



PONSETI VERSUS KITE'S METHOD OF TREATMENT FOR IDIOPATHIC CLUBFOOT.

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| Dr. Pranjal Tahbaldar | M.S. Orthopaedics, Professor and Head of Department, Department of Orthopaedics, Jorhat Medical College and Hospital. |
| Dr. Sikhar Jyoti Bhuyan* | M.B.B.S., Postgraduate Trainee, Department of Orthopaedics, Jorhat Medical College and Hospital *Corresponding Author |
| Dr. Sodagor Singha | M.S. Orthopaedics, Senior Resident, JSB Civil Hospital. |
| Dr. Nayanmoni Dutta | M.S. Orthopaedics, Assistant Professor, Department of Orthopaedics, Jorhat Medical College and Hospital. |

ABSTRACT **Introduction :** Idiopathic congenital talipes equinovarus deformities in infants are difficult to treat due to its complicated pathoanatomy of the growing foot. As clubfoot deformities are pliable in the early weeks of life, treatment preserved is always conservative. Both manipulation and casting methods of Kite and Ponseti are commonly used with good outcomes. Though most orthopaedicians prioritize using Ponseti method, advantages and disadvantages of both treatment should be taken into consideration when selecting the treatment. So, we have decided to carry out a comparative study between Kite's and Ponseti method in the treatment of idiopathic clubfoot. **Materials and methods :** 33 patients (48 feet) having idiopathic CTEV were randomized and divided into two groups. 18 infants (26 feet) were selected and treated by Ponseti method and 15 infants (22 feet) were treated by Kite's method. The results of both groups were compared based on Pirani score, time and number of casts required for correction, relapse and percentage of feet corrected. **Results :** Ponseti method had higher satisfactory correction rate (91.67% versus 80.95%), required less number of casts (7.57 versus 11.76), less duration of cast (53 days versus 82.35 days) and lesser percentage of relapse (8.33% versus 9.52%). The relapse were corrected by remanipulation in both the groups. In case of bilateral idiopathic CTEV mean Pirani score decreased faster in the Ponseti group compared to Kite's group. The difference was statistically significant 3rd week onwards in left sided CTEV and 4th week onwards in right sided CTEV. In case of unilateral idiopathic CTEV, the mean Pirani score in Ponseti group decreased faster in Ponseti group compared to Kite's group and the difference was statistically significant 3rd week onwards. **Conclusion :** Both Ponseti and Kite's method of casting are effective in correcting idiopathic CTEV deformities. Though correction rate was almost similar in both methods, Ponseti method proved slightly better than Kite's in correcting deformities faster with relatively lesser number and duration of casts. The Kite's method had an advantage of not needing any minor surgical procedure for the correction of deformity.

KEYWORDS : Idiopathic congenital talipes equinovarus, Kite's method, Ponseti method, Pirani score.

INTRODUCTION.

Congenital talipes equinovarus is a malformation of the osteoarticular system characterized by hindfoot or heel varus, forefoot adductus, an augmented midfoot arch (cavus), and equinus of hindfoot. It may involve either one foot or both feet, and is most commonly idiopathic, which means the causes are unknown. It can also present as syndromic clubfoot which is associated with other congenital anomalies. About 50% of the infants with congenital talipes equinovarus have bilateral foot deformities, and if unilateral foot is involved it occurs more frequently on the right side. Males are more affected than females with a male-to-female ratio of 2:1.2 The data available from the epidemiological studies done over the last few years shows a birth prevalence in the range of 0.5-2 cases per 1000 live births.³

Congenital talipes equinovarus deformities in infants are difficult to treat due to its complicated pathoanatomy of the growing foot. Therefore it is important to understand the pathoanatomy and biomechanics of correction. The clubfoot deformities are pliable in the early weeks of life, therefore treatment preferred is always conservative. Thus, the manipulation and casting methods of Kite and Ponseti are commonly used with good outcomes.¹

In the past many methods of casting have evolved to correct the deformities of congenital talipes equinovarus by applying the force in the opposite direction of the deformities with fair amount of success rates. The method of manipulation and casting described by Kite was probably the most accurate in correcting the deformities of congenital talipes equinovarus a success rate of 90%. Since then many studies have come showing the successful application of the Ponseti method in congenital talipes equinovarus correction, so much so that the method is being accepted as gold standard treatment of idiopathic clubfoot all over the world. Ponseti and Laaveg concluded based on long-term follow-up (average 19 years) that 90% of their patients were satisfied with the function and appearance of their feet.⁹

Of late, most orthopaedic services prioritize treatment using the

Ponseti method. Yet the advantages and disadvantages of both treatments that should be taken into consideration when selecting treatment. Kite's method is a simple method easy to learn being purely conservative without involving even a minor surgical procedures and complications due to it in contrast to Ponseti method with long learning curve and having complications due to minor surgical procedures like percutaneous Achilles tenotomy. However, as the time required for the use of the cast is longer in case of Kite's method.⁴ Only few studies have compared the efficacy of these different conservative treatment methods for idiopathic congenital talipes equinovarus with inconclusive results and no definitive conclusions have been reached. Therefore we decided to carry out a comparative study between Kite's and Ponseti method for the treatment of idiopathic clubfoot under same clinical condition in same centre which would help us choose the most effective method of correction for ICTEV.

MATERIALS AND METHODS.

A prospective study was conducted with 33 patients (48 feet) who met the inclusion criteria. Written consent was taken from the parents after which they were randomized into two groups. Ponseti method group had 18 infants (26 feet) and Kite's method group had 15 infants (22 feet). There were 24 males (13 in Ponseti and 11 in Kite's method group) and 9 females (8 in Ponseti and 7 in Kite's method group). 15 infants had bilateral pathology (8 in Ponseti and 7 in Kite's method group) while 18 infants had unilateral presentation (10 in Ponseti and 8 in Kite's method group).

Inclusion criteria:

- Age : 0 to 3 months of age.
- Idiopathic congenital talipes equinovarus.
- Providing consent to participate in the study

Exclusion criteria:

- Age > 3 months.
- Patients with associated neurological defects.
- Patients with associated congenital anomalies.

- d) Feet previously treated by conservative methods or has undergone any surgical intervention.
- e) Recurrent CTEV.
- f) Relapsed CTEV.

After giving consent to participate in our study, each infant was randomized into Ponseti or Kite's method group. A careful history and examination was done and baseline Pirani score was recorded. Then manipulation and casting was done as per Ponseti method or Kite's method as allotted.

Ponseti method : Here all components of clubfoot deformity requires correction simultaneously except the equinus which should be corrected at last. He explained that pronation of the forefoot in relation to the hindfoot causes the cavus deformity and is corrected when the foot is abducted by supinating the forefoot to align it with the midfoot. When the forefoot is in alignment, it can be gently and gradually corrected by abduction at the head of talus. When the entire foot is fully abducted in maximum central external rotation under the talus, it will correct the heel varus and foot supination. During the course of treatment the foot should never be everted. After all the components are corrected, the equinus can be corrected by dorsiflexing the foot. To facilitate the equinus correction percutaneous tendo-achilles tenotomy may be needed.



Fig 1 : Manipulation and serial casting by Ponseti method with percutaneous tenotomy and Steenbeck brace.

After percutaneous tenotomy, above knee cast is applied with foot in fully corrected position of 60-70 degrees of abduction, and 10-20 degrees of dorsiflexion. The cast is kept for 3 weeks and after 3 weeks the cast is removed and Steenbeck foot abduction brace is applied. The brace is worn 23 hours each day for the first 3 months after casting, letting one hour for bowel and bladder hygiene and bathing. Then while sleeping for 3 to 4 years. Follow up was done at monthly interval for three months and then three monthly for one year and six monthly thereafter. At each visit, patient was examined clinically for any relapse.

Kite's method : In Kite's method each component is corrected separately which involves gradual correction in order of forefoot adduction, heel varus and ankle equinus using repeated manipulation and casting. No attempt was made to progress to the next stage until the first had been fully corrected. At first, the adduction was corrected with the abduction of the foot with the thumb pressing over the calcaneocuboid joint and the foot was never beyond neutral 6. To correct the varus, hindfoot eversion was performed using cast changes. Then the forefoot and hindfoot equinus were corrected through progressive dorsiflexion but only after the adducted and inversion deformities were corrected. The toe-to-groin cast was changed in weekly interval until full correction of each component is secured.



Fig 2 : Manipulation and serial casting by Kite's method.

This was followed by similar splinting protocol as done in Ponseti group. Follow up was done at monthly interval for 3 months, then three monthly interval for one year and six monthly thereafter. At each visit patient was examined clinically for relapse. If there was relapse, trial to correct the deformities of the relapsed foot was done by remanipulation. The number of relapsed in both the group was recorded and compared. During each visit, scoring was done with the help of Pirani scoring system. The results in the both groups were categorized into good, acceptable and poor based on four parameters i.e. ankle dorsiflexion (degrees), heel varus (degrees), adduction of forefoot (degrees), tibial torsion. Final results were then compared between the two groups. Good and acceptable were considered as corrected and poor was counted as uncorrected.

Descriptive statistical analysis has been carried out in the present study. Quantitative data were expressed as mean ± standard deviation (S.D). Quantitative data were expressed as number and percentage. Qualitative data were analyzed using Chi-square (χ^2) test. Significance was assessed at 5% level of significance (p-value <0.05). The statistical analysis of all the data was performed using the computer program, Statistical Package for Social Sciences (SPSS for Windows, version 20.0 Chicago, SPSS Inc.) and Microsoft Excel 2010.

RESULTS.

In our study mean number of cast for correction was 7.57 in Ponseti method group and 11.76 in Kite's method group. The mean duration of casting in days was 53 in Ponseti group and 82.35 in Kite's group.

Bilateral idiopathic CTEV where both side treated by same method (either by Ponseti or Kite's method.)

Left side

When left sided feet of bilateral idiopathic CTEV treated by Ponseti method were compared to left sided feet treated by Kite's method, total Pirani score was 5.00±0.38 in the Ponseti group and 5.21±0.27 in the Kite's group at 1st week of follow up, which reduced to 2.81±0.53 and 3.50±0.29 respectively (p = 0.0093) at 5th week of follow up. The mean total Pirani scores in Ponseti group decreased faster than Kite's group and the difference was significant statistically from 3rd week onwards (p=0.0097). This indicates there was faster improvement and correction of deformities with Ponseti's method compared to Kite's method in the present study.

| Total Pirani score (Mean±SD) for left side of bilateral CTEV | | | |
|--|----------------|---------------|---------|
| Weeks | Ponseti method | Kite's method | P value |
| 1 | 5.00±0.38 | 5.21±0.27 | 0.2337 |
| 2 | 4.25±0.27 | 4.50±0.29 | 0.1052 |
| 3 | 3.69±0.46 | 4.29±0.27 | 0.0097 |
| 4 | 3.25±0.38 | 3.86±0.24 | 0.0076 |
| 5 | 2.81±0.53 | 3.50±0.29 | 0.0093 |

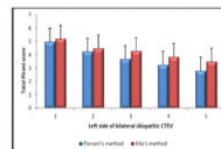


Fig 3 : Table and graph showing total Pirani score for left side in bilateral idiopathic CTEV.

Right side

When right sided feet of bilateral idiopathic CTEV treated by Ponseti method were compared to right sided feet treated by Kite's method, total Pirani score was 5.25±0.27 in the Ponseti group and 5.21±0.39 in the Kite's group at 1st week of follow up, which reduced to 2.88±0.52 and 3.93±0.35 respectively (p = 0.0005) at 5th week of follow up. The mean total Pirani scores in Ponseti group decreased faster than Kite's group and the difference was significant statistically 4th week onwards (p=0.0226). This analysis of the present study also indicates there was faster improvement and correction of deformities with Ponseti method compared to Kite's method.

| Total Pirani score (Mean±SD) for right side of bilateral CTEV | | | |
|---|----------------|---------------|---------|
| Weeks | Ponseti method | Kite's method | P value |
| 1 | 5.25±0.27 | 5.21±0.39 | 0.8383 |
| 2 | 4.56±0.42 | 4.79±0.49 | 0.3566 |
| 3 | 3.94±0.42 | 4.36±0.38 | 0.0634 |
| 4 | 3.71±0.59 | 4.07±0.53 | 0.0226 |
| 5 | 2.88±0.52 | 3.93±0.35 | 0.0005 |

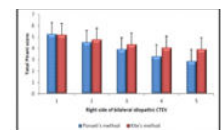


Fig 4 : Table and graph showing total Pirani score for right side in bilateral idiopathic CTEV.

Unilateral idiopathic CTEV treated by Ponseti or Kite's method (18 patients - 18 feet).

When unilateral idiopathic CTEV either side treated by Ponseti's method were compared to those treated by Kite's method, total Pirani score was 5.20±0.35 in the Ponseti group and 5.25±0.38 in the Kite's group at 1st week of follow up, which reduced to 2.85±0.24 and 3.56±0.56 respectively (p= 0.001) at 5th week of follow up.

The mean total Pirani scores decreased faster in Ponseti group than Kite's group and the difference was statistically significant from 3rd week onwards (p=0.013). This indicates there was faster improvement and correction of deformities with Ponseti's method compared to Kite's method.

| Total Pirani Score (Mean±SD) for either side of unilateral CTEV | | | |
|---|----------------|---------------|---------|
| Weeks | Ponseti method | Kite's method | P value |
| 1 | 5.20±0.35 | 5.25±0.38 | 0.879 |
| 2 | 4.50±0.24 | 4.75±0.46 | 0.179 |
| 3 | 3.95±0.28 | 4.44±0.42 | 0.013 |
| 4 | 3.35±0.24 | 3.86±0.35 | 0.002 |
| 5 | 2.85±0.24 | 3.56±0.56 | 0.001 |

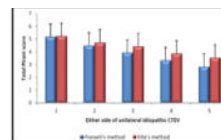


Fig 5 : Table and graph showing total Pirani score for unilateral idiopathic CTEV.

Percentage of relapse in both the study groups.

In Kite's group there were 2 (9.52%) feet with relapse of deformities, which were corrected by remanipulation and therefore did not require surgical intervention. In Ponseti group there were 2(8.33%) feet with relapse which were corrected by remanipulation without the need of surgical intervention.

Final assessment of deformity correction

Final results have been classified into three grades based on four parameters to assess the deformity correction.

| Ankle dorsiflexion (degrees) | Heel Varus (degrees) | Adduction of forefoot (degrees) | Tibial torsion(degrees) | Grade |
|------------------------------|----------------------|---------------------------------|-------------------------|------------|
| >10 | 0 | 0-10 | 0 | Good |
| 0-10 | 0-10 | 10-20 | Moderate | Acceptable |
| 0 | Over 10 | Over 20 | Severe | Poor |

Fig 6 : Table showing three grades and four parameters to assess deformity correction.

In Ponseti group 75%(18 feet) were graded as good, 16.67%(4 feet) as acceptable and 8.33%(2 feet) as poor. 2 (two) feet were lost in the follow up. In Kite's group 66.67%(14 feet) were graded as good, 14.28%(3 feet) as acceptable and 19.04%(4 feet) as poor. 1 (one) foot was lost in the follow up. In the Kite's group, satisfactory correction was achieved in 17 (80.95%) feet following treatment, and uncorrected in 4 (19.04%) feet. In the Ponseti group, satisfactory correction was achieved in 22 (91.67%) feet and uncorrected in 2 (8.33%) feet.

4 feet (18.18%) in the Kite's group and 2 feet(8.33%) in Ponseti group remained uncorrected which were advised surgical intervention.

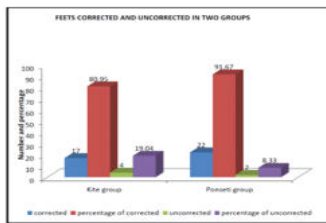


Fig 7 : Graph showing deformity correction in both the groups.

Comparative observations and results of the two study groups based on some of the important variables.

Comparison between the two groups showed that Ponseti group had slightly higher correction rate (91.67% vs 80.95%, 22 vs 17 feet, p=0.2921). The Ponseti method required fewer number of cast (p<0.0001) which was highly significant statistically and also required significantly shorter duration of casting (p<0.0001) for correction.

| Variables | Kite group | Ponseti group | p- value |
|--|---|---------------|---|
| Age at presentation in weeks (Mean±SD) | 3.00±0.85 | 3.56±1.04 | Not significant 0.1072 |
| Laterality | Right | 5 | Not significant 0.9851 |
| | Left | 3 | |
| | b/l | 7 | |
| No. of Casts (Mean±SD) | 11.76±0.75 | 7.57±0.51 | Highly Significant p<0.0001 |
| Percutaneous tenotomy | Yes | 0 | Highly Significant P<0.0001 |
| | No | 22 | |
| Duration of cast in days (Mean±SD) | 82.35±5.27 | 53.00±3.55 | Highly significant p<0.0001 |
| No. of feet | Corrected | 22 | Not significant Yates X ² value=0.38,df=1 p=0.2921 |
| | Uncorrected | 17 | |
| | Relapse | 4 | |
| | Lost to follow up | 2 | |
| | No. of feet advised surgical intervention | 2 | |

Fig 8 : Comparing the observations and results between the two study groups based on some important variables.

DISCUSSION.

The results of correction in 48 feet using both Ponseti and Kite's method were evaluated and compared with other similar studies conducted earlier.^{1,4,9,10,11,12,13}

The mean number of cast for correction was 7.57 and 11.76 in Ponseti

and Kite's group respectively. Our results were comparable to the study conducted by Sud et al. 9 who found the mean number of casts to be 6.2 and 10.7 in Ponseti and Kite's group respectively.

The mean duration of casting in our study was 53 and 82.35 days in Ponseti and Kite's group respectively. Our results were comparable to similar studies conducted by Sud et al. 9 and Sanghvi et al. 4

| | Mean duration of casting (in days) | |
|-----------------|------------------------------------|---------------|
| | Ponseti method | Kite's Method |
| Sud et al. 9 | 49.42 | 91.24 |
| Sangvi et al. 4 | 70 | 91 |
| Our study | 53 | 82.35 |

Fig 9 : Comparing our results of mean duration of casting (in days) with other studies.

When left sided feet of bilateral idiopathic CTEV treated by Ponseti method were compared to left sided feet of bilateral idiopathic CTEV treated by Kite's method, the mean total Pirani score in Ponseti group decreased faster than Kite group and the difference was significant statistically 3rd week onwards (p=0.0097). While on the right side also the mean total Pirani score in Ponseti group decreased faster than Kite's group, but the difference was significant statistically from 4th week onwards (p=0.0226).

When unilateral idiopathic CTEV either side treated by Ponseti method were compared to those treated by Kite's method, the mean total Pirani scores in Ponseti group decreased faster than Kite's group and the difference was significant statistically 3rd week onwards(p=0.013).

These comparisons indicates that there was faster decrease of total Pirani score with Ponseti method compared to Kite's method. As the decrease of total Pirani score means improvement and correction of the components of idiopathic CTEV deformities, this study shows that Ponseti method of manipulation and casting caused faster reduction and correction of idiopathic CTEV deformities as compared to the Kite method of manipulation and casting. The results of the present study are comparable with other studies in the literature in terms of Ponseti method being superior than the Kites method for the treatment of idiopathic CTEV.

Rijal et al. 11 compared the outcome of Ponseti and Kite's method of treatment for idiopathic clubfoot which was evaluated by Pirani score. The study showed Pirani scores decreased much faster with Ponseti than the Kite's method. Kaseke F et al. 12 in their study reported that feet managed by the Ponseti method showed faster rates of decrease in Pirani score as compared to feet treated by Kite's method.

In our study relapse in Ponseti and Kite's group were 8.33% and 9.52% respectively which was comparable to similar study conducted by Derzsi et al. 13 (relapse in Ponseti and Kite's group were 11.32% and 35.65% respectively). Relapse is slightly more in Kite's group than in Ponseti method which were mainly seen from 3 to 4 months after initial correction. The relapses were seen when splints were removed prematurely, mainly due to family's own decision, and also because when the parents see that the feet look normal while the child walks and yield to the child's resistance to continuing to wear the night splints.

When we closely examined the relapsed cases we found that in the Ponseti group there was reappearance of all the components of the clubfoot deformities which indicates that there was inadequacy in applying the force which corrects the components of deformities or in maintaining that correct position by splint. On the other hand the relapsed cases in Kite's group showed reappearance of mainly the varus component of clubfoot deformity which indicates again the inadequacy in applying the force which corrects the components of deformities or prematurely declaring the foot as corrected failing to identify the varus component. This explains the Ponseti's disagreement with the Kite's error. The use of calcaneocuboid joint as fulcrum instead of talar head actually blocks abduction of calcaneum which is the most important movement required for correction of heel varus.

In our study percentage of feet corrected in Ponseti group was 91.67 and percentage of feet corrected in Kite's group was 80.95 which was comparable to similar studies conducted by Sud et al. 9, Sanghvi et al., Garcia et al. 4. In the present study percentage of feet corrected was slightly higher in Ponseti group than in Kite's group.

| | Percentage of feet corrected | |
|-----------------------------|------------------------------|---------------|
| | Ponseti Method | Kite's method |
| Sud et al. ⁹ | 91.7 | 67.7 |
| Garcia et al. ⁴ | 94 | 76 |
| Sanghvi et al. ¹ | 87 | 79 |
| Our study | 91.67 | 80.75 |

Fig 10 : Comparing our results of percentage of feet corrected with other studies.

The results from this present study are comparable to the other studies in the literature which indicates Ponseti method has slightly better success rate than Kite's method. This present study also shows Ponseti method corrects the deformities much faster than Kite's method which was significant statistically. It also shows Ponseti method takes shorter duration than Kite's method to achieve correction. This above findings may be attributed to simultaneous correction of all the deformities in Ponseti method instead of sequential correction in Kite's method, correcting the cavus in the supinated position (called the magic move of Ponseti) and hyper-abducting the entire foot under the talus without touching the heel.

The other factor which might be responsible for superior results in Ponseti method are using of talar head as fulcrum instead of calcaneocuboid joint which allows anterior end of calcaneum to unlock under the talus followed by abduction, eversion and dorsiflexion leading to correction of heel varus and equinus. Finally the better result and shorter duration of correction in Ponseti method may be associated with involvement of minor surgical procedure like percutaneous achilles tendon tenotomy.

CONCLUSION.

From our study, both the methods were found to be effective in correcting the deformities of idiopathic CTEV. The correction rate was almost similar in both the methods. Ponseti method proved to be better than Kite's method in the treatment of idiopathic CTEV with respect to number and duration of casts required for correction of the deformities and rate of decrease of total Pirani score. However, the advantage of Kite's method was that it does not involve any minor surgical intervention. But the Ponseti method involved minor surgical procedure like percutaneous tenotomy of achilles tendon in majority of the patients for the correction of equinus component.

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