

FUNCTIONAL OUTCOME OF INFECTED NON UNION OF TIBIA WITH BONE LOSS TREATED BY ILIZAROV RING FIXATOR WITH BONE TRANSPORT

Kingsly. P¹, Hementha Kumar.G², Mohamed Zubair.A³, Buvanesh Janakiraman⁴

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Corresponding Author:

Dr. Buvanesh Janakiraman,
Email: buvanesh18594@gmail.com

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¹Associate Professor, Department of Orthopaedics, Kanyakumari Government Medical College, Asaripallam, Nagercoil, India.

²Associate Professor, Department of Orthopaedics, Stanley Medical College, Chennai, India.

³Associate Professor, Department of Orthopaedics, Kanyakumari Government Medical College, Asaripallam, Nagercoil, India.

⁴Senior Resident, Department of Orthopaedics, Bhaarith Medical College, Chennai, India.

Abstract

Background: Aim of the study is to analyze the functional and radiological outcome of Ilizarov ring fixator with bone transport for infected nonunion with bone loss of tibia. **Materials and Methods:** Twenty patients with nonunion of tibia with bone loss and infection were managed by extensive debridement and resection of infected portion of bone with or without resection of fibula. Tibia was stabilized by Ilizarov ring fixator and then bone transportation was done. Bone transport was done in all patients who had greater than 2.5 cm bone defect after debridement. **Result:** All fractures united and infection eradicated completely. Bone grafting was required in one patient to augment union. Bone results were 11 excellent in 11 patients, 7 good in 7 patients, 1 fair and 1 poor results. Functional results were excellent in 8 patients, good in 10 patients, fair in 2 patients and poor in 0 patient. Pin site inflammation was the most common problem and occurred in 17(85%) patients. We had 1 case of non-union resistant to Ilizarov ring fixation. There were no major complications or neurovascular complications. **Conclusion:** We conclude that debridement of necrotic bone combined with Ilizarov ring fixator with or without partial fibula resection is a reliable method for the treatment of infected non-unions of tibia.

INTRODUCTION

Ilizarov ring fixator with its percutaneously inserted and tensioned wires provide a stiff and stable construct for compression, distraction, bone lengthening and deformity correction. Infected nonunion of tibia with bone loss are often seen in clinical practice and it is a challenge to the treating surgeons. It is commonly caused by Grade III compound fractures and they usually have multiple coexisting problems like bone and soft tissue loss, deformities, limb-length inequalities, adjacent joint stiffness and infection. Treatment of such fractures usually takes long time for fracture to unite, requiring multiple surgical procedures and the outcome of the surgery may be guarded some leading to limb amputation.^[1] In patients with infection, exposed bone, bone loss and deformity internal fixation with implants was a relative contraindication. The ability to overcome all these problems is possible with application of Ilizarov ring fixator. It is a novel technique that has

revolutionized treatment of open fractures with bone defect, non-union and deformities.^[2-5] The purpose of this study was to evaluate the efficiency, complications, merits and demerits if any of Ilizarov technique in dealing with infected non-unions of the tibia.

MATERIALS AND METHODS

The study was conducted in tertiary care hospital from June-2019 to June 2022. The inclusion criteria in our study are patients with infected non-union of tibia with bone loss, age between 18-65years. Patients with neurovascular injury, pathological fractures, severe systemic illness and any other medical contraindication for surgery are excluded from this study. All patients were treated with Ilizarov ring fixator, corticotomy and bone transport for the management of infected gap non-union. In our study bone results were assessed by Association for the Study and Application of Methods of Ilizarov Scoring System (ASAMI) and Functional outcome were assessed by Association for the Study

and Application of Methods of Ilizarov Scoring System (ASAMI). All the patient with grade III B compound injury was given tetanus toxoid and tetanus immunoglobulin according to the protocol. Debridement of necrotic soft tissue and bones was done. Fractured bones are stabilized with AO tubular external fixator in emergency operation theatre under broad spectrum antibiotic coverage. Antibiotics were administered according to culture and sensitivity reports taken at the time of initial debirdement. Later soft tissue reconstruction with flap cover or skin grafting was done electively in main operation theatre by plastic surgeons to close the soft tissue defect. Scaled radiographs were used to determine limb length discrepancy and the length of the bone loss. Size of the ilizarov ring was selected according to the patient calf size and prefabricated construct was assembled and shown to all the patients well before surgery. They were also explained about. Consent for surgery was obtained pre operatively after the patients were explained about the procedure and the need for additional procedure if required. General or spinal anesthesia was used. Plastic surgeon opinion is obtained about the placement of incision for sequestrectomy to avoid flap necrosis. The proximal and distal ends of the defect were freshened transversely until bleeding viable bone. The fibrous and granulation tissue around the bone ends was excised and lizarov ring fixator was applied. If necessary, an osteotomy or excision of 1-2cm of the fibula was done to correct the residual mal-alignment of the limb. After application of the fixator corticotomy of tibia was done for bone transports. The postoperative protocol was quadriceps strengthening exercise, knee and ankle range of motion exercise. On second day the patients were allowed to walk with partial weight bearing with the support of the crutches. It was followed by gradual weight bearing to full weight bearing by end of 2 weeks as tolerated. Distraction was started after 7-10 days with screw was adjustment done with quarter turn distraction four times a day or half turn distraction atleast two times a day and it was taught to the patient. In each follow-up visit serial radiographic evaluation was done with x-ray of leg in Antero-Posterior, Lateral, internal oblique and external oblique views radiographs. During distraction phase initially each week and then at 3, 6, 12, 18 and 24 months to assess progress of distraction and quality of regenerated bone. After consolidation of the corticotomy and the fracture frame removal was done after dynamization as an outpatient procedure under minimal analgesia.

RESULTS

In the 20 patients included in our study, left side was involved in 8 and right side was involved in 12 cases. The mean age of the patients was 35.15 [range 18 – 58] years. Most common mode of injury was road traffic accident (18 patients) and one of our patient has sustained injury due to wall collapse and other one patient fell into dry well. All of our patients sustained grade III B compound injuries for which initially AO tubular external fixator were applied initially with wound debridement followed by plastic surgery procedures for soft tissue defect. Flap cover was done for six of our patients by Plastic surgery team and Split skin grafting for remaining fourteen of our cases by plastic surgery team to reduce the raw area. Average time from injury to ilizarov external fixator application was 5 months with the minimum of one month to maximum of 12 months. Foot assembly was used in 5 out of 20 patients. Low energy corticotomy was done in all of our patients. Nine of our patient underwent proximal metaphyseal corticotomy, seven patient underwent proximal diaphyseal corticotomy and four patients underwent distal diaphyseal corticotomy. recorticotomy was done in two of our patients due to premature consolidation of corticotomy site. This was due to noncompliance of the patient to treatment. All the corticotomy site consolidated well with grade 5 and 6 Fernandez Esteve grading without any infection and nonunion. Average bone transport of around 6.5 cm was observed in our study which indirectly indicated the average bone loss of tibia in our patients. Maximum bone loss of 10 cm and minimum bone loss of 3 cm was observed in our study. All of our patients achieved bony union but one of our patient didn't get rid of infection which was due to poor skin condition at the fracture site due to chronic dermatitis. Average time for bone union observed in our study was 16 weeks after docking with the minimum of 12 weeks to maximum of 28 weeks. This time depend upon the location of the fracture and soft tissue procedures (skin graft or flap cover). Proximally located wound united early than the distal wound due to more blood supply and location of fracture in metaphyseal area. Patient who undergone flap cover resulted in early bone union than the skin graft group. Two patient underwent bone grafting for nonunion at fracture site which is at the distal third of tibia. These two patients had foot arch ring due to which the patient was not able to mobilize with full weight bearing leading to nonunion. Average time patient on ilizarov fixator was seven months.

Table 1: shows results assessed as per ASAMI criteria in our study

Grading	Bone results		Functional results	
	Total no	%	Total no	%
Excellent	11	55	8	40
Good	7	35	10	50
Fair	1	5	2	10

Poor	1	5	0	0
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Table 2: shows comparison of results from different studies

	Our study	Paley D et al, ^[5]	Dendrinis et al, ^[8]
Bone results			
Excellent	55	60.8	50
Good	35	26.0	29
Fair	5	8.7	3.6
Poor	5	4.3	17.4
Functional results			
Excellent	40	64	60
Good	50	28	32
Fair	10	4	4
Poor	0	4	4

Complications in the form of limb length discrepancy [1 to 3 cm], joint stiffness [ankle > knee], pin site infection occurred in 15, 11 and 17 cases respectively. There were no cases with neurovascular injury. We had 1 case of non-union resistant to Ilizarov ring fixation.

DISCUSSION

The Ilizarov ring fixator is a versatile technique that holds great promise in the management of non-unions after soft tissue repair when needed. A limb that would have been non-salvageable and proceeded to amputation in the past is given a chance and made salvageable by plastic surgeons by soft tissue reconstruction.^[6] Non-union is one of the greatest challenges associated with limb length discrepancy, multi drug resistant organisms, soft tissue defects, deformities etc. Although many techniques are available for the treatment of infected non-union, all of them cannot be addressed simultaneously. By using the Ilizarov method most the problems associated with infected non-union can be handled. But it is technically demanding and time consuming.^[7] The patient's acceptance plays a crucial role in the success of this modality of treatment. The psychological and physical trauma to the patient when presented to with the thought of another surgery is often underestimated.

Stabilization stimulated callus formation and union. Once the fracture unites, infection spontaneously disappears. The combinations and modifications of the Ilizarov ring fixator make it versatile and almost a salvage procedure as it addressing all the problems of open or infected musculo-skeletal injuries and achieving union in 90 percent cases in this series. Flap cover done in 8 of 20 patients. Regardless of the infection Ilizarov fixator gives fantastic results.

Our results are comparable with the study done by paley et al,^[5] and Dendrinis et al.^[8] Bone transport after corticotomy has been compared to bone shortening – lengthening in tibia to address bone and soft tissue defects.^[9,10] It concluded that bone shortening – lengthening technique had high union rates with low duration of treatment. This has been observed to be true with our study as we had 5 cases of delayed union/non-union out of 8 cases who underwent bone transport after corticotomy. In two

patients augmentation of docking site with bone graft from iliac crest accelerates consolidation, prevents non-union and reduces the duration on Ilizarov ring fixator.^[11] Pin site inflammation was the most common problem and occurred in 17 (85%) patients. There were no major complications or neurovascular complications. Rancho technique consisting of insertion of half pins instead of wires reduce the risk of neurovascular complications associated with the procedure.^[12] Considering the complexity of the condition with the possible altered anatomy of vasculature, a preoperative evaluation with arteriogram can be helpful in preventing such disastrous vascular complications.

CONCLUSION

Non-union with infection is a complicated issue for the treating orthopedic surgeons. Conventional Ilizarov ring fixation technique is a better option for treatment of infected non-unions and gap non-unions in tibia with high success rates. Bone grafting in Ilizarov ring fixation accelerates fracture healing and reduces duration on fixator and is done in cases with delay in docking site union. Follow-up done serially atleast during the initial phases of treatment that include distraction during bone transport, weight bearing, joint mobilization, pin site care has a rather great impact on the final functional and radiographic outcome in Ilizarov ring fixation. Multidisciplinary team approach including orthopaedic surgeon, plastic surgeons, radiologists and physiotherapists leads to early fracture union and good functional recovery leading to salvage of the limb.

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