To study the Ilizarov's External Ring Fixator for Management of Infected Non-union Fracture of Tibia

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Abstract:

Background : Infected non-union fractures of tibia can be treated by many modalities ranging from bone grafting, free tissue transfer, antibiotic cement and Ilizarov's external ring fixator **Aim:** It is to study the effectiveness of Ilizarov's ring fixator system in treating non-union **Objectives :** To evaluate the outcome of Ilizarov's external ring fixator system applied for infected fracture non-union of Tibia both clinically and radiologically. **Study design :** Prospective longitudinal observational study. **Result :**The study comprised of 10 patients with the mean age of 43.2 years, with 2 female and 8 male patients. It was a secondary procedure for 6 patients and all 10 had evidence of infection. Satisfactory union was achieved in 9 cases with sustained non-union in one. One patient was lost in follow-up and there were no mortalities

Key words : Ilizarov, Infected Non-union,External fixator, Fracture Tibia

Introduction : Infected tibial nonunion is common in clinicalpractice[1], and there are usually some coexistingproblems of bone and soft tissue loss, deformities,limb-length inequalities and polybacterialinfection[2]. Up to now, the treatment of infected tibialnon-union has still been a challenge for orthopedicsurgeons[3]. Some different treatment optionshave been reported, including bone grafting, freetissue transfer, antibiotic cement and Ilizarov's methods. The ability of treating non-union fracture with infection is possible with the use of Ilizarov'sexternal ring fixator system[4,5,6]. In the following report, we describe our successful experience in treatment of infected non-union fracture of tibia by using Ilizarov's external ring fixator.

Historical Aspect : The Ilizarov frame takes its name from Dr. Gavril AbramovichIlizarov. He was born in the Soviet Union in 1921 and attended medical school in Crimea aged 18. Having graduated in 1944, his first job was as a family doctor in the Kurgan province of Northern Siberia. As this was a remote area, Ilizarov worked largely alone, and was required to perform a range of surgical procedures. As there were no experienced physicians available to guide him, he taught himself many surgical techniques from books as his only formal surgical training had been a six month course in military field surgery.

Ilizarov first became interested in orthopaedics and bone reconstruction because many of his patients were soldiers returning from the front line battles of World War 2. Many of the patients suffered severe fractures, and had to endure lengthy treatment; casts and skeletal traction being the only methods generally used (Ilizarov&Rozbruch, 2007). Ilizarov believed there must be other ways of treating fractures, and devoted his career to orthopaedics.

In 1950, Ilizarov moved to Kurgan where he worked within the general surgery department at the Kurgan regional hospital. He continued his research into improving the treatment of fractures, and developed the idea of an external fixator ring with cross wires to improve their stability.

The first patient to be treated with the new external fixator was a worker with a non - union fracture from the

factory where the metal parts for the frame were made (Ilizarov&Rozbruch, 2007). Although the Ilizarov device was met with scepticism, similar devices began to emerge.

Ilizarov's methods started to become more widely accepted after he successfully treated Soviet high jumper Valery Brumel in 1968. Brumel had suffered an open fracture (one in which the bone sticks through the skin) of his tibia, which several other surgeons had attempted to treat without success. Three years after his fracture, Brumel saw Ilizarov but by this time had developed osteomyelitis and had a significant limb length discrepancy. Ilizarov treated both of these, and Brumel was able to continue his athletic career.[7]

Figure 1: Dr. Gavril AbramovichIlizarov

Materials and Methods :

The present work was conducted in the department of Orthopaedics, PDVVPF's Medical College and Hospital, Ahmednagar from January 2014 to August 2015 with follow up period of 6 months upto December 2015.

A total of 10 cases were studied from admission to rehabilitation upto 6 months post-operative using the following criteria-

Inclusion criteria:

- Fracture of Tibial diaphysis of more than 6 months duration with no evidence of callus.
- Presence of infection documented by raised ESR/ raised TLC/ positive pus culture report.

Exclusion criteria:

- Skeletally immature patient.
- Intra-articular non-union fractures.
- Non-compliant patients.

Figure 2: Pre-op x-ray of Patient K.B.

Figure 3: Pre-op x-ray of Patient G.N.

Procedure : After full pre-operative work-up and anaesthesia fitness, all the patients meeting inclusion and exclusion criteria admitted to this hospital and consenting to the procedure and the research proposal were operated under spinal epidural anaesthesia by expert team of orthopaedic surgeons with the help of image intensifier machine in two sittings : first : Ilizarov ring setup, second : Ilizarov ring fixation. The procedures were done in major O.T as first case under full aseptic precautions.

Figure 4: Ilizarov ring fixator setup made at first sitting

Immediate Post-op: The patients were kept in Surgical ICU for 3 days. Ankle pumps and static quadriceps were started immediately post-op and partial weight bearing was started on day 3 post-op.

Figure 5: Immediate post-operative clinical photos taken in SICU

Late Post-op: Dressing of the wound and pin tracts were done on day7 and day 14.

Follow-up : Patients were followed-up with serial x-rays taken every monthly upto 6 months. Compression/ Distraction was achieved with serial x-rays after admission in the orthopaedic wards.

Parameters of Evaluation:

1) Clinical:

- Pain
- Abnormal mobility
- Discharging wound

2) Radiological:

Evidence of callus in 3 out of 4 cortices

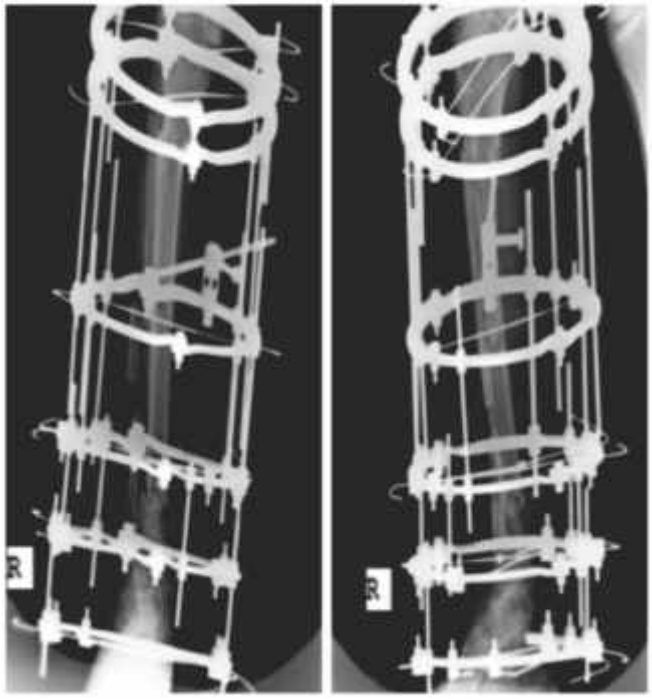

Figure 6: Immediate post-op of Patient K.B.

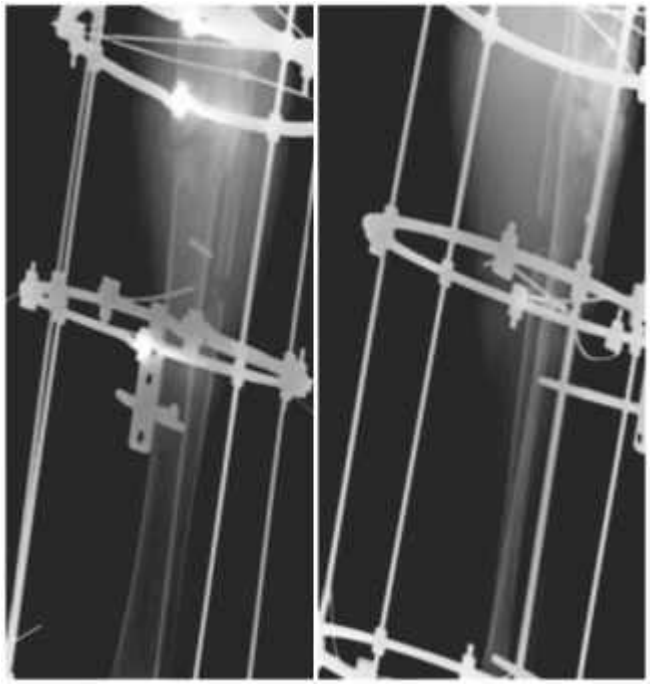

Figure 7: Immediate post-op of Patient G.N.

Figure 8: Six months follow-up of Patient G.N.

Results:

- The study comprised of 10 patients (excluding 1 patient lost to follow-up)
- The mean age of patients was 43.2 years with the youngest being 32 years and eldest being 70 years of age.
- There were 2 females and 8 males in the study.

- 6 of the 10 patients had undergone prior operative intervention, out of which 5 patients had their implants removed at this centre before Ilizarov fixation was done. 1 patient had been treated with closed reduction and one patient was given delta frame fixation as part of initial damage control orthopaedics.
- All 10 patients had evidence of infection at the time of presentation which was promptly treated with culture sensitive antibiotics pre-op and continued till 21days post-operatively.

Organism isolated	No. of patients
S. aureus	6
S. epidermidis	2
P. aeruginosa	1
Coliforms	1

Table 1: Bacteria isolated from wounds

- 7 patients showed signs of union within 4 months post-op. 1 patient had superficial infection of the pin tracts. 2 patients required compression half turns twice a day for 5-7 days.

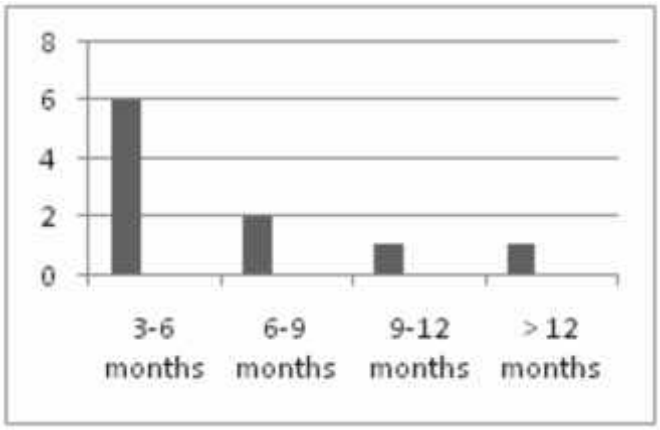

Figure 9: Time spent in frame

- Satisfactory union was achieved in 9 patients while one patient showed no evidence of callus and was taken up for bone grafting and corticotomy after the infection had subsided.

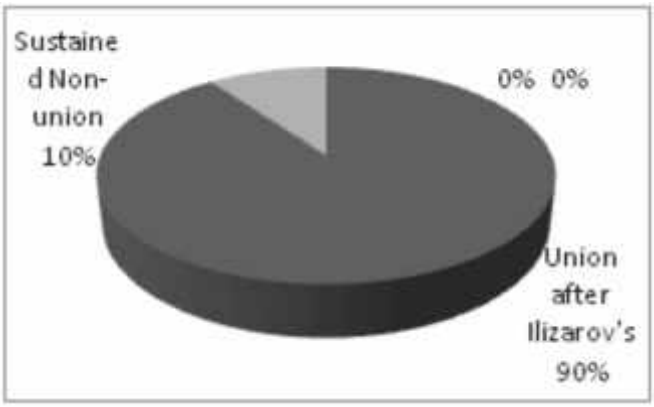

Figure 10: Result of Ilizarov's ring fixation

Discussion : The value of the Ilizarov method must be judged in thelight of the severity of the problems of our patients, few ofwhom would have been suitable for treatment by intramedullarynailing or other forms of internal fixation but could not be undertaken because of infection, an avascular segment or severe mal-unionand shortening.

In our series 30% of non-unions were atrophic and mobile and over 100% were infected; therefore a rate of union of 90% in the first frame seems satisfactory. The one failuresof union of the tibia may have healed if the frame had been retained for longer: that case was taken up for a second frame with bone grafting

Our success in the eradication of chronic infection, withno recurrences after a median follow-up of 9 months isvery satisfactory. We believe that this was because wewere able to apply the basic surgical principle of thetreatment of infection by the excision of all unhealthytissue. This was achieved by local debridement and removalof infected metal work in five of the 10 infections, butmost required excision of a segment of bone which wasthen regrown from regions of good vascularity, avoidingthe use of avascular cancellous graft.[8]

Conclusion : Ilizarov's external ring fixator procedure is a technically demanding and physically fatiguing operation with a meticulous post-operative management. However the results of its use in infected non-union have been impressive. Until some newer modality is developed to treat non-unions in general and infection in particular, Ilizarov's ring fixator remains the mainstay in treatment of infected non-unions of long bones.

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