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External fixation as a primary and definitive treatment for compound fractures of tibia

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Abstract

Introduction: Compound tibial fractures with severe soft tissues injuries are in threatened compartment syndrome, and in multiply injured patients. To evaluate the end result of external fixation as a primary and definitive treatment for compound fractures of tibia and its effect on rate of union.

Materials and Methods: Total of 25 patients of compound fractures of tibia external fixation. Average age was 45 years. Regular pin tract dressings were done. Average period of follow-up was 12 months. Mean fracture healing time and mean duration of external fixator in place were evaluated with Johner wrughs criteria and Oleaur Molander score.

Results: Mean fracture healing time is 22 weeks. Mean duration of fixator in place is about 25 weeks. There were 2 infected non unions, 5 with pin tracts infections which recovers after regular dressing. Reoperation was performed in 2 patients, only when there is a no or delay in callus formation

Conclusion: The external fixators can be used as primary and definitive treatment for compound tibia fractures gives good results and fewer complication rates, with adequate stability. When there is a delay in callus formation, re-operation or change of the method to be performed.

Keywords: External fixation, Definitive treatment, Compound tibial fractures, Nonunion, Pin tract infection.

Introduction

In compound fractures of tibia, debridement followed by fracture fixation is that the usually followed two

stage treatment protocol [1, 2] within the management. The soundness of the fracture after debridement will prevent infection and promote wound healing. So, temporary fracture stabilization by external fixation [3, 4] is advocated. Regarding management in open type III fractures, tibial shaft fractures with severe soft tissue injuries or compartment syndrome, and tibial fractures in multiply injured patients, there are controversies in the literature. However, in the literature there is controversy regarding the best way of managing open type III fractures, tibial shaft fractures with severe soft tissue injuries or compartment syndrome, and tibial fractures in multiply injured patients.

In the early part of the 20th century, external fixation was widely used but with advent of new internal fixation devices cause fell into disregard. Furthermore, there has been considerable debate over the optimal frame design and biomechanical characteristics of different fixators. The purpose of this prospective study was to evaluate the results and effectiveness of an external fixator as a primary and definitive treatment for compound fractures of tibia.

Materials and methods

A prospective study of 28 patients with compound injuries of tibia during a period of august 2017 to march 2019, in Gandhi Medical college and Hamidia Hospital, Bhopal MP All fractures were treated by external fixator after taking proper patient consent and approved by ethical committee.

Inclusion criterion is all fresh cases of open fracture of tibia from Gustilo Anderson type II to type IIIB metaphyseo-diaphyseal Fractures. Exclusion criterion are pathological fractures, patients related to ipsilateral femur fractures, patients with neurological and vascular deficit.

The patients were underwent conventional external fixation using 4.5 mm cortical or 6.5 mm cancellous Schanz pins, AO universal clamps and transverse clamps and stainless steel tubes. Under spinal anesthesia, the involved limb was prepared and draped in the usual standard sterile fashion. Pre-operative antibiotic treatment was given. No tourniquet was used to ensure intravenous antibiotics to reach the limb. A thorough debridement and wound washing was done. Fracture alignment was achieved prior to wound closure. Compound wound was generally closed in one layer before the placement of the AO external fixator as the assembly might limit easy access to wound. The most proximal and most distal Schanz pins on either side of the fracture were fixed first to the tibia after drilling holes with 3.2mm (in case of 4.5 mm cortical Schanz pins) or 4.5 mm drill bits (in case of 6.5 mm cancellous Schanz pins). These two were connected by a single tube using AO universal clamps or transverse clamps. Then, the other pins were applied sequentially. To ensure rigid fixation, the pins closest to the fracture site are placed as close to the fracture as possible., and a second connecting tube was fixed to allow for dynamization later. The space between the lower pin and bone was kept as less as possible. Minimum two Schanz pins with bicortical purchase was kept on either side of the fracture. Regular pin tract and compound wound dressings were done.

Early knee movement and ankle joints and muscular exercises were encouraged in patients. Individualized axial dynamization and loading was done. Only in transverse or short oblique fractures early dynamization was allowed. Generally, within 6 weeks partial weight bearing was allowed and within 3 months full weight bearing was advised. By standard radiographic projections, fracture healing was assessed and with

dense callus in at least three cortices called as union. At the end Johner wrughs criteria16 and Oleaur molander scoring17 were done.

Results

We prospectively evaluated 25 cases of fresh compound tibial fractures. 16 of 25 cases were males and rest 9 were females. Average age was found to be 45 years with a range of 24 to 66 years. According to the Gustilo Anderson classification the fractures were classified as 3 cases of grade II, 15 cases of grade IIIa and 7 cases of grade IIIb

The mean duration of surgery was 35.5 minutes range (30 minutes to 60 minutes), The mean fracture healing time was 15 week (range, 12-18 weeks) for proximal tibia, 25 weeks (range, 18-26 weeks) for tibial diaphysis / multi segmental fractures, 19 weeks (range, 14-20 weeks) for distal tibia. Once biplaner radiographic cortical bridging was observed, full weight bearing for 1 month before implant removal was advised. The mean follow-up period was 12 months (range, 7 to 18 months). All fractures healed in a mean time of 22 weeks (range, 16 to 26 weeks).

Total of 25 patients 2 complicated with Infected Non union causing reoperation after eradication of infection Superficial pin tract infection in 5 patient which got healed with regular dressings. According to the Johner and Wruhs criteria [16] Excellent in 70%, Good in 22%, Poor in 8%. and Oleaur and Molander score [17] was Excellent in 74%, Good in 18%, Poor in 8% at the end of follow-up.

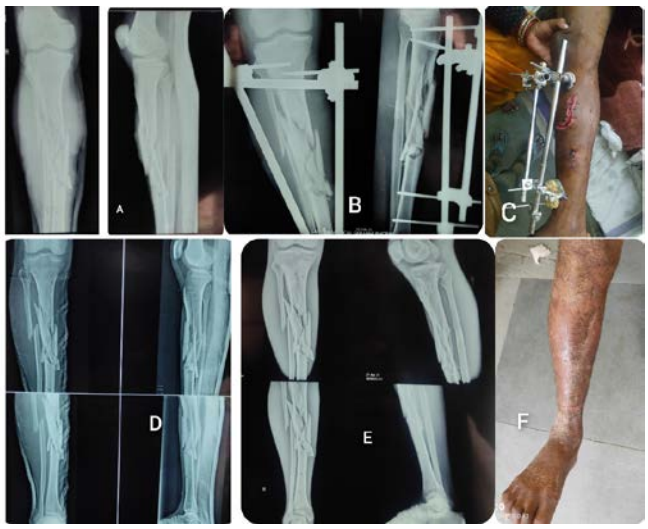

Fig. 1 A 45-year-old man presented with compound grade IIIa, anteroposterior radiograph showing communited fracture both bone right leg (a), which was treated by External Fixation [B] with compound wound [c]; Follow up after 6 months with complete wound healing (D). 7 months later, radiological union.[E,F]

Fig. 2 Followup after 7 months with 10-20 dorsiflexion,[A] and 90 knee flexion[B], full weight bearing [C]

Discussion

In recent years, managing open fractures, even type IIIB, with reamed or unreamed nails has been increased.[7] There is increased the risk of septic complications, non union and pulmonary dysfunction after immediate intra- medullary nailing, a sequence in management using external fixation initially and then for the treatment of type-III open fractures and in

polytrauma patients delayed reamed IM nailing have been advocated. [8, 9].

The proponents and detractors to the technique is initial application of external fixation in open fractures followed by exchange to an IM nail [10–12]. Question remains unanswered for the best time to convert an external fixator to an IM nail [13, 14]. To define an appropriate time interval between the removal of the pins and nailing which will allow for the host's defence mechanisms to eradicate any residual bacteria from the pin sites is the major concern. In a recent systematic review of 96 open tibial fractures, union was achieved in 92% at a mean time of 38.5 weeks which were treated by external fixation followed by reamed IM nailing,. Always after complete healing of the pin track and with a normal ESR the mean time of conversion from external fixation to reamed IM nailing was 26 days. Despite this policy, the overall rate of deep infection was 17%, with 2.5% of cases developing chronic osteomyelitis [4].

In our study, the incidence of infected nonunion was 8 % which are lower than those published currently in the literature. Kimmel noted a 13% non-union and 39% delayed union rate when he reviewed open tibial fractures that were treated with external fixation. Velazco and Fleming[19], in a report on 40 open tibial fractures, noted a 12.5% incidence of delayed union. In the systematic analysis by Giannoudis et al., a total of 536 open tibial fractures were treated by external fixation of which 82% were grade-III open injuries. The overall incidence of delayed union (after six months) was 24% [4].

The incidence of pin track infection in this series was 20% whereas osteomyelitis developed in 2 open fractures (8%). In the current literature, the incidence of pin track infection ranges from 32 to 80% while the incidence of deep infection is 16.2%, with average 4% developing chronic osteomyelitis [4, 18, 19].

The rate of total number of re-operations in our study was 8 % with a change of the method or fixation device necessary in 2 fractures. The unilateral external fixator was definitive treatment in 23 out of 25 fractures (92%) in this series. Velazco and Fleming noted a 2.4% reoperation rate [19] whereas in a recent analysis 68.5% of the fractures required at least one further operation before union was achieved [4]. In spite of that, our results with external fixators are better than the results from previous studies in most respects.

Conclusion

The external fixators can be used as primary and definitive treatment for tibia shaft fractures and are associated with a low deep infection rate. Only when there is a delay in callus formation, re-operation or a change of the method or fixation device should be performed. For most trauma surgeons, the alternative is the advances in the design of fixators and bone pins may have expanded indications and their use as definitive fracture treatment.

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