

Research Article

Treatment Outcomes of Congenital Pseudarthrosis of Tibia Treated with Ilizarov

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ABSTRACT

Congenital pseudarthrosis of the tibia (CPT) is a rare but very difficult issue to deal. There is dysplasia of the tibia which leads to progressive anterolateral bowing, pathological fracture, nonunion and limb length discrepancy. The Ilizarov method works on the basic principle of distraction osteogenesis. It has advantage of deformity correction, compression at the nonunion site, correction of limb shortening, and early mobilization and weight-bearing. This retrospective study was done at the Department of Orthopaedic Surgery Chandka Medical College Hospital Larkana @ SMBB Medical University from January 2018 to March 2025. Data was collected in terms of age, gender, side involved, limb length discrepancy (LLD), previous treatment history, time to union, and complications were collected and analyzed using SPSS version 27. Continuous variables were presented as mean $\pm$ standard deviation, while categorical variables were expressed as frequencies and percentages. The study included 15 patients with a mean age of 7.9 ± 3.1 years. There were 9 males (60%) and 6 females (40%). Right-sided involvement was observed in 8 patients (53.3%) and left-sided involvement in 7 patients (46.7%). Mean preoperative LLD was 4.6 ± 1.4 cm. Ten patients (66.7%) had undergone previous interventions. Union was achieved in 13 patients (86.7%). Pin tract infection occurred in 5 patients (33.3%), wire loosening in 3 patients (20%), wire breakage in 2 patients (13.3%), and refracture in 2 patients (13.3%). The Ilizarov technique is an effective treatment modality for congenital pseudarthrosis of the tibia with a high union rate and satisfactory correction of limb length discrepancy. Refracture remains the most significant long-term complication and necessitates prolonged follow-up.

Keywords: Congenital Pseudarthrosis Tibia, Ilizarov Fixator, Limb Length Discrepancy, Refracture, Distraction Osteogenesis.

INTRODUCTION

Congenital pseudarthrosis of the tibia (CPT) is a rare but very difficult issue to deal. There is dysplasia of the tibia which leads to progressive anterolateral bowing, pathological fracture, nonunion and limb length discrepancy. Incidence of CPT ranges from one per 140,000 to 250,000 live births and approximately 50–70% of patients have associated Neurofibromatosis Type 1 (NF-1)¹. The cause of CPT is still not exactly known. Histopathology has shown growth of disorganized, fibrous tissue at the nonunion bone ends. This

histopathological finding is most probable cause for increased chances of nonunion². The goals of treatment in CPT treatment are union, alignment, correction of limb length discrepancy, and prevention of refracture during long term follow-up³. Intramedullary fixation, vascularized/non-vascularized fibular graft, cancellous bone graft, and Ilizarov have been used frequently for the treatment of CPT. Still there is lack of consensus that which method is the gold standard; due to different outcomes and high rate of complications⁴. The

Ilizarov method works on the basic principle of distraction osteogenesis. It has advantage of deformity correction, compression at the nonunion site, correction of limb shortening, and early mobilization and weight-bearing⁵. Gradual correction decreases the chance of soft tissue issues and stimulates bone regeneration⁶. Even though union rates are high (75% to 95%) with Ilizarov; the main concern is complications such as pin tract infection, wire loosening, wire breakage, residual deformity, and refracture⁷. The aim of this study is to look for the clinical and radiological outcomes of Ilizarov in patients with congenital pseudarthrosis of the tibia. This study will set local guidelines and look for issues and their solutions.

METHODOLOGY

This Retrospective case series study was done at the Department of Orthopaedic Surgery Chandka Medical College Hospital Larkana @ SMBB Medical University from January 2018 to March 2025. Informed consent was obtained and patient confidentiality was maintained throughout the study. Fifteen patients were included in this study through consecutive sampling. Patients diagnosed with congenital pseudarthrosis of the tibia, age less than 16 years, treated using Ilizarov external fixation, minimum follow-up period of 12 months with complete clinical and radiographic records were included in this study. Patients with tibial nonunion secondary to trauma, infective tibial nonunion, incomplete records and follow-up less than 12 months were not included in this study.

Surgical Technique

All procedures were performed under general anesthesia/spinal anesthesia. The pseudarthrosis site was exposed through a limited approach. Fibrous hamartomatous tissue was excised and bone ends were freshened until punctate bleeding was observed. The medullary canal was reopened and bone segments were normally aligned. The Ilizarov frame was mounted on the diseased limb using trans-osseous wires and schanz screws. Primary compression was applied across the pseudarthrosis site if residual shortening after excision of pathological bone ends was < 3 cm. In patients with limb length discrepancy exceeding 3 cm, corticotomy and distraction osteogenesis were performed. Partial weight-bearing was initiated within the first postoperative week and progressed according to radiological evidence of regenerate formation. Data was collected in terms of age, limb length discrepancy, time to union, gender, side involved, previous treatment, union rate, and complications (Pin tract infection, wire loosening, wire breakage and refracture. Data was analyzed. Quantitative variables including age, limb length discrepancy, and time to union were expressed as mean $\pm$ standard deviation. Qualitative variables including gender, side involved, previous treatment, union rate, and complications were presented as frequencies and percentages.

RESULTS

A total of 15 patients were included in the study. The mean age at surgery was 7.9 ± 3.1 years (range 3–14 years). There were 9 males (60%) and 6 females (40%).

Table I: Demographic Characteristics (n=15)

Variable	Frequency
Male	9 (60.0%)
Female	6 (40.0%)
Right side	8 (53.3%)
Left side	7 (46.7%)

The right tibia was involved in 8 patients (53.3%) and the left tibia in 7 patients (46.7%). Mean preoperative limb length discrepancy was 4.6 ± 1.4 cm (range 2.5–7 cm). Ten patients

(66.7%) had undergone previous treatment before presentation, whereas 5 patients (33.3%) had received no prior intervention.

Table II: Previous Treatment History

Previous Treatment	Frequency (%)
None	5 (33.3)
Casting	4 (26.7)

Previous surgery	6 (40.0)
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Radiological union was achieved in 13 patients (86.7%). Mean time to union was 7.8 ± 1.9 months. Most frequent complication noted was pin tract infection occurring in 5 patients (33.3%). Wire loosening was seen in three patients (20%) and wire breakage was noted in 2 patients (13.3%). 2 patients (13.3%) suffered from refracture.

DISCUSSION

Congenital pseudarthrosis of the tibia is the most difficult condition to treat because of its undetermined pathogenesis and increased chances of nonunion. Refracture is not uncommon even after successful union. The principal goals of treatment include achieving union, correcting deformity, addressing limb length discrepancy, and minimizing refracture. In this study we achieved union in 86.7% of patients. These results are comparable to El-Rosasy and Paley et al who achieved union in 83% of patients and 90% of patients respectively with Ilizarov method. Paley et al further emphasized that for optimum results it's very important to follow biological and mechanical principles. The mean age of patients in our study was 7.9 years, which is similar to studies by Joseph et al. and Shah et al. who reported average ages ranging from 6 to 9 years. It is recommended by many researchers that delaying Ilizarov treatment beyond 3 years improves treatment results because of good bone quality and maintenance and adaptability of frame. Repeated fractures and growth disturbance leads to limb length discrepancy which adds to the difficulties faced during treatment of CPT. Mean LLD of 4.6 cm was noted in our study which can be compared to other studies. Ilizarov technique is superior to other treatment modalities because it treats nonunion, deformity and limb length discrepancy by the principle of distraction osteogenesis⁸. In our study pin tract infection was the most common complication affecting 5 (33%) of patients. Similar rates ranging from 20% to 45% have been reported in studies for Ilizarov. Mostly pin tract infections were superficial and were treated with oral antibiotics and pin cleansing with antiseptic solution⁹. Wire loosening and wire breakage occurred in small number of patients and did not affect outcome. These complications can be managed with periodic frame adjustment or wire replacement¹⁰. Refracture after treatment is the main issue in the management of CPT. Our

study reported refracture in 13.3% of patients after frame removal. Refracture is dreaded complication and it is very imperative to have close follow-up till skeletal maturity and use of orthosis for prevention of re-fracture¹¹. The limitations of the present study include its retrospective design, small sample size, and absence of a comparison group. However, CPT is an uncommon disorder and the current series contributes useful information regarding the effectiveness of Ilizarov fixation in resource-limited settings.

CONCLUSION

The Ilizarov technique is an excellent method for treatment of congenital pseudarthrosis of the tibia with increased chances of union and deformity correction. Pin tract infection and wire loosening are common complications; which can be managed with oral antibiotics and maintenance of local wire hygiene. Refracture is a major long-term complication. Close follow-up, strict long term bracing and proper patient counseling and education is very important to optimize outcomes and reduce complications.

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