

## Early Experience with Ilizarov for Correction of Resistant Clubfoot

MUHAMMAD ZAHID SHAH<sup>1</sup>, AFSAR KHAN<sup>2</sup>, MUHAMMAD SHOAIB KHAN<sup>3</sup>

<sup>1</sup>Senior Registrar, Department of Orthopaedic, Peshawar Medical College Peshawar

<sup>2</sup>Assistant Professor, Department of Orthopaedic, DHQ Teaching Hospital KDA Kohat

<sup>3</sup>Associate Professor, Department of Orthopaedic, Khyber Teaching Hospital Peshawar

Correspondence to: Dr. Muhammad Zahid Shah email: zasafisurgicald@gmail.com

### ABSTRACT

**Aim:** To evaluate the role of Ilizarov technique for correction of relapsed, resistant and neglected clubfeet.

**Study Design:** Descriptive cross sectional study.

**Place and Duration of Study:** This study was carried out at Department of Orthopedics and Traumatology Khyber Teaching Hospital Peshawar from August 2013 to August 2015.

**Methods:** All the children of both sexes aged 2 to 18 years with resistant clubfeet were enrolled in the study via outpatient department (OPD) of Khyber teaching hospital Peshawar Pakistan.

**Results:** A total of 15 clubfeet in 15 patients were included. Out of which 10(66.6%) patient were males and 5(33.3%) were females. The average age was 9±4.33 years (2 SD) with range from 2 to 18 years. Average follow up was 19.11±2.42 months (2 SD) with range from 15 to 24 months. Average correction time and frame application was 5.3±1.53 months with a range from 3 to 8 months. 11(73.33%) patients showed excellent and good results and 26.66% (n=4) patients showed fair and poor results.

**Conclusion:** Ilizarov technique is efficient, cost effective, adjustable and procedure of choice in resistant clubfoot deformity.

**Key words:** Resistant clubfoot, Ilizarov, Recurrence

---

### INTRODUCTION

Clubfoot or congenital talipes equinovarus (CTEV) is treated conservatively in the early phase. Ponsetti protocol of serial casting followed by percutaneous tenotomy of tendo Achilli is a renown and time tested method.<sup>1</sup> This noninvasive cheaper method of treatment is very effective with promising results.<sup>2-4</sup> It is a versatile and comprehensive treatment modality reducing need of extensive and radical surgical procedures.<sup>5,6</sup> Ponseti method consists of assessment, manipulation and casting weekly followed by reassessment and percutaneous tenotomy of the Achilles tendon.

Resistant congenital talipes equinovarus deformity of the foot is a common entity faced by general and pediatric orthopeditions and most difficult and challenging problem even for the experienced ones.<sup>7,8</sup> The reason in majority of cases is late presentation, older age i.e. above 2.5 years, poor compliance to treatment by the parents i.e. delayed follow up, cast removal and not reporting to Ponseti clinics. There may be technical deficiency on the part of attending orthopedition. There may be intrinsic issues like syndromic clubfeet are resistant to conservative measures i.e. in the setting of arthrogryposis multiplex congenita and meningomyelocele.

Resistant and relapsed clubfeet are treated by Ponseti method followed by percutaneous tenotomy aided by various soft tissue procedures, tendon transfers and bony interventions. Complete subtalar release is done to correct heel varus and to get plantigrade foot.<sup>9</sup> Modified posteromedial release or modified complete subtalar release is done to correct hind foot varus and equinus deformity in resistant clubfeet.<sup>10</sup> To address residual varus and equinus in these feet posteromedial-lateral release is

performed by two separate limited surgical incisions. Better results are obtained by posteromedial release only<sup>11</sup>. Mid foot varus and forefoot adduction can be corrected by transfer of tibialis anterior tendon to 3<sup>rd</sup> metatarsal or to extensor digitorum.<sup>12</sup>

Ilizarov is a versatile and diverse modality of treatment for resistant and neglected clubfeet with excellent results.<sup>1,7,13,14</sup> It avoids the need of extensive surgical dissections and unwanted complications such as soft tissue damage and scarring responsible for residual deformity, vascular damage to bone i.e. vascularity of talus, navicular and cuneiform bone. It can be used with minimal soft tissue or bony procedures, even it can be applied for soft tissue distraction only to correct CTEV using ponseti protocol without any surgical incision with very good results.<sup>15-17</sup>

The current study is aimed to evaluate Ilizarov external fixator application in the treatment of challenging, resistant and relapsed clubfeet with previously failed conservative and surgical managements. It digs out various aspects of corrective stages of Ilizarov correction, Ilizarov application with different limited soft tissue releases, minimal bony osteotomies, the clinical and functional outcomes. It also points out various inevitable complications and side effects during the treatment. The study is aimed to provide evidence based outcomes and provide a platform for further studies in this versatile field. It is aimed to be applied and to be shared to various orthopedic set ups in the public and private sector.

### PATIENTS AND METHODS

This descriptive prospective study was conducted in Khyber teaching hospital Peshawar, Pakistan. The time period of study was from august 2013 to august 2015. The patients inclusion criteria were resistant CTEV: (A) Persistent deformity after Ponseti followed by tenotomy or persistent deformity after soft tissue procedures i.e. limited

Received on 17-07-2019

Accepted on 13-01-2020

posteromedial release, extensive posteromedial release and tendon transfers preceded by serial casting according to Ponseti protocol, (B) recurrent deformity during treatment after initial successful treatment i.e. during Dennis brown splint application after good scores by serial casting or after successful serial casting and soft tissue procedures (C) Neglected CTEV i.e. presentation in late age with no previous treatment i.e. presentation after the age of 4 years, age limit was from 2 years to 18 years and non-syndromic CTEV i.e. idiopathic CTEV patients were included. Patients with neuromuscular disorders, dermatological and skin conditions and systemic illness, medical, surgical and orthopedic comorbidities were excluded. Patients were recruited via outpatient department (OPD) directly and referral from lower orthopedic centers and clinics across the Khyber Pukhtoonkhwa province mostly, and adjacent district of Punjab and Baluchistan i.e. Attock and Quetta of and from Afghanistan as well. After admission to orthopedic department informed consent was taken and counselling of the parents undergone. All the patients were thoroughly assessed i.e. complete physical and systemic examinations performed. Each patient relapse pattern was classified according to relapse pattern classification.<sup>19</sup> After thorough assessment and counselling with the parents, preoperative preparation was carried out i.e. complete blood picture, virology, chest x-ray, ECG, fitness for general anesthesia.

All patients were operated on elective list under general anesthesia, on a table with image intensifier facility to help in proper wire placement. Standard Ilizarov rings, simple and beaded wire of size 1.5 were placed. Two standard complete Ilizarov rings were applied to the tibial diaphysis and one near the tibial plateau and one above the plafond with three simple wires in each ring, one standard one half ring or five eight ring was applied to hind foot to engage calcaneus with one or two simple wires for correction of heel varus and equinus, one ring applied to fore foot with 2 or 3 wires at metatarsal levels simple or beaded, preferably to include maximum metatarsal bones for correction of forefoot adduction, varus and equinus at the end. All the wires and rings were rechecked in image intensifier for proper placement. Acute correction was achieved up to maximum extent without skin tethering and without compromising tissue vascularity. Limited soft tissue release i.e. posteromedial release in younger age group, some bony procedure i.e. calcaneal wedge osteotomy in older children with severe deformities were performed. With minimal supple deformities, simple Ilizarov frame was applied without any soft tissue or bony procedures. Postoperatively correction at rate of 1 mm per day four times i.e. 6-12-6-12 was started according to Ponseti protocol. Cavus and forefoot adduction was corrected followed by heel varus and then equinus.

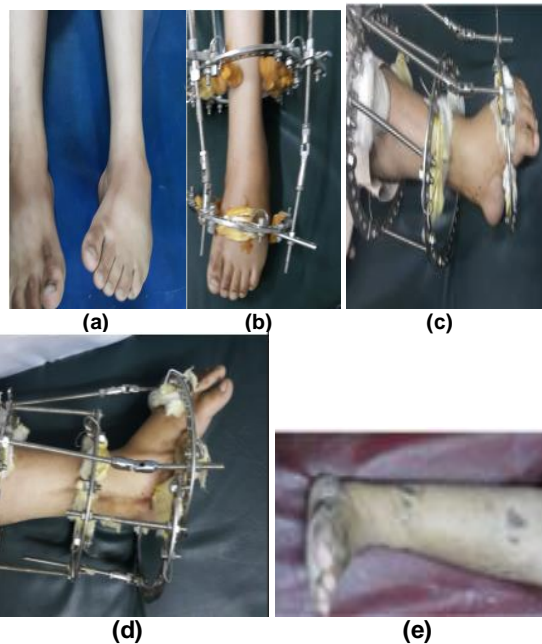


Fig. 1: CTEV correction in a 8 year male child (a) preoperative (b) after frame application (c) correction of adduction and cavus (d) correction of equines (e) finally corrected foot with frame removal

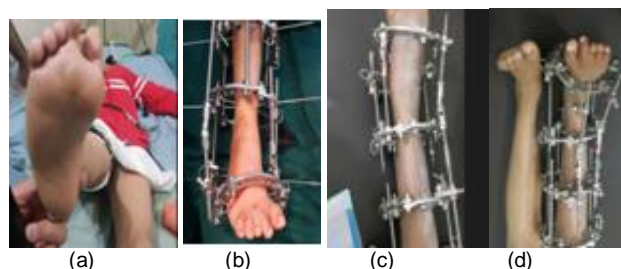


Fig. 2: CTEV correction in a 12 year male child (a) preop (b) after frame in situ (c) correction of adduction and cavus (d) correction of equines and fully corrected foot

Patients were kept for about a week and were sent home after proper education and understanding. All patients were followed weekly for initial 6 weeks, assessed for correction clinically and radiographically, looked for soft tissue status and then 2 weekly after 6 weeks time. Functional outcome was assessed clinically by functional classification<sup>13,14</sup>

## RESULTS

Out of 15 clubfeet, 66.6% (n=11) patient were males and 33.3% (n=3) were females. The average age was 9±4.33 years (2 SD) with range from 2 to 18 years. Average follow up was 19.11±2.42 months (2 SD) with a range from 15 to 24 months. Average correction time and frame application

was 5.3±1.53 months (2 SD) with a range from 3 to 8 months. At removal of fixator, 60% (n=9) feet had excellent outcome, 13.34% (n=2) feet had good outcome, 13.33% (n=2) had fair (relapse grade IIB) and 13.13% (n=2) feet had poor (relapse grade III) outcome. Excellent and good outcome, 73.33% (n=11) were satisfactory results and fair and poor outcome, 26.66% (n=4) were unsatisfactory results. 26.66% (n=4) feet had minor pin site infection, 6.66% (n=1) feet had knee stiffness, 13.33 % (n=2) feet had skin breakage and 6.66% (n=1) had major pin site infection. No issues of compartment syndrome and wire or ring breakage observed (Table 1).

Table 1: Frequency of outcome (n=9)

Functional outcome	No.	%
Excellent	9	60
Good	2	13.33
Fair	2	13.33
Poor	2	13.33

**DISCUSSION**

Congenital talipes equino varus (CTEV) can be addressed by various treatment modalities. The very basic and most acceptable and with maximum results is serial casting according to ponseti protocol mostly for fresh cases and early months of life. Resistant and neglected CTEV pose a big problem to orthopeditions all over the world<sup>7</sup>. It can be managed by a variety of treatments, each one associated with its own merit and demerits. Ilizarov ring fixator is a multi-optional and modifiable treatment modality for congenital club feet (CTEV) and other deformities of the foot.

Our study was designed and aimed to determine the outcome and efficacy of Ilizarov application for the treatment of resistant, relapsed and neglected congenital talipes equino varus deformity. The efficacy, simplicity, cost effectiveness, less invasiveness, multi-optional and adjustability of this procedure provide a rational basis for its application in pediatric orthopedics. Looking at the available literature various studies have performed to evaluate role of Ilizarov in resistant clubfeet<sup>7,8,17</sup>.

In our study 60% (n=9) showed excellent results at the removal of Ilizarov frame with correction of cavus, forefoot adduction, hind foot varus and equinus deformity and achieving a painless plantigrade foot with full functionality. 13.33% (n=2) had good results i.e. plantigrade foot with mild pain on long distances. 13.33% (n=2) had fair outcome i.e. some functional limitation, pain and some residual deformity i.e. hind foot varus which needed cast, bracing and physiotherapy. 13.33% (n=2) had poor results i.e. activity limitations, moderate pain and significant cavus, forefoot adduction and midfoot varus or overcorrection deformity noted at removal of fixator and at one year follow up which needed redo surgery. Gupta et al in a prospective study enrolling 15 patients and 16 clubfeet. Fourteen feet showed excellent or good results on the basis of international club foot study group score (ICFSG). In all patients plantigrade foot was achieved except one having mild equinus deformity. The study concluded that Ilizarov is a useful tool in the management of clubfoot<sup>14</sup>.

Refai et al<sup>13</sup> in a retrospective study reviewing 18 patients and 19 feet with relapsed clubfeet treated by

Ilizarov with an average follow up 4.5 years. 16 patients showed excellent results with painless plantigrade foot. 3 patients showed recurrence which needed revision surgery. The preoperative clinical American foot and ankle score (AOFAS) increased from 57 to 81 and AP and lateral talocalcaneal and AP and lateral talo first metatarsal angles improved. This study concluded Ilizarov a good option in relapsed clubfeet. In our study no frank recurrence was noted. Only residual deformity (13.33% patients) was seen i.e. hind foot varus and painful foot and limitation of activity. El-Sayed<sup>12</sup> in his prospective study enrolled 42 relapsed clubfeet treated by Ilizarov. Patients were assessed clinically by Dimeglio classification preoperative and postoperatively with an average follow up of 4.6 years. 37 patients showed excellent or good results i.e. painless plantigrade foot and 5 patients showed poor results and needed revision surgeries. This study showed Ilizarov technique a good option in treatment in relapsed clubfeet.

El-Mowafi et al<sup>18</sup> in a prospective trial including 35 feet in 28 patients treated by Ilizarov distraction osteogenesis and a calcaneal v shaped osteotomy percutaneously. Patients were divided into two groups. Group one 16 feet in 13 patients underwent calcaneal osteotomy and gradual correction by Ilizarov. Groups second 19 feet in 15 patients were offered only soft tissue distraction by Ilizarov and the average follow up was 5.6 years. At final follow up 25 feet showed excellent or good results (9 feet in group one and 16 feet in group 2) and 10 feet (7 in group one and 3 in group 2) showed poor results with residual deformity. The study concluded Ilizarov technique procedure of choice in recurrent and relapsed feet and recurrence can be seen in Ilizarov only procedure and with adjunctive bony procedures.

One of local study conducted at Jamshoro Pakistan by Makhdoom et al<sup>7</sup> enrolling 27 resistant feet in 21 patients treated by Ilizarov distraction osteogenesis with limited Achilli tendon sheath tenotomy and plantar fasciotomy. Patients were followed up to an average of 18 months and were assessed by Rienker and Carpenter scale as excellent, good, fair and poor. 3 (11.11%) feet out of 27 stood excellent, 17 (63%) feet as good, 5 (18.5%) as fair and 2 (7%) as poor. Excellent and good (74%) were considered satisfactory and fair and good (26%) were considered unsatisfactory. This declared Ilizarov as a promising tool and good option in resistant CTEV.

In our study we encountered few minor complications like pin sit infection in 4 (26.66%) patients which needed local wash, dressing and oral antibiotics for 3 days. 1 (6.66%) patient had knee stiffness (because of placement of first ring near the knee joint) at removal of fixator which were treated by daily exercises. We also noted major issues in three patients two (13.33%) had skin breakdown by the proximal ring which was changed under general anesthesia on main list. One (6.66%) patient had pin site infection severe enough which needed wires change and ring site on the main list. No issues of compartment syndrome, ring breakage, loss of fixation or osteomyelitis observed during the study.

Although our study is showing good results but few limitations are worth mentioning. Our sample size may not be large enough and real representative one. Limitations in follow up that is patients from for plunge areas of the

province with scarce logistic resources not coming at due timing to see for exact complications and progress. Our follow up period will not be an ideal one. We achieved satisfactory results but with a large sample size and long follow up period more precise conclusion can be withdrawn regarding Ilizarov efficacy in the treatment of resistant clubfoot.

## CONCLUSION

Ilizarov ring fixator is a comprehensive, cost effective and viable option for the treatment of relapsed, resistant and neglected clubfeet. It avoids the need for extensive tissue dissections and tissue scarring. It is adjustable and slowly distract correcting deformities within the natural resilience of body tissues thus avoiding its damage. We recommend Ilizarov as a procedure of choice for treatment of relapsed, resistant and neglected clubfeet.

## REFERENCES

1. Pirani S, Naddumba E, Mathias R, Konde-Lule J, Penny N, Beyeza T, et al. Towards effective Ponseti clubfoot care: The Uganda substantiable clubfoot care project. Review article. *Clin Orthop Relat Res* 2009; 467 (5):1154-63.
2. Van Bosse HJ. Ponseti treatment for clubfeet: an international perspective. Review article. *Curr Opin Pediatr* 2011;23 (1):41-5.
3. Jowett CR, Morcuende JA, Ramachandran M. Management of congenital talipes equinovarus using the Ponseti method: a systemic review. *J Bone Joint Surg Br* 2011; 93 (9):1160-4.
4. Colburn M, Williams M. Evaluation of the treatment of idiopathic clubfoot by using the Ponseti method. *J Foot Ankle Surg* 2003;42 (5):259-67.
5. Morcuende JA, Dolan LA, Dietz FR, Ponseti IV. Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method. *Pediatrics* 2004;113 (2):376-80.
6. Ayidin BK, Sofu H, Senaran H, Erkocak OF, Acar MA, Kirac Y. Treatment of clubfoot with Ponseti method using semi rigid synthetic soft cast. *Medicine (Baltimore)*.2015;94 (47):2072.
7. Makhdoom A, Qureshi PA, Jokhio MF, Siddiqui KA. Resistant clubfoot deformities managed by Ilizarov distraction histiogenesis. *Indian J Orthop* 2012;46 (3):326-32.
8. Von Bosse HJ. Treatment of neglected and relapsed clubfoot review article. *Clin Podiatr Med Surg* 2013;30 (4):513-30.
9. Hassan FO, Jabaiti S, El tamimi T. Complete subtalar release for older children who had recurrent clubfoot deformity. *Foot Ankle Surg* 2010;16 (1):38-44.
10. Kaewopornsawan K, Khuntisuk S, Jatunarapit R. Comparison of modified posteromedial release and complete subtalar release in resistant congenital clubfoot: a randomized controlled trial. *J Med Assoc Thai* 2007;90 (5):936-941.
11. Hallaj-Moghadam M, Moradi A, Ebrahimzadeh MH. Clinical outcome of posteromedial versus posteromedial lateral-release for clubfoot. *J Pediatr Orthop B* 2015;24 (1):24-7.
12. El-Sayed M. Ilizarov external fixation for management of severe relapsed clubfeet in older children. *Foot Ankle Surg* 2013;19 (3):177-81
13. Refai MA, Song SH, Song HR. Does short term application of an Ilizarov frame with transfixation pins correct relapsed clubfoot in children. *Clin Orthop Relat Res* 2012;470(7):1992-9.
14. Gupta P, Bither N. Ilizarov in relapsed clubfoot: a necessary evil. *J Pediatr Orthop B* 2013;22(6): 589-94.
15. Ganger R, Radler C, Handlbauer A, Grill F. External fixation in clubfoot treatment - a review of the literature. *J Pediatr Orthop B*.2012;21 (1):52-8.
16. Utukuri MM, Ramachandran M, Hartley J, Hill RA. Patient-based outcome after Ilizarov surgery in resistant clubfeet. *J Pediatr Orthop B* 2006; 15(4): 278-84.
17. Tripathy SK, Saini R, Sudes P, Dhillon MS, Gill SS, Sen RK, et al. Application of the Ponseti principle for deformity correction in neglected and relapsed clubfoot using the Ilizarov fixator. *J Pediatr Orthop B* 2011;20 (1):26-32.
18. El-Mowafi H, El-Alfy B, Refai M. Functional outcome of salvage of residual and recurrent deformities of clubfoot with Ilizarov technique. *Foot Ankle Surg* 2009;15 (1):3-6.
19. Bhaskar A, Patni P. Classification of relapse pattern in clubfoot treated with Ponseti technique. *Indian J Orthop* 2013; 47(4):370-376.