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Original article

Comparative study of the results of compound tibial shaft fractures treated by Ilizarov ring fixators and limb reconstruction system fixators

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ABSTRACT

Purpose: Ilizarov ring fixator and limb reconstruction system (LRS) fixators have been used in the management of complex tibial fractures with severe soft tissue injuries, compound tibial fractures, and infected tibial nonunion for which conventional internal fixation cannot be contemplated. Fracture union and distraction osteogenesis can be done simultaneously with these external fixators, allowing early weight bearing. Several previous studies have shown almost equal results of rail and ring fixators for the compound tibial shaft fractures. Thus we performed a prospective study to evaluate the union rate, functional outcome and amount of limb lengthening after the treatment of compound tibial shaft fractures with or without infected nonunion by ring or LRS fixators.

Methods: This prospective study was done at Sarojini Naidu Medical College and Hospital, Agra, India and included 32 patients of compound tibial shaft fractures with or without infected nonunion. There were 26 males and 6 females and the average age was 40 years. Patients were randomly divided into two groups ($n = 16$ for each): one underwent Ilizarov fixation and the other received LRS fixation. Cases were followed up for 3–24 months, 6 months on average from September 2012 to October 2014. Functional and radiological outcomes were assessed using the Association for the Study and Application of Methods of Ilizarov (ASAMI) criteria for both rail and ring fixators.

Results: Union was achieved in all cases. Radiological outcome was found excellent in 68.75%, good in 18.75% and fair in 12.50% of cases treated by rail fixators whereas it was excellent in 56.25%, good in 18.75%, fair in 12.50% and poor in 12.50% of cases treated by ring fixators. Functional result was satisfactory in 75.00% of cases treated by rail fixator and 68.75% of cases treated by ring fixators whereas the corresponding rate of unsatisfactory was 25.00% vs. 31.25%.

Conclusion: In our short-term assessment, LRS fixators show a better result than Ilizarov fixators in terms of fracture union and functional outcome with soft tissue care and limb length.

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1. Introduction

High velocity trauma is showing an increasing trend with social development and metropolisation. The incidences of both closed and open tibial fractures are increasing. But due to the distal location and less soft tissue envelop of tibia, open fractures are more common in tibia than in any other long bones.¹ The conventional protocol of management of compound fractures are debridement, temporary stabilization by external fixators, wound

management and definitive management.² The disadvantage of this technique is the need for several operative procedures and longer period of hospitalization. However even this sequential management is strictly followed, the infection rate is high and several operative procedures are needed for bony union and combat with troublesome complications.^{3–5} Thus many surgeons are using external fixators as definitive management for open fractures like compound fractures, severely contaminated fractures, and those with delayed union or in polytrauma patients.^{6–9} External fixators have unique capability of stabilizing the bone and soft tissue at a distance from injury or operative focus, providing an easy access to the wound with minimal vascular compromise to the bone and soft tissue.

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Both limb reconstruction system (LRS) and ring fixators are minimally invasive fixators which permit effective wound management, early weight bearing and limb lengthening, working on the same principle of compression distraction histogenesis. Several previous studies have shown almost equal outcomes of rail and ring fixators for compound tibial shaft fractures. But there are few studies in the literature showing comparative outcomes of rail and ring fixators. Here we conducted such a study to compare the outcomes of rail (LRS) and ring external fixators for compound tibial shaft fractures in terms of achieving anatomical reduction, stable fixation, postoperative ambulation, complications, bony union, soft tissue coverage with special consideration of knee and ankle joint movements.

2. Materials and methods

In Sarojini Naidu Medical College and Hospital, Agra, India, 32 cases of open tibial shaft fractures were selected. The inclusion criteria were: compound diaphyseal fractures of the tibia, compound segmental fractures of the tibia, compound fractures of tibia

with bone loss, and old compound fractures with infected non-union. The exclusion criteria were: closed diaphyseal fractures, pathological fractures, and tibia fractures with intra-articular extension.

Patients were divided into two groups including 16 cases each. Members of one group were treated with rail fixator (Fig. 1a and b) and the other groups were managed with ring fixator (Fig. 2a and b). All of them were followed-up from September 2012 to October 2014. Patients were between 20 and 70 years of age; most of them were in 31–40 year age group. Out of the 32 patients, 26 were males and 6 were females, suggesting higher level of activities and mobility of males.¹⁰

The most common mechanism of injury is road traffic accidents. Thorough examination was done to rule out associated injuries and all patients were administered prophylactic cephalosporines along with aminoglycosides, tetanus toxoid to combat with infection. Once the patient is haemodynamically stable, clinical evaluation and primary wound debridement with copious amount of normal saline were done. Open fractures were classified according to Gustilo Anderson's classification to be more precise to determine



Fig. 1. A representative case in rail fixator group. Preoperative (A), postoperative (B) and after removal of the rail fixator (C).

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