Open distal tibial pilon fractures treated with "one stage" external fixation method

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INTRODUCTION

Open distal tibial pilon fractures are serious injuries and big challenge for medical treatment. In contrast to rotational mechanism that results in malleolar fracture-dislocations of the ankle joint, distal tibial pilon fractures result from high-energy axial-load mechanism. Clinical manifestation of this mechanistic difference is the occurrence of osteochondral fracturing, comminution and displacement of the tibial plafond weight-bearing articular portion and distal tibial metaphysis. These fractures are most common found in young persons, capable for work, but it's also not rare in old people with marked osteoporosis. Open distal tibial pilon fractures are presenting as a challenge in their treatment. Traumatologist is encountering with the problem of both soft tissue and broken bones and with a number of potential early and late complications. Different treatment methods of open distal tibial pilon fractures are described in the actual literature. Authors of this paper present own clinical experience using „one-stage“ external fixation method with or without minimal internal osteosynthesis.

OBJECTIVE

External fixation of distal tibial pilon fractures can be used as a temporary method in „staging“ treatment protocol or as a definitive „one-stage“ method with or without limited internal fixation. In this paper authors are presenting own results of external fixation with or without minimal internal fixation used as a definitive (one-stage) treatment method in open distal tibial pilon fractures.

MATERIAL AND METHODS

Patients hospitalized at Clinic for Orthopaedic Surgery and Traumatology in Clinical Center Niš were analysed in this study and they were all having surgery in 4 to 8 hours after the hospitalization. External fixator according to Mitković had been used. External fixation had been
performed both as an only definitive treatment method and in addition with a limited internal fixation. Ankle movements had been achieved by a bone fragments refixation in some patients during their treatment. In patients treated by „bridging“ external fixation rigid type had been transformed to the a dynamic type of fixation. Additional debridement and reconstructive surgery were performed in some patients to recover soft tissue defects (fasciocutaneous flap, free skin grafts according to the Thiesch method). Gustilo-Anderson and AO classifications of distal tibial pilon fractures had been used (Figure 1)\(^3\). Applied diagnostic procedures were clinical and radiographic examination. In AO Type C fracture CT scan had been performed. Final functional results were assessed by Karlsson and Petersson scoring system \(^4\). Average follow-up time was 19 (12-48) months.

**RESULTS**

In this retrospective study 16 patients with open distal tibial pilon fractures were analysed. They were hospitalised at Clinic for Orthopaedic Surgery and Traumatology in Clinical Center Niš, between 2009 and 2014. There were 11 female and 5 male patients. All injuries had been caused by high-energy load mechanism. All patients were treated surgically from 4 to 8 hours after the hospitalization. Patients average age was 46 (22-74) years. According to Gustilo-Anderson classification 10 patients had open fracture type III A and B and 6 patients had open fracture type II (Figure 2,3). Regarding to AO classification 5 patients had fracture type A, 4 patients had fracture type B and 7 patients had fracture type C (Figure 4,5,6). Delayed union had been noted in 2 patients, one 74 years old patient with comorbidity had had septic pseudoarthrosis and in 3(18,75%) patients had been noted late ankle arthrosis. Final functional result was excellent in 5(31,25%) patients (Karlsson Score was 60-90), good in 6 (37,5%) patients (Karlsson Score was 80-89), moderate in 3(18,75%) patients (Karlsson Score was 60-79) and bad in 2(12,5%) patients (Karlsson Score was <60). Final anatomical and functional results were in correlation with degree of the injury (due to the soft tissue damage degree and to the comminution presence, for AO C(1-3) fractures.

**DISCUSSION**

Open distal tibial pilon fractures are severe and complex injuries requiring high professional skills of the orthopaedic surgeon and often teamwork with a plastic surgeon. According to applied surgical protocol, emergent surgery, including irrigation, debridement and „one-stage“ external fixation, had been performed for all patients with AO A fracture type. In AO type B and C fractures „bridging“ external fixation had been combined with limited internal fixation. Some patients with limited internal fixation of the pilon fracture also were performed fibular fracture plating. Primary wound closure was real-
ised in patients with satisfactory local condition. Soft tissue defects coverage was performed as soon as possible after repeated debridements if these defect had occurred primarily. Thus local fasciocutaneous flaps and free Thiersch skin grafts had been used. In cases with “bridging” external fixation, rigid type had been transformed to a dynamic type of fixation 6-8 weeks after surgery allowing ankle movements. Various clinical series with open reduction and internal plating fixation of distal tibial pilon fractures were described during 1980s and 1990s in the literature. High complications rate, at first soft tissue infections and problems with the soft tissue coverage, indicate that this method is no longer advisable to be used in the treatment of not only open but also closed fractures of the distal tibial pilon \textsuperscript{5,6}. ORIF remains the method of choice in the “staging” protocol, following the temporary external fixation. Proponents of “staging” treatment method suggest temporary external fixation until soft tissue consolidation, swelling reduction and bullae healing. In second stage (10-14 days after) definitive internal fixation is performed after external fixator removal \textsuperscript{7}. In a treatment method similar to the aforementioned “bridging” external fixation and fibular osteosynthesis are performed temporarily. The second stage is performed when the soft-tissue swelling has abated, allowing definitive ORIF. Infection occurrence is reduced for

FIGURE 2.
OPEN TIBIAL PILON FRACTURE AFTER THE INJURY (A); APPEARANCE OF THE LEG AFTER EXTERNAL FIXATION AND PRIMARY SOFT-TISSUE COVERAGE (B); DEBRIDEMENT AFTER PARTIAL SKIN NECROSIS TWO WEEKS AFTER THE SURGERY (C); SKIN GRAFTING- SKIN TRANSPLANTATION ACCORDING TO THE THIERSCH METHOD (D,E); LOWER LEXTREMITY AFTER THE 4 MONTHS (F); APPEARANCE AFTER THE EXTERNAL FIXATOR REMOVING (G).
about 10% in “staging” way of the treatment. There are many studies in recent years literature describing MIPO-minimal invasive plate osteosynthesis. Authors of this study are recommending “one-stage” method of external fixation with or without limited internal fixation. In this way, Mitković type external fixator is used. This type of external fixator is high adaptable allowing additional corrections after surgery and transformation from rigid to
dynamic fixation. The high rate of soft-tissue complications associated with primary ORIF of pilon fractures led to the use of external fixation with limited internal fixation as an alternative definitive treatment method. Literature data describe the use of Ilizarov and some hybrid external fixators types in this way of the treatment. Most common complications in the treatment of these injuries are infection (4-35%), ankle arthrosis (up to 40% in C fracture type), delayed union, nonunion (1-15%), malunion, chronic pain, ankle and foot swelling (30%), contracture. Thus high-energy open distal tibial pilon fractures remain big surgical problem and big medical managing challenge.

CONCLUSION

High-energy open distal tibial pilon fractures remain big surgical problem and big challenge for medical treatment. Recent literature data describes different ways of...
these injuries treatment. External fixation with or without limited internal fixation, as an “one-stage” method, has been approved as the method with excellent and good functional and anatomical results. Though final functional results were in correlation with degree of the injury, described method gives good outcome results and further clinical application will surely approve its clinical significance.

SUMMARY

OTVORENI PRELOMI DISTALNOG PILONA TIBIJE LEÈENI METODOM SPOLJAŠNJE FIKSACIJE U JEDNOM AKTU

Uvod: Otvoreni prelomi pilona tibije su teške povrede, nastaju dejstvom jakih aksijalnih sila sa velikom energijom. Literatura opisuje nekoliko različitih metoda lečenja. Autori rada prikazuju svoje rezultate iacional re sults were in correlation with degree of the in -func tional and an a tom i cal re sults. Though fi nal func -tion: the use of a scoring scale. The Foot 1991;1:15.19

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