

A Clinical Study on Management of CTEV by JESS Fixation

Lakshminarayana S¹, Venkat Lakavath², Omprakash T³, Pramodh Kumar S⁴

¹ Assoc. Professor

² Asst. Professor

^{3,4} Final Year PG Students
Department of Orthopaedics
MGM Hospital
Kakatiya Medical College
Warangal, India.

CORRESPONDENCE:

¹ Dr. S. Lakshminarayana
MS (Ortho)
Assoc. Professor
Department of Orthopaedics
MGM Hospital
Kakatiya Medical College
Warangal, India.
E-mail:
narayanaseela@rediffmail.com

ABSTRACT

Aim : Our purpose of this study was to evaluate the role of jess fixation for correction of CTEV.

Materials and Methods : This prospective study was conducted in MGM Hospital, Warangal from October 2011 to April 2014. 17 patients were included, average age was 2.2 years. Unilateral feet and male were more in this study. Used Hospital for joint diseases, orthopaedic institute functional rating system for club foot assessment.

Results and Conclusion : Short term followup results were excellent to satisfactory based on above system (total score of 100, excellent 85 – 100, good 70-84, fair 60-69, poor <60 at followup of 3, 6 and 9 months.)

Keywords : CTEV, deformities, JESS fixation

INTRODUCTION

Idiopathic clubfoot is one of the oldest and commonest congenital deformities of mankind, ever since man has adopted the erect posture was described by Hippocrates.^[1] It occurs in variable severity and some of the mobile feet are corrected well with manipulation and stretching. Nearly half the feet are rigid and do not show full correction with conservative management.

The goal of any type of CTEV management is to reduce, if not to eliminate all elements of the clubfoot deformity, hence achieving a functional, pain free, normal looking plantigrade, mobile and normally shoeable foot.^[2]

The various factors that have been associated with the poor prognosis in CTEV management are female child, hereditary, late age of presentation, severity of deformity, rigidity of foot, associated cavus, clawing of toes, and small Heel.^[3,4,6,7] In the older child, issue of correction of

deformities becomes more complicated by additional skin scar, fibrosis of previous surgery which need extensive soft tissue surgeries along with various bony osteomies and forcible manipulation.^[3,8,9]

But none of method can completely achieve the goal of functional, painless and cosmetically acceptable foot. This unsatisfactory situation prompted scientists to seek a method which does not involve soft tissue trauma, bony resection etc.^[6,12]

Gavril Abramovich Ilizarov at Kurgan in Russia started with ring fixator treatment in the early 1950's. In the 1960's he showed successful lengthening of bone and soft tissue with gradual distraction.^[5,11]

A simple versatile and light fixator system with tremendous potential was developed by B B Joshi of Bombay (Mumbai) India in 1988. This method proved successful in almost all age groups ranging from 4 months

to 19 years. Joshi advocated a method of controlled, differential distraction which is semi invasive more physiological in comparison to any other technique.^[9, 12] Our purpose of this study was to evaluate the role of jess fixation for correction of CTEV.

MATERIALS AND METHODS

This study includes management of 19 feet in 15 patients with old neglected, recurrent or resistant cases of CTEV by JESS between October 2012 to October 2013 admitted at MGM Hospital attached to Kakatiya Medical College, Warangal.

Inclusion criteria

- Age 1 – 8 years
- Type of club feet: Relapsed / recurrent / resistant / neglected / POP cast drop out cases.
- Patients were assessed and classified with “Clubfoot severity by dimeglio” and labeled them as benign , moderate ,severe and very severe.

Exclusion criteria

- Age <1 year and >8 years
- Patients who are medically unfit for the surgery
- Parents refusal for surgery

On admission of the patient a careful history was elicited from the parents/atndents to reveal the duration and previous treatment of the deformed foot.

Components of JESS fixator

- Distracters
- Link joints
- Connecting rods
- Z & L- rods
- k-wires

Operative procedure for JESS

The procedure is carried out under general anesthesia with the patient in the supine position. Tourniquet applied at thigh level.

K-Wire insertion

Tibial K wires

Two parallel transfixing wires are passed in the tibia a finger breath distal to the tibial tuberosity, perpendicular to the longitudinal axis from lateral to medial. The length of the middle segment of the 'Z' bar is marked below the first wire. The second wire is passed parallel to the first wire at this level.

Metatarsal K wires

One transfixing wire is passed from the fifth to first metatarsal engages at least the fifth and the first metatarsals at the level of the neck. 2 separate wires, one from the medial and the other from the lateral aspects are inserted parallel to the first wire. These two K wires engage two or three metatarsals on their respective side at the level of the proximal shaft. Calcaneal wires: Two tansfixing parallel wires are passed into the tuber of the calcaneum from the medial side avoiding the posterior tibial artery. These wires should be perpendicular to the long Axis of the calcaneum. The axial Calcaneal wire is passed posterior to anterior. The point of entry is just distal to the insertion of the Achilles tendon.

Components of the Deformity



Figure 1: Cavus Adductus

Varus

Equinus

Attachment of Z' and L' rods

Tibial attachment

The tibial are attached to the middle segment of the 'Z' rods by link joints on the medial and lateral aspects. The wires are pre-stressed by bringing them forwards each other by few millimeter while tightening the joint. The limbs of the Z' rods now lie perpendicular to the axis of the tibia.

One connecting rod is used to span the anterior limbs of 'Z' rod and other span the posterior limbs. Maintain a finger breadth clearance between the skin and the Z' rods and all subsequent connections to the 'K' wires.

Metatarsal attachments: Two small 'L' rods are attached to the metatarsal wires on medial and lateral aspect of the foot .

Calcaneal attachment

Two large 'L' rods are attached to the transfixing Calcaneal wires on the either sides of the heel. Behind the foot these rods are connected to each other by a connecting rod one which the axial Calcaneal wire is clamped.

Connecting the segmental hold

Calcaneal - Metatarsal connection

A pair of appropriately sized distracters are attached to the Calcaneal and metatarsal wires on either side of the

foot keeping the distractors knobs interiorly For easy handling during distraction.

Tibio-Calcaneal connection

Posterior limbs of the 'Z' rods are attached to L rods of the Calcaneal hold by a distraction on either side. Distractors are attached near the transfixing pins (lateral and medial aspect of Calcaneum).

Tibio-metatarsal connection

The anterior limbs of the 'Z' rods are connected by a pair of rods to the small 'L' rods anterior to the attachment of the metatarsal wires.

Post Operative Management

Pin site care: The dressings are performed twice a week with savlon, spirit and betadine lotion. Pin sites are covered with dry gauze and protective dressings are applied.

Distraction: In all patients fractional distraction at the rate of 0.25 mm/6hrs is applied. Differential distraction on medial side is performed twice the rate than that on the lateral side. Distraction at the lateral side not only prevents crushing of the articular cartilage but also permits normal growth of epiphyseal plate on lateral side which may be affected if compression is done on lateral side.

On the 3rd post operative day distraction is started as follows:

| | |
|---------------------------|--------------------------|
| The calcaneo – metatarsal | Distraction |
| Medial | - 0.25 mm every 6 hours |
| Lateral | - 0.25 mm every 12 hours |

By calcaneo metatarsal distraction we achieve

1. Correction of forefoot adduction at tarso-metatarsal joints.
2. Stretching the socket for head of talus.
3. Reduction of calcaneocuboid joint.

The tibio-calcaneal distraction is carried out in two positions.

The distractors are mounted between the inferior limbs of the 'Z' rods and posterior limbs of the calcaneal 'L' rods. The distractors lie parallel to the leg and just posterior to the transfixing calcaneal wires.

Distraction in this position corrects varus of the hindfoot and equinus.

| | |
|-----------|-----------------------|
| Medial | - 0.25 mm every 6 hrs |
| Lateral | - 0.25 every 12 hrs |
| End point | - (Judged clinically) |

The tibio calcaneal distractors are now shifted posteriorly and connected above to the transverse bar connecting the posterior limbs of 'Z' rods and below to the posterior calcaneal bars connecting the posterior limbs of 'L' rods and axial calcaneal pin. The distractors lie on the either side of the axial calcaneal pin.

Distraction in this position provides thrust force to stretch posterior structures and corrects hind foot equinus at the ankle and subtalar joints.

Both distractors - 0.25 mm every 6 hours.
End point - assessed clinically and radiologically

Approximately 2-3 weeks of distraction (end of 6th post-operative week).

1. Clinical and Radiological assessment

Visual correction of the deformities is noted during the distraction phase. Full correction is achieved, usually at the end of 5 to 6 weeks. X-ray was taken finally after the removal of the fixator. The roentgenogram correlates well with the clinical picture.

2. The static phase

Following the correction, assembly is held in static position for further three to six weeks to allow soft tissue maturation in elongation position.

3. Removal of the fixator

Single stage removal of the whole assembly was done under general anaesthesia and initially POP slab applied till pin tracts get healed then pop cast applied.

4. Maintenance in the plaster cast

Knee plaster cast is applied in maximum correction for 4-6 weeks.

5. Orthotic device

Appropriate orthotic devices are absolutely essential for maintenance of correction and prevention of recurrence in .

6. Follow up

Patients were advised follow-up every 1month for initial 3 months followed by every 3 months for six months, then every 6 months.

RESULTS

Using Hospital for joint diseases, orthopaedic institute functional rating system for club foot (Lehman, Atar et al)^[15] Assessment .The results were classified with total score of 100, excellent 85 – 100, good 70-84, fair 60-69, poor <60 at followup of 3, 6 and 9 months.

Age distribution: The age of these patients ranged from 1 – 8 years with an average 2.2 years.

Sex distribution: Out of 15 patients 11(73.33) male and 4(26.67) were female patients

Side involvement: There were 11 feet (57.90%) unilateral and 8 feet (42.10%) bilateral cases

Type of CTEV: There were 8 (42.1%) neglected, 7 (43.6%) POP dropout and 4 (26.1%) relapsed cases.

Previous treatment history: Out of 19 feet, 11(57.9) underwent previous procedures, 7 (36.84%) manipulation and serial casting, 4 (21.06%) soft tissue release.

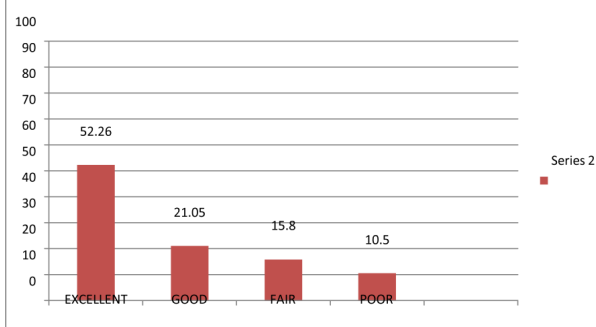
| Category | Points | Category | Points |
|---|----------------------|---|--------------|
| 1. Ankle dorsi-flexion (passive motion) More than 90° 90° Less than 90° | 15 5 0 | 6. Radiographic measurements T-C Index 40° or more Less than 40° | 10 5 |
| 2. Sub-Talar Joint Motion (passive motion) More than 10° Less than 10° Stiff | 10 5 0 | 7. Shoes Regular – No complaints Regular with complaints Orthopaedic shoes inserts, braces | 5 2 0 |
| 3. Position of heel when standing 0 - 5° Valgus More than 5° Valgus Varus | 10 5 0 | 8. Function No limit Occasionally limited Usually limited | 15 8 0 |
| 4. Forefoot (Appearance) Neutral Less than 50° Adduction / Abduction More than 50° Adduction / Abduction | 10 5 0 | 9. Pain Never Occasionally Usually | 10 5 0 |
| 5. Gait Normal Heel / toe gait Cannot heel walk Can-not toe walk Flatfoot gait | 10 -2 -2 -4 | 10. Flexor tendons Full function Partial function No function | 5 3 0 |

Table 1: Table showing results

| Results | JES | |
|--------------|-------------|------------|
| | No. of feet | Percentage |
| Excellent | 10 | 52.26 |
| Good | 4 | 21.05 |
| Fair | 3 | 15.8 |
| Poor | 2 | 10.5 |
| Total | 19 | 100 |

Out of 19 feet treated by JESS 10 were (52.26) excellent, 4(21.05) were good , 3 (15.8%) were fair and 2 (10.5) was poor.

RESULTS



X-Rays and Clinical Photos

Case 1:



**Figure 1: A) Pre Clinical Picture (Anterior View)
B) Showing immediate post-operative picture (Anterior View)
C) 18 Months followup**

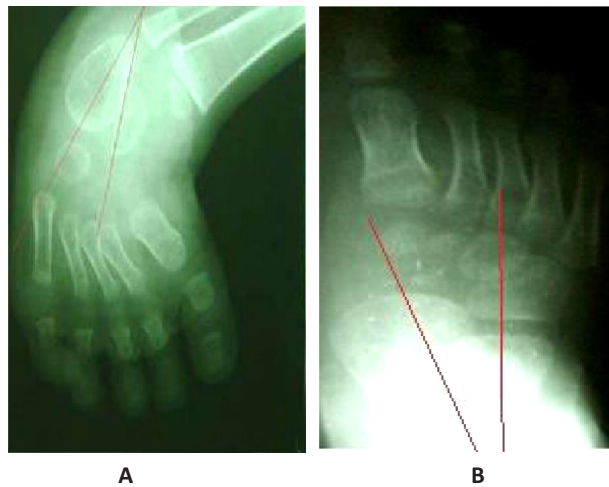


Figure 2: A) Pre reduction X-ray B) Post reduction X-ray

CASE 2:

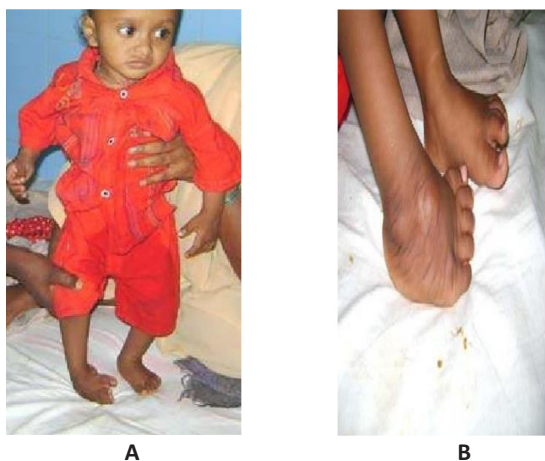


Figure 3:
A) Pre Operative Picture
B) Immediate
Post Operative Picture

DISCUSSION

The goal of this prospective study is to obtain a cosmetically acceptable foot, pliable, functional, painless, plant grade foot and to spare the parents and the child

from frequent hospitalization and years of treatment with casts and braces. In this prospective study all cases of CTEV coming in orthopaedic OPD shall be included, in each case complete record shall be made for the patient profile (age, sex, profession, any previous treatment). Each case shall be examined clinically, radiologically.

The basic principle of external fixation (JESS) in this study was the same advocated by Ilizarov.^[11] Physiological tension and stress applied to the tissue stimulates histogenesis of tissues, while controlled differential distraction gradually corrects the deformities and realigns the bones.

Pre-operative assessment revealed poor scores for all cases, but the post-operative rating yielded results that were comparable to those of other external fixator systems of Oganesian and Istomina, and superior to those reported by Galante et al, Bethem and Weiner, and Turco.

In our study there were 19 feet with male predominance, with age ranging from 1 to 8 years and 11 unilateral and 4 bilateral cases. There were 8 feet (42.10%) with neglected type 7 feet (36.8%) POP dropout and 4 feet (21.1%) were recurrent type average fixator period was 14 weeks with follow up ranging from 6month to 18 months.

In our study Results of 19 feet treated with JESS 11 were (52.26%) excellent, 4(21.05%) were good, 3 (15.8%) were fair and 2 (10.5%) was poor according to assesment using Hospital for joint disease, orthopaedic institute functional rating system for club foot (Lehman, Atar et al).

Out of 19 feet, 10 feet (52.6%) had superficial pin tract infection which had been treated with regular sterile dry dressings and oral antibiotics for a week which subsided. 2 feet (10.5%) had loosening of axial calcaneal pins and tibial pins secondary to pin tract infection and hence the fixator had to be removed prematurely which lead to fair to poor results.

Table 2: Comparative analysis of data

| Series | Excellent | Good | Fair | Poor | Type of fixator used |
|--|-----------|--------|---------|-------|---------------------------|
| Oganesian and Istomina (1991) ^[13] | 75.7% | 18.5% | 5.7% | 0 | Hinged distraction device |
| Suresh S, Ahmed A et al (1999) ^[16] | 77% | 13% | 0 | 9% | JESS |
| Bradish CF et al (1999) ^[11] | 47% | 29.4% | 11.7% | 11.7% | Ilizarov |
| Anwar Marthya H. Arun B (2004) ^[24] | 47% | 29.4% | 22.8% | 17.5% | JESS |
| Ajit Shinde, Suhas Kamble (2008) ^[12] | 68.5 | 23.9 | No data | 7.6 | JESS |
| Present study (2012) | 52.26% | 21.05% | 15.8% | 10.5% | JESS |

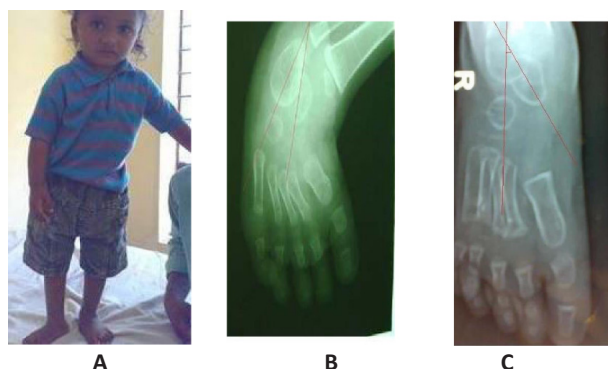


Figure 4: A) 1 Year followup
B) Pre Operative X-ray
C) Post Operative reduction X-ray

CONCLUSION

The goal of any clubfoot surgery is to obtain a cosmetically acceptable, pliable, functional, painless, and plantigrade foot. The best treatment for clubfoot that does not respond to conventional treatment remains controversial.^[15] The procedure used in the current study holds promise for fulfilling the above-mentioned goals. This procedure is ideally suited for children in whom the clubfoot deformities remain uncorrected by POP casts and manipulation, as well as for recurrent clubfoot. If performed at early age, the procedure enables the child to walk with a plantigrade foot by the time he or she is in the walking age group.

JESS modality working on the principle of gradual differential distraction with modification of the frame from ring frame produces better results with less morbidity and low complication rate than conservative and operative management.^[12]

Differential distraction technique gives good and fair results in children but results are excellent in younger child. All cases of CTEV are not amenable to this technique, only those cases should be operated which are neglected, recurrent and resistant. Motivated and compliant parents were a pivotal factor on which the success of the study depended.

Although the technique has a lot of advantages, one should not forget that injudicious and unsupervised distraction may lead to catastrophic results in the small developing foot. Thus we conclude that JESS application is an excellent technique for treatment of resistant, recurrent and neglected clubfoot.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

FUNDING:None

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