

MANAGEMENT OF CONGENITAL TALIPES EQUINOVARUS BY PONSETI METHOD

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ABSTRACT: INTRODUCTION: Idiopathic congenital talipes equinovarus (CTEV), a congenital deformity that has plagued the medical profession and society before the days of Hippocrates. Most of the orthopedic surgeons are now of the opinion that the initial treatment of clubfoot should be non-operative. Many different method of non- surgical treatment are being used with reported success rate from 15 to 90%. Sir Ignatio Ponseti a leading advocate of conservative treatment of clubfoot by serial casting achieves excellent result if instituted early. The present study, therefore, has been undertaken to determine the treatment outcomes of patients treated with ponseti casting technique and establish if results produced by ponseti method is reproducible. **AIMS OF STUDY:** 1. To study and evaluate the Ponseti method of treatment of congenital talipes equinovarus. 2. To obtain a painless, plantigrade, pliable, cosmetically and functionally acceptable foot. **MATERIALS AND METHODS:** The study was conducted in the Department of Orthopedics, Hindu rao hospitals between July2009 to nov2010. A total of 30 feet of 25 patients were included in the study between the age of 1week to 6 months. **INCLUSION CRITERIA** Children with virgin idiopathic clubfoot in the age group of 1week to 6 months. **EXCLUSION CRITERIA:** a. Secondary clubfoot. b. Those that has already treated by other than Ponseti method. c. children with age < 1 week and >6 months. Clinical assessment Quantification of various components of clubfoot deformity using the Pirani score. **RESULTS:** In the present study with 25 patients with 30 feet, total duration of our study was 16 months. With average follow up of 11 months. ranges from 6 to 15months, 1 patient with bilateral clubfoot lost in follow up, 4 were shifted to surgical treatment the cause being, severe deformity and noncompliance to conservative technique. Of the remaining 20 patient with 24 feet where treated by ponseti method and the clinical results were assessed and compared. The results of our series were assessed clinically according to Pirani's classification. **CONCLUSIONS:** Ponseti serial corrective cast management is an easy, effective and economical method of CTEV correction when it is applied in idiopathic clubfoot. Treatment must start at earliest possible age. Result of method is excellent when it was applied within a golden period of CTEV that means in initial 0-3 months of newborn. Result can be clinically evaluated by Pirani score. Strict compliance in foot abduction brace after full correction produces good results.

KEYWORDS: CTEV, ponseti technique, pirani score, abduction brace.

INTRODUCTION: Clubfoot is now worldwide synonymous with the Idiopathic congenital talipes equinovarus, a congenital deformity that has plagued the medical profession and society before the days of Hippocrates.¹ The clubfoot has always remained a difficult and perplexing problem for the Orthopedics surgeons to treat successfully. Most of the orthopedics surgeons are now of the opinion that the initial treatment of clubfoot should be non-operative and should be as early as possible preferably in the first week of life in order the take advantage of favorable viscoelastic properties of

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the connective tissue forming the joint capsules, ligaments and tendons.² Many different method of non-surgical treatment are being used with reported success rate from 15 to 90%. Mackay stated that only 15% patients can be treated non-operatively by manipulation and casting.³

Kite advised another method with an efficacy of 90% in his hand.^{4,5} Turco advocated manipulation and serial POP casts while correcting all the elements of the deformity simultaneously, with a reported success rate of 35%.⁶ French taping is another method of non-operative treatment with reported 50% good results.⁷

The underlying philosophy of the advocates of non-operative treatment was that this should be a definite method of eliminating or significantly reducing the incidence and amount of surgery that might eventually be required.⁷ Perhaps the most determined protagonist of non-operative treatment was J.H. Kite who in the period of 1924-1960 treated more than 800 patients by cast application with a reported success rate of 90%⁴ but such good results was never produced by others. For nearly 40 years, Kite method of cast application was the method of choice for correction of clubfoot deformities in infants.

Kite recommended correction of each component of deformity separately and in order, beginning with correction of forefoot adduction and proceeding to correction of varus and at last correction of equinus. Kite abducted the foot at midtarsal joint with thumb pressing on the lateral side of the calcaneo-cuboid joint. He managed to correct the cavus and obtain plantigrade feet but correction of heel varus took him an inordinate amount of time of many months (26 to 49 weeks) and multiple cast changes.⁸

Ponseti, another leading advocate of conservative treatment of clubfoot found a flaw in Kite's method and pointed out that by arching the foot against pressure at the calcaneo-cuboid joint, Kite blocked the abduction and lateral rotation of the calcaneum under the talus, a motion that is fundamental for correction of the deformities, thereby interfered with the correction of heel varus.⁹

Ponseti felt that Kite achieved calcaneal correction by great patience and a long treatment time by not allowing the heel to correct simultaneously with the forefoot². He also stated that the French taping method is very lengthy and expensive and repeated mobilization of displaced tarsal joints through physiotherapy will not help reshape the foot as immobilization in a proper position in a cast does.

Ponseti corrected all the components of the deformity simultaneously except equinus and was more efficient than Kite. The correction of deformities was usually accomplished in 10 or less in number, weekly casts. Despite the excellent results, the Ponseti method remained a local oddity.

Although Ponseti's method of treatment has been there for around 50 years it has aroused interest only in the recent past after the long term results of this method were published.²

Typically, in Ponseti's method the infant undergoes weekly serial casting for three to six months. At that point, it usually become obvious if non-operative treatment is going to succeed or not and if required surgery is recommended. The most frequently used surgical approach is posteromedial release, which has many variations. However, long-term follow-up studies have shown that the results of surgical treatment are disappointing.¹⁰ Increasing foot pain, weakness, and stiffness often lead to premature arthritis and disability of the foot.

Recently this deformity has seen the use of minimally invasive external fixator like UMEX¹¹ (on the principles of JESS, Joshi's external stabilizing system) and Ilizarov¹²⁻¹⁶ for older children.

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Ignacio Ponseti has championed a non-operative school of treatment for clubfoot. He reported satisfactory functional results in 89% of feet¹⁷. After 30 years of follow-up, excellent or good functional outcomes were achieved in 78% of patients, compared with 85% of control (normal) patients who experienced no previous pathological abnormalities of the foot, based on a subjective questionnaire.¹⁷

Despite the excellent results reported in highly respected, peer-reviewed journals, the Ponseti method remained a local oddity until a decade ago. Even now in our country this technique remains a less understood and lesser still used method of treatment, Orthopedicians relying more on traditional method advocated by Kite⁴ (1963). The present prospective study, therefore, has been undertaken to determine the treatment outcomes of patients treated with ponseti casting technique and establish if results produced by ponseti method is reproducible.

OBJECTIVES:

- To study and evaluate the Ponseti method of treatment of congenital talipes equinovarus.
- To reviews and compare the results with the available literature on this subject.
- To reduce or eliminate all the component of clubfoot deformity.
- To obtain a painless, plantigrade, pliable, cosmetically and functionally acceptable foot.

MATERIALS AND METHODS: The study was conducted in the Department of Orthopedics, Hindu rao hospitals between July2009 to November 2010.

A total of 30 feet of 25 patients were included in the study between the age of 1week to 6 months.

INCLUSION CRITERIA: Children with virgin idiopathic clubfoot in the age group of 1week to 6 months at the time of presentation were included in the study.

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- a. Secondary clubfoot.
- b. Those that has already treated by other than Ponseti method
- c. Those children with age less than 1 week and more than 6 months.

Pre-treatment Workup: Patients were worked up thoroughly; a detailed history was taken regarding the onset of deformity, other associated deformity, family history of similar deformity and history of treatment. A general examination was done to detect any other associated congenital anomaly.

Clinical Assessment: Quantification of various components of clubfoot deformity using the Pirani score.

Pirani Score: Pirani 1995¹⁸ described a system for grading of clubfoot. It is composed of 6 different physical examination findings, each scored 0 for no abnormality, 0.5 for moderate abnormality, or 1.0 for severe abnormality. Each foot was assigned a total score of less than or equal to 1, a higher score indicating a more severe deformity.

The physical examination Consisted of:

1. The curvature of lateral border of foot:
 - 0 = straight border.
 - 0.5 = mild distal curved border.
 - 1.0 = lateral border curves at calcaneocuboid joint.

2. The severity of the medial crease (foot held in maximal correction).
 - 0 = multiple fine creases.
 - 0.5 = one or two deep creases.
 - 1.0 = deep creases change the contour of the arch.

3. The severity of posterior crease (foot held in maximal correction).
 - 0 = multiple fine creases.
 - 0.5 = one or two deep creases.
 - 1.0 = deep creases change the contour of the heel.

4. Palpation of lateral part of the head of the talus (the fore foot is fully abducted).
 - 0 = navicular completely “reduces” the lateral talar head cannot be felt.
 - 0.5= navicular partially “reduces” the lateral talar head less palpable.
 - 1.0= navicular does not “reduce” the lateral talar head easily felt.

5. The emptiness of the heel (foot and ankle held in maximal correction).
 - 0 = tuberosity of calcaneus is easily palpable.
 - 0.5 = tuberosity of calcaneus is more difficult to palpate.
 - 1.0 = tuberosity Of calcaneus is not palpable.

6. The rigidity of equinus (knee extended, ankle maximally corrected).
 - 0 = normal ankle dorsiflexion.
 - 0.5 = ankle dorsiflexion beyond neutral, but not fully.
 - 1.0 = cannot dorsiflex ankle to neutral.

Clinical assessment were done prior to onset of treatment and on completion of plaster cast treatment

TREATMENT PROTOCOL: After detailed clinical assessment, first corrective cast was applied by Ponseti’s method. According to Ponseti, the heel varus and foot supination occur primarily in the tarsus. The tarsal joints are mechanically interrelated. Therefore the components of clubfoot deformity must be corrected simultaneously except for the equinus, which takes place in the ankle joint and must be corrected last. The cavus corrects as the foot is abducted with forefoot in supination. The correction of the cavus brings the forefoot and the hind foot into proper alignment.

The adduction is corrected when the foot in supination is abducted while counter pressure is applied with the thumb against the lateral aspect of the head of the talus, not the calcaneus. Gradually, the lateral aspect of the head of the talus becomes covered by the navicular.

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As the foot is further abducted, the supination decreases. The foot should never be pronated. As the calcaneus abducts together with the cuboid, it simultaneously evert owing to the curvature profile of the subtalar joint, thereby correcting the heel varus.

Corrective casts were changed at weekly intervals in OPD, and Pirani 6 point scoring was done after each cast removal. Patients showing no change in clinical scoring after 3 consecutive casts were considered non-responsive to Ponseti's method of treatment and taken as failed case. These cases were planned for alternative method of surgical treatments. A maximum of 10 casts were applied. After 10 casts, the residual deformity was dealt surgically.

Residual equinus deformity or dorsiflexion less than 15 degree was managed by percutaneous tenotomy. After these surgical procedures, corrective cast was applied for 3 weeks.

Immediately after removal of the last cast, the correction was maintained by foot abduction brace. The brace consists of open toe high-top with straight medial side shoes attached to a bar. The bar should be of sufficient length so that the heels of the shoes are at the shoulder width. The bar should be bent 15 degrees with the convexity away from the child, to hold the feet in dorsiflexion. A small hemispherical cut is made on the posterior side of the shoes, to allow checking, that the heel is not lifted up inside the shoes.

Foot abduction braces were applied while maintaining corrected club feet in 70 degrees of abduction and 15 degrees of dorsiflexion in bilateral cases. In unilateral cases corrected club foot was maintained in 70 degrees while the other in 45 degrees of abduction with both feet in 15 degrees of dorsiflexion Foot abduction brace was advised to be worn for full time for the first 3 months after the last cast and only at night and nap time after 3 months.

Patients were called every two weeks for next 6 weeks, then every 6 weekly till the current follow up. Foot abduction brace was to be worn whole day for at least 23 hours and to be removed only for bathing the child or change of clothes etc.

The foot abduction brace was to be changed every 3 months to accommodate the rapidly growing foot of the child till the child reaches the walking age of about 11 months. Then walking shoes were given for day time with night time splint. Walking shoes were heel less with a lateral wedge and curved medial border with convexity medially.

RESULTS: In the present study 25 patients with 30 feet, total duration of our study is 16 months with average follow up of 11 months duration range 6 to 15 months, 1 patient with bilateral clubfoot was lost in follow up, 4 were shifted to surgical treatment the cause being late age of presentation, severe deformity and noncompliance to conservative technique.

Of the remaining 20 patient with 24 feet were treated by ponseti method and the clinical results were assessed and compared. The results of our series were assessed clinically according to Pirani's classification. The results were graded in to four categories Excellent, Good, Fair and Poor.¹⁹

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AGE DISTRIBUTION:

S. No.	Age Group	No. of cases	%age
1	<30 days	16	64
2	31-60 days	06	24
3	61-180 days	03	12
	Total	25	100

NUMBER OF CAST APPLIED BY PONSETI METHOD BEFORE TENOTOMY:

S. No.	No. of cast	No. of foot	%age
1	5 cast	6	25
2	6 cast	10	41.7
3	7 cast	4	16.7
4	8 cast	4	16.7
	Total	24	100

DETAIL OF TENOTOMY IN CONSERVATIVELY TREATED PATIENTS:

Tenotomy	No. of foot	%age
Done	19	79
Not done	5	21

DURATION OF TREATMENT IN CONSERVATIVELY TREATED PATIENTS:

S. No.	Duration (in days)	No. of foot	%age
1	40 to 60	6	25
2	61 to 80	18	75

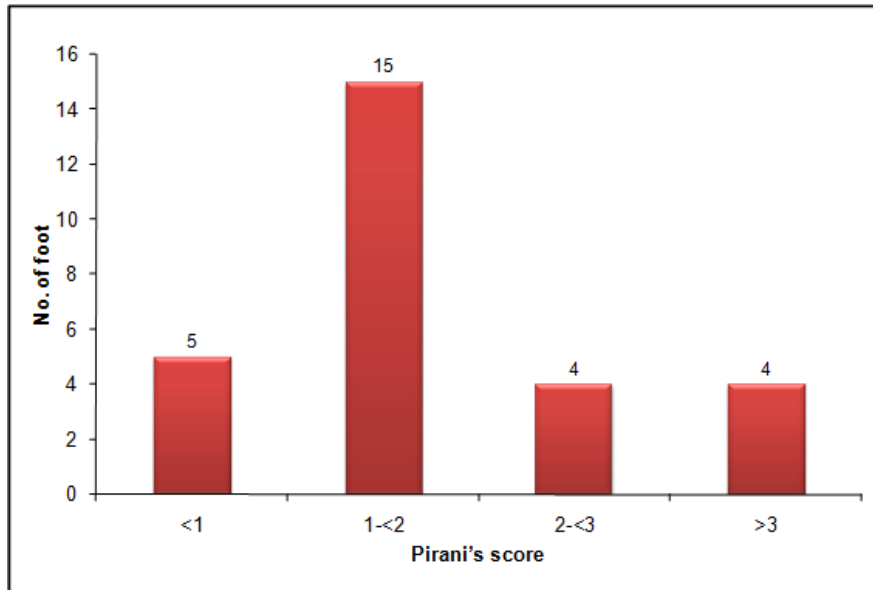
COMPARISON OF PATIENTS WITH DIFFERENT INITIAL PIRANI SCORE:

S. No.	Pirani's score	No. of foot
1	3	6
2	4	11
3	5	11
4	6	2

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COMPARISON OF PATIENTS WITH DIFFERENT FINAL PIRANI SCORE:

S. No.	Pirani score	No. of foot
1	<1	5
2	1-<2	15
3	2-<3	4
4	>3	4



Number of cases [foot] with different Final Pirani Score

RESULTS OF PATIENTS AFTER COMPLETION OF CONSERVATIVE MANAGEMENT BASED ON FINAL PIRANI SCORE:

Results	No. of foot
Excellent	5
Good	15
Fair	4
Poor	4

Prognosis with conservative treatment and different Pirani Score:

Excellent:	Score < 1, with all 6 scores of zero except posterior and medial crease score of 0.5
Good:	Score 1-2 with equinus and abduction score of 0.5
Fair:	Score 2-3
Poor:	Score > 3

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AGE OF APPLICATION OF CTEV SPLINT TO MAINTAIN CORRECTION OF FOOT:

Age of application in days	No. of patient	%age
<90 days	11	46
91-180 days	13	54



Clinical results

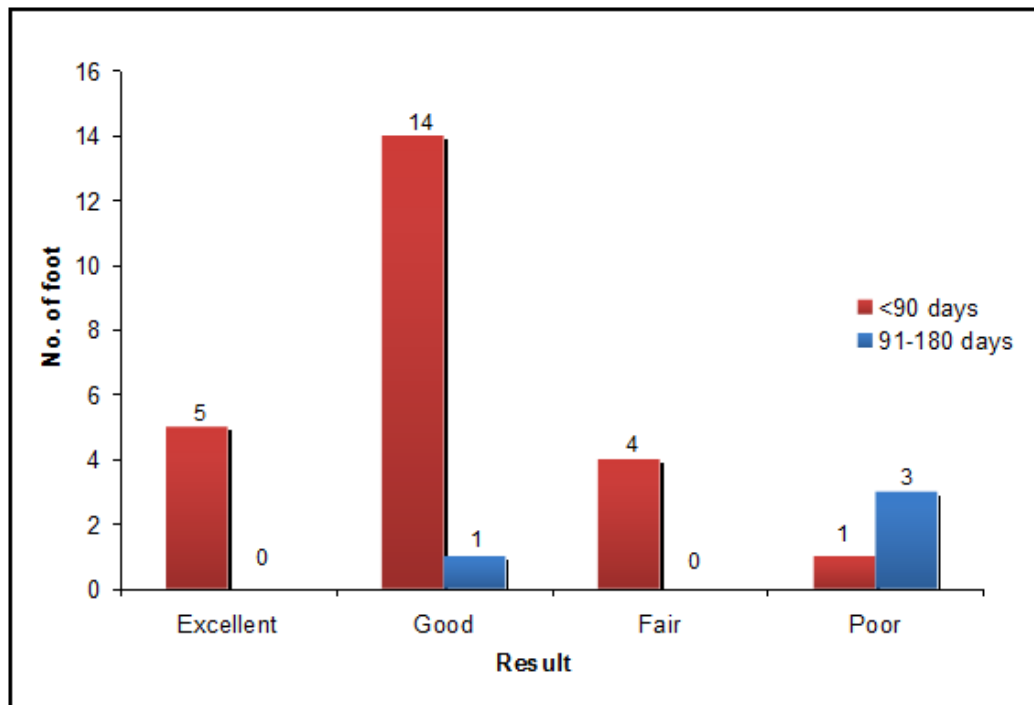
DIFFERENT COMPLICATION ASSOCIATED WITH CONSERVATIVE TREATMENT:

Complication	No. of patient	%age
Non- compliance	2	8
Cast slippage	3	12
Ulcer	2	8
Infection	0	0

COMPARISON OF DIFFERENT AGE GROUP PATIENT AS PER FINAL RESULTS:

Age (in days)	No. of foot	Excellent	Good	Fair	Poor
<90	24	5	14	4	1
91-180	4	0	1	0	3

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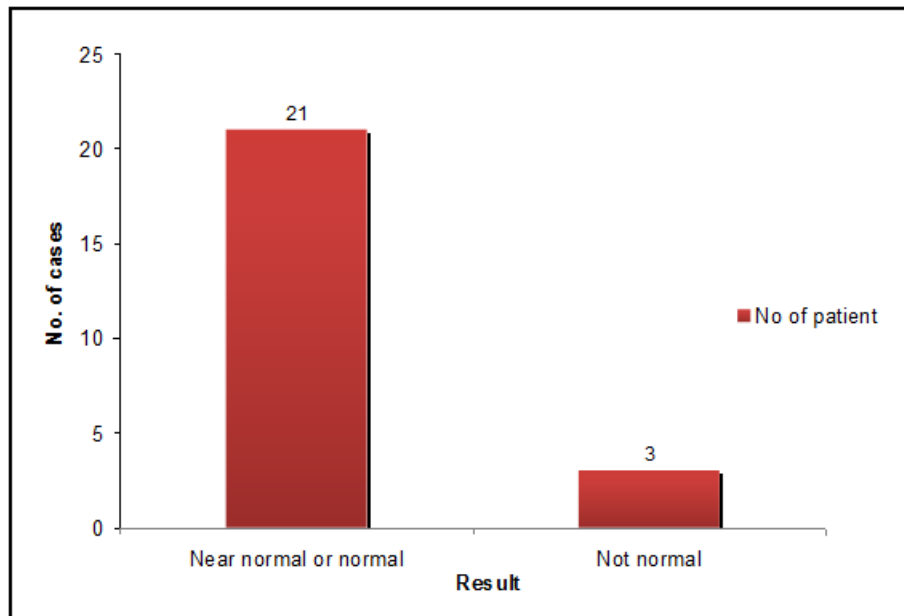
Age at treatment and result

APPEARANCE OF FOOT AFTER COMPLETION OF CONSERVATIVE TREATMENT:

Look of clubfoot	No. of patient	%age
Near normal or normal	21	88
Not normal	3	12

DURATION OF FOLLOW UP OF DIFFERENT PATIENTS DURING STUDY PERIOD:

Duration of follow up in months	No. of patient
6-10	10
11-16	14
Lost in follow up	1 (with bilateral deformity)



Look of the clubfoot

DISCUSSION: The goal of clubfoot treatment is to achieve a plantigrade, mobile, and functional foot. Everybody agrees that the initial treatment should be non-operative and preferably the Ponseti's method. During the last 50 years, several casting techniques have been described including the ponseti method, the French method and Kite method. Complications observed after over aggressive and improper casting treatment include plaster sores, flat top talus, rocker bottom deformity, and residual deformity. When the patients experience these problems, physicians assume that casting technique as a failure and recommend surgical intervention.

Ponseti (1980) treatment in newborns consists of weekly manipulations and long leg casting^{9,20}. Ponseti uses the thumb as counter pressure on the head of the talus laterally and gently abducts the foot around the talus. In the first cast, it is important to elevate the first ray (supination) while abducting the forefoot. It seems counterintuitive, as the forefoot is already supinated. However, Ponseti has shown that the forefoot varus deformity is less than the hind foot varus deformity at initial presentation.

Therefore, the first metatarsal is raised to bring it into line with the hind foot, reducing the cavus deformity and setting the stage for the remainder of the correction. As the foot is abducted, the heel and foot varus deformity spontaneously corrects to a valgus position without touching the calcaneus. Grasping the calcaneus prevents it from abducting and causes iatrogenic deformation of the midtarsal bones and joints.

Typically surgical treatment is considered when the foot fails to attain an anatomic or neutral position after non-operative treatment. Surgical treatment can result in complications like wound healing problems, over correction, under correction, avascular necrosis of talus.¹⁰

Studies have shown that patients who have undergone extensive soft tissue release initially do well; however, as the child grows the functional result typically starts to deteriorate.

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Long term studies have shown that the patients who have undergone operative treatment experience foot pain, stiffness and disability.

The longest published follow up is of 30 years follow up of 45 patients (with 71 feet) treated with the ponseti method of manipulation and casting at university of Iowa hospital and clinics between 1950 and 1967.¹⁷

Highlight of this Study:

- Most of clubfoot, when treated shortly after birth can be easily corrected by manipulations and plaster cast application.
- The timely and well treated clubfoot is compatible with a normal active life.
- Physical evaluation of clubfoot treated patient is not predictive of excellent, good or poor functional results.

Our study is carried out at department of orthopedics Hindu rao hospital, Delhi it include 30 feet in 25 patient who had presented to us with virgin clubfoot in first 6 Months of life between July 2009 and November 2010.

In the present study 25 patients with 30 feet, total duration of our study is 16 months with average follow up of 11 months duration range 6 to 15 months, 1 patient with bilateral clubfoot was lost in follow up, 4 were shifted to surgical treatment the cause being late age of presentation, severe deformity and noncompliance to conservative technique.

Of the remaining 20 patient with 24 feet were treated by ponseti method and the clinical results were assessed and compared. The results of our series were assessed clinically according to Pirani's classification. The results were graded in to four categories Excellent, Good, Fair and Poor.

Sex Incidence: There were 15 male and 10 female patients in our series with male to female ratio of 1.5:1. The male to female ration in Kite series was 2.07:1 and in series of Wynn Davis 2.17:1. The reason for preponderance of male over female patient could be the female child is still neglected in lower a socioeconomic stratum which forms the bulk of our patient.

Laterality: As regarded laterality 5(20%) of our cases were bilateral and 20(80%) unilateral with right sided more common than the left side the ratio of right to left is 1.22:1 which is concordance with other series presented by Wynn Davis²¹ (44% bilateral and 56% unilateral with right side is more common than left side.

In our study we did not find any positive family history for the deformity Associated congenital anomalies were not observed in our series:

Tenotomy:

- We have done percutaneous tenotomy in 19(79%) for correction of equinus deformity the average age group being in between 60 to 120 days, while in series of Dr. Ponseti it is necessary in 74 feet out of 94 feet (78.72%) with same average group as in our series.
- It has been observed in both studies that if the treatment is started in first 3 week of life (10 patients) than we achieve 15 degree of dorsiflexion at end of 5-6 casts and tenotomy was not required.

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Total duration of treatment (from application of cast to modified CTEV splint): In our study of total duration of treatment was about 52 days (7.4 week) which is approximately same in Dr. Ponseti series of 8 week:

- When feet were divided on the basis of the age of the first reporting, it was seen that a large number proportion of patient were seen early in the life (70%). The youngest patient who was included in our study was only 8 days old.
- In our study, 2 patient (8%) had an ulcer responding nicely to dressing and healed in 3-4 days, 2 patient (8%) had non-compliance of CTEV splint, 3 patient (12%) had problem of cast slippage; the most common complication in our study. These complications are higher than Dr. Ponseti study 12%. The development of complication depends upon the skill of the surgeon treating the case and by gradual learning of the procedure these are decreasing simultaneously.
- In our study, 21 feet (88%) had normal or near normal appearance during our follow up only 3 feet (12%) had not normal in appearance, which is same as Dr. Ponseti study 89% if the patient stated the same.

We compared our study with few similar Studies:

- Evaluation of the utility of the Ponseti method of correction of clubfoot deformity in a developing nation. Carried out at Department of Orthopedics, Smt. Nathibaa Hargovinddas Lakshmi Chand Municipal Medical College, Ellis Bridge, and Ahmadabad, India. "154 feet with mean Pirani score of 5.57 in 96 children (78 males, 18 females) treated by the Ponseti method from January 2003 to December 2005. A prospective follow-up for a mean duration of 19.5 months (range 6-32 months) was undertaken. After six months of treatment the Pirani score was reduced to zero for all patients" In our study 28 feet with mean Pirani's score of 4.30 and the corrected mean score was 1.57 and in 84% patients correction was achieved as compared to 100% in the study of Medical college Ahmadabad, it was found in our study that it was not possible to convert Pirani's score to zero, as score of zero is for normal foot.
- A study carried out at Department of Orthopedics Surgery, University of Iowa, Iowa City, Iowa.¹⁷ Clubfoot correction was obtained in (98%). 90% of patients required 5 casts for correction. In our study correction obtained in 84% of patients. 25% patient required 5 cast 41.7% patient required 6 casts for correction.
- Wallace B. Lehman, MD¹ reported that over 90% of cases will require no other treatment except for percutaneous tenotomy of Achilles tendon.
- Jhon E Herjenberg MD²² showed 80% good to excellent result and 3% recurrence in his series of 46 clubfoot treated by ponseti method
- Naom Bor, MD²² found that only 5% required open surgical release. 85% required percutaneous Achilles tenotomy of average age 6 months. Average number of ponseti cast applied before tenotomy was 6.

Clinical results of the 20 patients:

- Excellent results were obtained in 5 foot, all presented at or within 15 days of birth.
- Good results were obtained in 15 foot, 9 presented with in 1st month after birth, 5 presented between 1-3 month of life, 1 presented between 3-6 month of life.

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- Fair results were obtained in 4 foot, of this 2 had age of presentation in 1st month of birth, 2 were between 1-3 month of age.

Poor results were obtained in 4 foot with Pirani score of 4, age of presentation of 1 is 60 days and remaining 3 is more than 90 days, these were shifted to surgical treatment.

CONCLUSIONS:

- Ponseti serial corrective cast management is an easy, effective and economical method of CTEV correction when it is applied in idiopathic clubfoot.
- Treatment must start at earliest possible age. Result of method is excellent when it was applied within a golden period of CTEV that means in initial 0-3 months of newborn.
- If the treatment was started in the late period of life i.e. after 4-5 months, the deformity is more resistant to treatment and requires more number of casts for correction.

BIBLIOGRAPHY:

1. Wallace B. Lehman.: The Clubfoot. J. B. Lippincot Company. 1980.
2. Ponseti IV. Common concepts review: Treatment of Congenital clubfoot. J Bone Joint Surg, 1992; 74A: 448-54.
3. Mckay D W. New concept and Approach to clubfoot. Treatment section III Evaluation and results. J Paed Ortho. 1983; 3: 141-148.
4. Kite J H. The classic Principles involved in the treatment of congenital clubfoot. Clinort and Riel research 84:4-8, 1972.
5. Kite JH. Non-operative treatment of congenital clubfoot. Clinical Orthopaedics and Related Researches, 84:29, 1972.
6. Turco VJ. Clubfoot, Churchill Livingstone 1981.
7. Richards BS et al. Non-operative clubfoot treatment using the French physical therapy method. J Pediatrics Orthopedics' 2005; 1081:98-102.
8. Kite JH. The treatment of congenital clubfeet. A study of the results in two hundred cased. Journal of American Medical Association. 1932; 99:1156-1 162. Ponseti IV.
9. Common error in the treatment of congenital clubfoot. International Orthopedics (SICOT).21; 1997:137-41.
10. Kramicz J, Than P, Kustos T. Long term results of the operative treatment of clubfoot. A representative study. Orthopedics 1998; Vol.21: No. 6. 669.
11. Joshi BB, Laud NS et al. Controlled differential distraction for correction of complex congenital talipes equinovarus. The Clubfoot. The present and a view of the future. Ed. Simosns, G.W. Springer Verlag 1994.
12. Grill F. Correction of clubfoot deformity without osteotomy by the use of the Illizarov method. The clubfoot. The present and a view of the future. Ed. \Simons G.W. Springer Verlag. 1994.
13. ASAMI group. Operative principles of Illizarov. Williams and Wilkins 1991.
14. Grill F, Frankie J. The Illizarov distraction for correction of relapsed or neglected clubfoot. J.B.J.S. 1987; 69- B: 593-597.
15. ASAMI group. Operative principles of Illizarov. Williams and Wilkins 2002.

ORIGINAL ARTICLE

16. Fassier MA, Morin F et al. The Ilizarov external fixator in severe foot deformities. Preliminary results. The Clubfoot. The present and a view of the future. Ed. Simons G.W. Springer Verlag. 1994.
17. Laaveg SJ, Ponseti IV. Long term results of results of congenital clubfoot. J Bone and Joint Surge, 1980; 62A:23-31.
18. Pirani S, Outerbridge H, Moran M et al. A Method of Evaluating the Virgin. Clubfoot with Substantial interobserver Reliability. Presented At The Annual Meeting of Pediatrics Orthopedics Society of North America, Miami, Fla, 1995.
19. MacEven GD, Scott DJ Jr, Shands AR Jr. Follow up survey of clubfoot treated at Alfred I. Dupont Institute. J.A.M.A., 1961; 175:427.
20. Ponseti IV. Editorial, Clubfoot management. J Pediat Orthop, 2000; 20:699-700.
21. Wynne-Davies R. Family studies and cause of clubfoot. J Bone Joint surg, 1964:46-B: 445.
22. Noam Bor, John E Herzenberg. Ponseti treatment in older children for whom traditional casting has failed. Paper number 053 AAOS-podium presentation, DALLAS, TX (2002).

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