

Original article

External Fixation of Extra-Articular Open Tibial Fractures

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SUMMARY

External fixation is one of the most commonly used methods for the treatment of open tibial fractures. In everyday practice, for fixation of open tibial fractures we use the external fixator by Mitković. External fixator is unilateral and easy to use. This retrospective study included 59 patients with 59 open tibial fractures, of which 37 (62.71%) men and 22 (37.28 %) women, with mean age 43.92 (16-84) years. The fractures were localized in the proximal part of the tibia (11), tibial shaft (29) and distal part of the tibia (19). According to Gustilo classification, 12 (20.33 %) patients had Type I open tibial fractures, 15 (25.42%) patients had Type II open tibial fractures, and 32 (54.23%) (13 IIIA, 17 IIIB, 2 IIIC) patients had Type III open tibial fractures. The union rate without complications was 77.96 % (46). Nonunion and delayed union rate was 15.25 % (9). Malunion rate was 6.77% (4). Pin tract infection rate was 13.55 % (8). Compartment syndrome was observed in 5.08 % (3) of patients. The patients had fasciotomy done and the external fixator applied. The average time of fracture healing was 26 weeks (6.06 months). External fixation of open tibial fractures is a simple and effective method that enables the safe healing of fractures, early mobilization of patients, early weight-bearing as well as early rehabilitation.

Key words: tibia, extra-articular open fractures, external fixation

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INTRODUCTION

Because of its position in the human body, tibia is the most commonly injured long bone (1). Tibial fractures usually occur due to high energy trauma, but they can also occur because of the force of axial loads with rotation. Older patients with osteoporosis can face tibial fractures which are caused by low energy trauma. Open lower leg fracture can represent a huge problem for a surgeon. In literature, various surgical methods for tibial fractures treatments can be found (2-11). Two of the most commonly used methods are intramedullar fixation and external fixation (4, 12). Because of the subcutaneous localization of tibia, external fixation allows fixation and treatment of both open and closed tibial fractures (12).

AIM

The aim of the paper was to show the efficacy of the external fixation method with unilateral external fixator in the treatment of open tibial fractures.

PATIENTS AND METHODS

The retrospective study shows the results of the treatment of 59 patients with 59 open tibial fractures. All fractures were treated with the external fixation method at the Clinic of Orthopedics and Traumatology, Clinical Center Niš. Fractures were fixed using the unilateral Mitković external fixator. The follow-up period was 16-24 months post-injury.

RESULTS

Retrospectively, we analyzed 59 open tibial fractures, of which 37 (62.71%) in men and 22 (37.28 %) in women, with mean age 43.92 (16-84) years. The fractures were localized in the proximal part of the tibia (11), tibial shaft (29) and distal part of the tibia (19) (Figure 1, 2) (Table 1, 2). According to the Gustilo classification, 12 (20.33 %) patients had Type I open tibial fractures, 15 (25.42%) patients had Type II open tibial fractures and 32 (54.23%) (13 IIIA, 17 IIIB, 2 IIIC) patients had Type III open tibial fractures (Figure 1, 2).

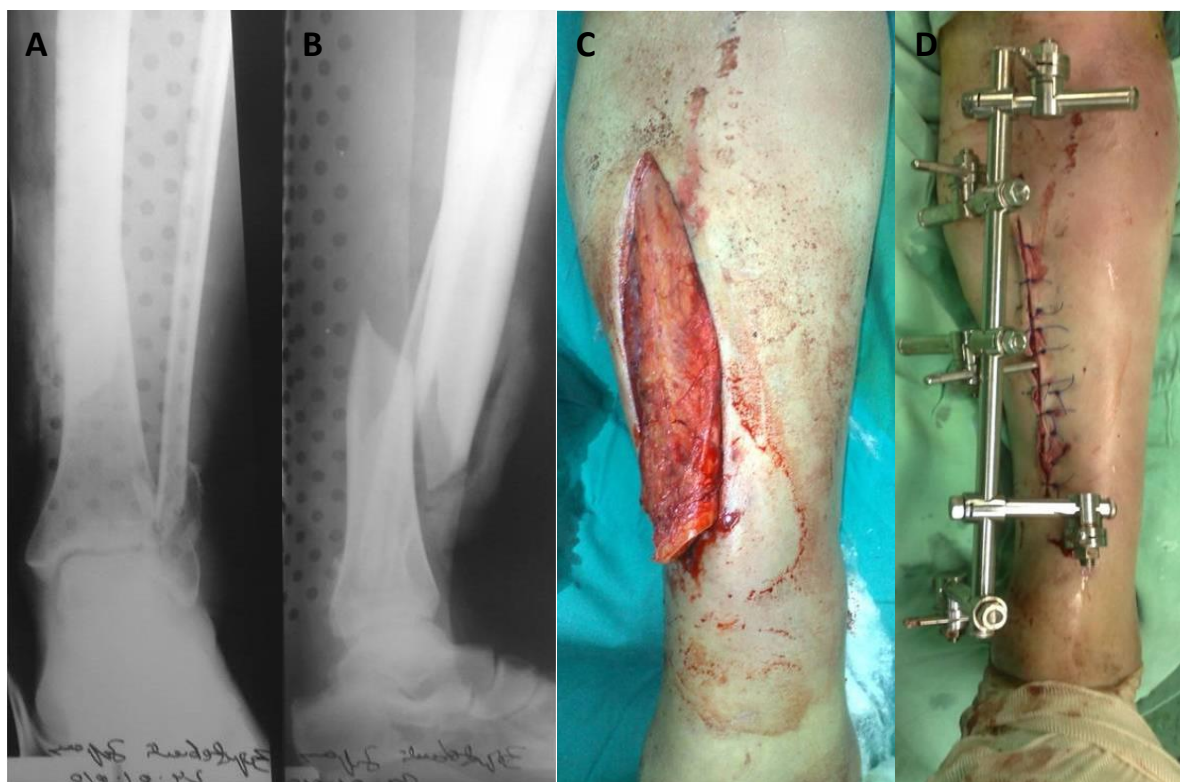


Figure 1. External fixation of an open tibial shaft fracture

A. X ray- AP view; **B.** X ray- Lateral view;

C. Open tibial shaft fracture;

D. External fixation of the open tibial shaft fracture



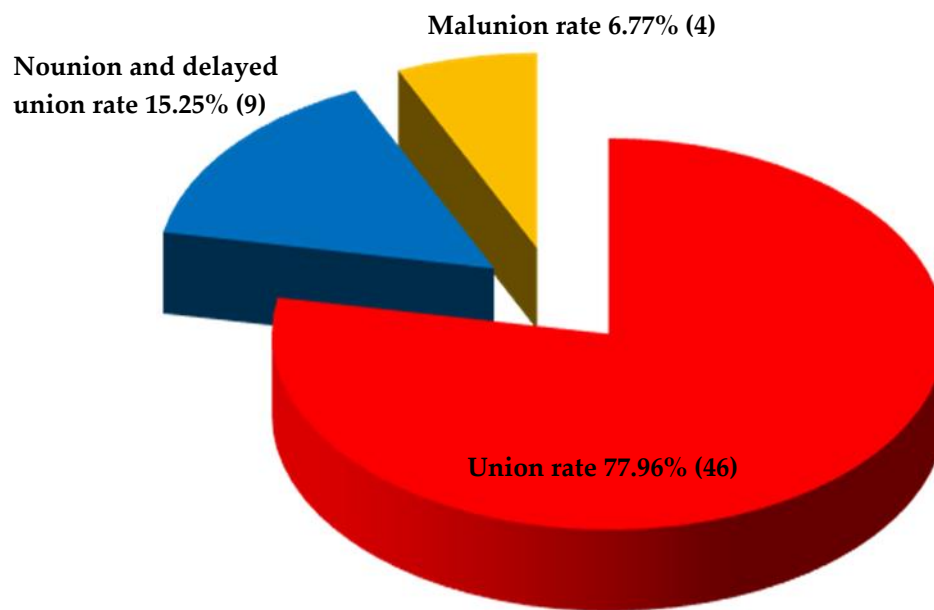
Figure 2. The lower leg after external fixation of the open tibial fracture

Table 1. Fracture localization

Fracture localization	N
Proximal part of the tibia	11
Tibial shaft	29
Distal part of the tibia	19

Table 2. Open tibial fractures according to the Gustilo-Anderson classification

Gustilo-Anderson type	N
Type I	12
Type II	15
Type III A	13
Type III B	17
Type III C	2



Graph 1. Union rate, nonunion, delayed union and malunion after external fixation of the open tibial fractures

The union rate without complications was 77.96 % (46). Nonunion and delayed union rate was 15.25 % (9). Malunion rate was 6.77 % (4) (Graph 1). Pins tract infection rate was 13.55 % (8). Compartment syndrome was observed in 5.08 % (3) of patients. The average time of fractures healing was 26 weeks (6.06 months). The final functional outcomes according to the Lower Extremity Functional Scale (LEFS) were excellent in 37 (62.71 %), good in 15 (25.42 %), moderate in 5 (8.47 %) and poor in 2 (3.38%) patients.

DISCUSSION

Surgical treatment of open tibial fractures, whether they are treated with internal or external fixation, usually leads to healing and good treatment results (13). The most commonly used methods for the treatment of tibia are the methods of internal fixation with plates, intramedullary nails and external fixation with external fixators. External fixator could be used as a temporary or definite method for fracture fixation (3-8). In deciding which method will be used for fracture treatment, the type of fracture, condition of soft tissue and neurovascular status of the injured extremity are of great importance. External fixation is a great method and according to our experience it can be applied to every type of closed and opened tibial fracture at any level, whether the

proximal part of tibia, tibial shaft or distal part of tibia is affected. A lot of intra-articular fractures can also be treated with the method of external fixation. Possibilities of postoperative complications such as infections and postoperative osteitis are minimal after external fixation of tibial fracture. In case of infection and osteitis after internal fixation of tibial fracture, external fixation is the only method which can be used after the removal of osteo-fixational materials. The external fixator by Mitković which is used in our practice allows a lot of postoperative corrections and manipulations; it also enables compression and distraction as well as the correction of angular and rotational deformities. This fixator enables an additional surgical intervention on soft tissues if necessary (10, 12). Relative disadvantages of this method are discomfort of patients because of the fixator, necessity of regular toilets around the pins and the possibility of the pin-tract infection. External fixation of open tibial fractures is a widely accepted method of treatment by many authors around the world. Shaw et al. reported 100 % union in a group of 44 closed tibial fractures and open fractures Gustilo type I and Gustilo type II, treated with the external fixation method (14). Keating et al. had 95 % union rate after the external fixation of 100 tibial fractures (47 closed and 53 open) with Orthofix external fixator. The same authors reported 6 % nonunion in the same series after using external fixation, 14 % malunion

after external fixation of closed tibial fractures, and 32 % malunion after external fixation of open fractures (7). Krettek et al. found 10.9 % nonunion after the external fixation of 202 tibial fractures (70 closed and 132 open) (8). The Mitković external fixator consists of a road, a carrier of clamps, and clamps and pins which are placed in the bone. Pins are placed convergent and for their placement a special guidance is not needed. The apparatus has been tested in the laboratory and it has been applied on several thousand of patients. It is being used for primary treatment as well as possible complications after the treatment of open tibial fractures (12).

CONCLUSION

Open tibial fractures are serious injuries and they can represent a huge problem. External fixation is one of the widely accepted and applied methods in the world. External fixation with external fixator by Mitković is a great method for the treatment of every type of open tibial fracture, at any level. The apparatus-external fixator provides good biomechanic conditions for fracture healing as well as postoperative corrections if necessary and early rehabilitation of patients who have been operated on.

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Spoljašnja fiksacija otvorenih vanzglobnih preloma tibije

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SAŽETAK

Spoljašnja fiksacija je jedna od najčešće primenjivanih metoda za lečenje otvorenih preloma tibije. Za fiksaciju otvorenih preloma tibije u svakodnevnoj praksi mi primenjujemo spoljašnji fiksator po Mitkoviću. Spoljašnji fiksator je unilateralni i jednostavan za primenu. Retrospektivnom studijom je uključeno 59 pacijenata sa 59 otvorenih preloma tibije, od toga 37 (62,71%) muškaraca i 22 (37,28%) žene, prosečne starosti 43,92 (16-84) godine. Prelomi su lokalizovani u proksimalnom delu tibije (11), dijafizi tibije (29) i distalnom delu tibije (19). Prema Gustilovoj klasifikaciji, 12 (20,33%) pacijenata je zadobilo otvoreni prelom Tip I, 15 (25,42%) pacijenata je zadobilo Tip II otvoreni prelom i 32 (54,23%) pacijenata Tip III (13 IIIA, 17 IIIB, 2 IIIC) otvoreni prelom tibije. Zarastanje preloma bez komplikacija bilo je prisutno kod 77,96% (46) pacijenata. Nezarastanje i usporeno zarastanje preloma bilo je prisutno kod 15,25% (9) pacijenata, a loše zarastanje preloma kod 6,77% (4) pacijenata. Infekcija oko klinova aparata bila je prisutna kod 13,55% (8) pacijenata, dok je kompartman sindrom bio zabeležen kod 5,08% (3) pacijenata. Kod ovih pacijenata je u toku spoljašnje fiksacije preloma urađena fasciotomija. Prosečno vreme zarastanja preloma bilo je 26 nedelja (6,06 meseci). Spoljašnja fiksacija otvorenih preloma tibije je jednostavna i efikasna metoda koja omogućava zarastanje preloma, ranu mobilizaciju pacijenata, rani oslonac i ranu rehabilitaciju.

Ključne reči: tibija, ekstra-artikularni otvoreni prelomi, spoljašnja fiksacija