



MANAGEMENT OF INFECTIVE NON UNION OF SHAFT OF LONG BONES WITH LIMB RECONSTRUCTION SYSTEM

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ABSTRACT **Background:** Complex nonunions are difficult to manage due to the presence of infection, deformities, shortening, and multiple surgeries in the past. Ilizarov fixation has traditionally been used to manage complex nonunions. The disadvantages of Ilizarov include poor patient compliance, frame inconvenience, and difficult frame construction. We studied ten long bone infective nonunions treated with the limb reconstruction system (LRS). Materials and methods : Between September 2020 and December 2022, we treated 10 cases of infective nonunion of long bone with the LRS. Patients were routinely followed up for 12 to 18 months and assessed both clinically and radiologically. **Results :** Out of 10 cases we were able to achieve union in all cases. And eradication of infection in 90% of cases with no limb length discrepancy in any case. Bone results are excellent in 80% of cases and good in 20% of cases. Functional results are excellent in 80% of cases and good in 10% of cases, fair in 10% of cases. **Conclusion :** LRS is an alternative to the Ilizarov fixation in their management of complex nonunion of long bones. It is less cumbersome to the patient and more surgeon and patient friendly.

KEYWORDS : infective non union , LRS,

INTRODUCTION

The prevalence of open fractures of long bones is rising due to an increase in road traffic accidents (RTA), which is leading to an increase in complex nonunions. These patients are typically operated on several times for stabilisation (and healing) or infection eradication, resulting in scarring of soft tissues and devitalization of any surviving bone. They usually present with an indolent infection that is accompanied by deformity, limb length discrepancy, joint stiffness, disuse osteoporosis, and soft tissue atrophy.⁽¹⁾ Infected non-union has been defined as a state of failure of union and persistent infection at the fracture site for 6-8 months⁽²⁾ and union is not likely to occur without active intervention. As a result, it is regarded as one of the most complex and difficult orthopaedic situations to manage.⁽³⁾ External fixation can address both of these issues at the same time.^(4,5) The Ilizarov ring fixators have traditionally been used to manage complex nonunions. However, it is difficult, heavy, and complicated for both the surgeon and the patient.⁽⁶⁾ The Limb Reconstruction System is uniplanar and compact. Its advantage is that it allows for distraction and compression at the fracture site. It also enables dynamization of the fracture site, which is a key principle in the treatment of nonunions.⁽⁷⁾

Material and methods : this is a prospective study carried out between September 2020 and December 2022. We include 10 cases (4 femur and 6 tibia) which were diagnosed clinically and radiologically. Patients with discharging sinus clinically and non union radiologically along with implants insitu are included. Non union due to pathological fractures are excluded.

Initially patients came to our orthopaedic opd with chronic discharging sinus along with implant insitu. All patients were undergone routine blood investigations and sent for pus culture and sensitivity. Until the pus culture and sensitivity report come patients were kept under empirical intravenous antibiotics. Then we managed with implant removal, radical debridement, and LRS fixation in the operating room under all aseptic conditions and spinal anaesthesia with the assistance of an image intensifier. during the time of debridement , kept polymethyl methacrylate bone cement mixed with one gram of vancomycin antibiotic near to the non union site in soft tissue. Patients were started on appropriate antibiotics after pus culture and sensitivity report. Corticotomy and bone transport done in three cases. Distraction and compression were done at the rate of 1mm/day in case of corticotomy patients. Distraction started from the postoperative day 8. Active and passive mobility of knee and ankle started immediately on postoperative day one. Partial weight bearing was started on postoperative day one in all cases except for corticotomy cases where it was done after 3 weeks. After 6 to 8 weeks , antibiotic bone cement beads were removed once there were no signs of infections clinically.

Follow up was done regularly on monthly basis. Patients were taught about pin tract hygiene and complications like pin tract infections during follow up. Problems with pin tract infection, loosening of pins, bolts, and clamps were addressed at each follow-up appointment. LRS was removed after achieving radiological union and allowed the patient to walk with support of walker for 3 to 4 weeks.

Results: Out of 10 cases we were able to achieve union in all cases. And eradication of infection in 90% of cases with no limb length discrepancy in any case. Bone results are excellent in 80% of cases and good in 20% of cases. Functional results are excellent in 80% of cases and good in 10% of cases, fair in 10% of cases. Results were calculated and graded as excellent, good, fair and poor based on ASAMI Scoring System.⁽⁸⁾

Ilizarov scoring system

	Bone results	Functional results
Excellent	Union, no infection, deformity <7 degree, limb-length discrepancy <2.5 cm	Active, no limp, minimum stiffness (loss of <15 degree knee extension) <15 degree (flexion of ankle), no reflex sympathetic dystrophy, insignificant pain
Good	Union + any two of the following: Absence of infection, <7 degree deformity and limb-length inequality of <2.5 cm	Active + with one or two of the following: Limp, stiffness, RSD, significant pain
Fair	Union + Only one of the following: Absence of infection, deformity <7 degree, limb-length inequality of <2.5 cm	Active with three or all of the following: Limp, stiffness, RSD, significant pain
Poor	Nonunion+fracture+union + infection + deformity >7 degree + limb-length inequality >2.5 cm	Inactive (unemployment or inability to return to daily activities because of injury)
Failures	-	Amputation

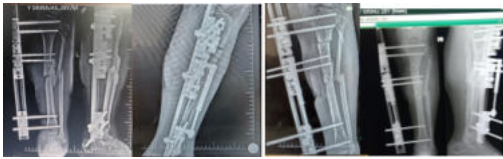
RSD=reflex sympathetic dystrophy

CASE 1: INFECTED NON UNION SHAFT OF FEMUR



FOLLOW UP CLINICAL IMAGES AND XRAYS SHOWING UNION



CASE 2 : INFECTIVE NON UNION OF SHAFT OF TIBIA**FOLLOW UP CLINICAL IMAGES AND XRAYS**

Complications: pin tract infection along with loosening of the pins is mainly observed. Joint stiffness was seen in one patient.

DISCUSSION: Ilizarov distraction osteogenesis has traditionally been used to treat complex non-union of long bone fractures associated with large defects and infection.^(9,10,11) However, the Ilizarov technique has been tempered by its complexity and technical difficulty, the time and resources required to achieve a good result, and the possibility of numerous complications. LRS is a uniplanar dynamized external fixator that is light in weight, easy to build, and has a short learning curve. It is based on the same basic principle as Ilizarov. It provides stable external fixation with the ability to change the stiffness of the fixation, allowing for more precise control of the fracture environment. Because of the robust design, LRS is mechanically very stable. However, unlike the Ilizarov fixator, it is difficult to correct three-dimensional deformities with a uniplanar external fixator LRS. Antibiotic bone cement beads are used in order to control the infection. Local antibiotic therapy is a useful technique that results in high local antibiotic concentrations with low systemic levels⁽¹⁴⁾. Local antibiotic delivery methods include the use of antibiotic cement beads and spacers, bio-absorbable delivery vehicles such as calcium sulphate, and synthetic polymers^(14,15).

In this study most of the patients are in the third decade. RTA is the most common injury which lead to compound fractures of shaft of long bone which lands in infective non union. Tibia is the most vulnerable bone for compound injuries being more subcutaneous. Therefore non union of tibia is more common. Intramedullary nailing is the most common mode of previous surgery. Most of the fractures are united between 48 to 52 weeks. No patient underwent any amputation. Bone grafting was done in few cases to achieve union as compared to study done by Patil et al.⁽¹²⁾ and Hashmi et al.⁽¹³⁾. Before removing the frame, the pin tract infection was treated with regular dressing. Pin reinsertion and intravenous antibiotics were used to treat pin loosening. Refracture occurred in a 3-year-old infected nonunion tibia while trying to improve the pre existing joint stiffness, we were able to control the infection, and after one year of no signs of infection, intramedullary TENS nailing was performed. Joint stiffness is pre existing before the application of LRS. We tried passive and active exercises, as well as physiotherapy, to improve it, but there was no noticeable improvement.

CONCLUSION: The infective nonunion of shaft of long bones are managed satisfactorily with LRS. It is an alternative to Ilizarov fixation in management of infective nonunion of long bones and also less cumbersome to the patient.

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