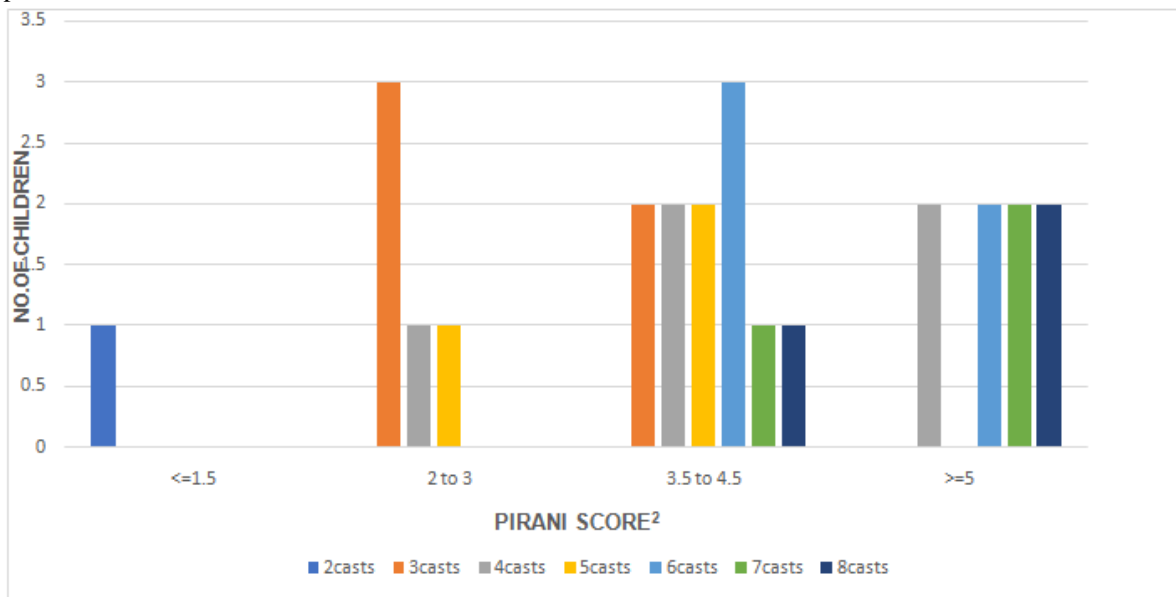


Fig 7: Present study – Pirani score<sup>2</sup> vs no. of casts required.

Fig 7: represents the number of casts required to achieve deformity correction in 25 children, in relation to the Pirani score<sup>2</sup> at the time of initial presentation for 25 children in the present study.



PIRANI SCORING<sup>2</sup> VS. TENOTOMY:

Fig 8: M. Porechea, D Parmar study<sup>14</sup> – tenotomy vs Pirani<sup>2</sup> score

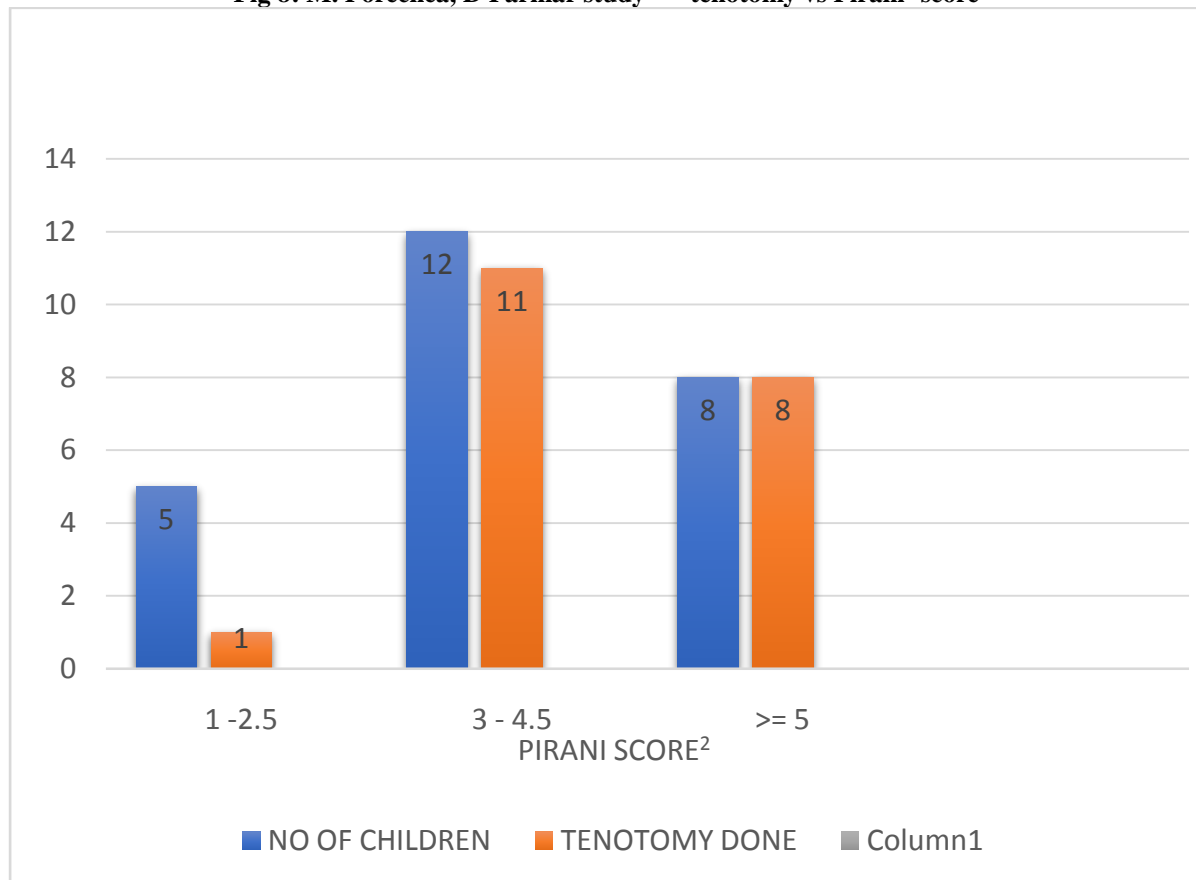


Fig 9: Present study – Pirani<sup>2</sup> score vs Tenotomy.

**V. CONCLUSION:**

From this study, we conclude that the Ponseti method<sup>1</sup> of clubfoot management is effective in deformity correction and tendoachilles tenotomy is a crucial part of the Ponseti method<sup>1</sup> of treatment which is a safe minor day-care procedure performed under local anesthesia which will correct residual equinus and decreases the need for extensive corrective surgery. Pirani score<sup>2</sup> is used to assess the severity of club foot, to monitor the progress of the treatment by Ponseti technique<sup>1</sup>, to know the need and timing of tenotomy, and to recognize relapse during the bracing protocol. The Achilles tenotomy in clubfoot patients not only increases ankle dorsiflexion but also increases foot abduction due to the oval field of motion of the ankle and subtalar joint complex however Dimeglio scoring system<sup>15</sup> is a better measuring tool for this. A Foot abduction brace is used to maintain correction after tenotomy and to prevent a recurrence. Ponseti method<sup>1</sup> is an excellent and scientifically accepted conservative method of treatment for Clubfoot with Pirani scoring<sup>2</sup> to have a foot that is pain-free,

flexible, plantigrade, mobile, and normal in appearance.

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