Open tibial shaft fracture treatment with plating within 6 hours and between 6-24 hours after injury

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ABSTRACT

Background: Open tibial shaft fractures are usually complicated injuries that require the collaboration of a surgical team consisting of orthopedic, plastic, and vascular surgeons to control the inflicted harms. There are different fixation methods, such as plating. This study aimed at comparing open tibial shaft fracture treatment with plating within 6 hours and between 6-24 hours after injury.

Methods: This randomized clinical trial was conducted on 30 patients with open tibial shaft fracture (Gustilo Type I and Type II), admitted to the Shahid Rahnemoon Hospital in Yazd. The patients were divided into two groups. The first group was treated with plating within 6 hours after injury (Group 1). The second group was treated with plating between 6-24 hours after injury (Group 2). The outcome of patients in both groups in terms of infection, delayed union, non-union, malunion, and reoperation was determined. Finally, the results were statistically analyzed in SPSS 18.

Results: The mean age of patients was 23.19±6 years. There was no significant relationship between the two groups in terms of age, sex, postoperative infection, need for reoperation, delayed union, and malunion (P-value>0.05).

Conclusion: According to our findings, plating within 6 hours and plating between 6-24 hours had not any differences in the rate of complications.

Keywords: Plating, Open Tibia Shaft Fracture, Infection

Cite This Article: Pahlevanhosseini, H., Shahbazi-Bilehsavar, F., Mohammad-Jalil Abrisham, S., Shafiee, M. 2017. Open tibial shaft fracture treatment with plating within 6 hours and between 6-24 hours after injury, Bali Medical Journal 6(2): 445-448. DOI:10.15562/bmj.v6i2.594

INTRODUCTION

Increasing use of machinery and vehicles is associated with accidents and injuries, which raises a critical issue concerning human health. These accidents usually occur at high speeds, and they have terrible consequences, specifically death and disability.1 Fractures of the tibia are the most common long bone fractures, which may occur in proximal metaphysis, shaft, and distal metaphysis. The fracture may be associated with such complications as infection, compartment syndrome, neurovascular damages, malunion, delayed union, nonunion, the stiffness of knee or ankle joints, and muscle, skin, and Sudeck’s atrophy.2 The non-surgical treatments include casting and bracing, and surgical treatments include the application of external fixator, intramedullary nailing, and different types of non-locking, locking, and bridging plates.3 Due to the lack of the stability, tibial intramedullary nailing is not applied in a fracture which is near the joints. The selective treatment of such fractures is plating; however, tibial intramedullary nailing can be used for other cases.4 Open fractures of the lower limbs are usually complicated injuries that need the collaboration of a surgical team consisting of orthopedic, plastic, and vascular surgeons to control the inflicted damages. Open fractures mostly occur in Tibia and Fibula with a prevalence ranging from 21.9% to 25%.5 The shaft accounts for the majority of open tibial fractures, which may be associated with the fracture of fibula bone. There are several fixation methods for these fractures, including plating. In the open tibial shaft fractures which refer after 6 hours, surgeons avoid internal fixation, due to the chance of infection, and instead apply external fixator, casting or splinting with a delayed internal fixation.6 The main objectives of open tibial shaft fractures are to decrease the length of treatment and the need for more surgeries; whereas, the common external fixators, and even Ilizarov fixator need further surgical measures.7 Comparative studies on the fixation with plate and external fixation showed no significant difference in terms of malunion, nonunion, and deep infection; however, the need for further operations was greater in the former group.8 Results from another study on the frequency of plating complications in patients with open tibial fractures are as follows: union (100%), delayed union (38%), malunion (4%), infection (35%), reoperation (69%), and bone grafting (42%).9 The internal fixation of open fractures (Gustilo type I and II) with plate and screw were allowed...
within 6 hours after injury. The results of debridement of open fracture within 6 hours and between 6-24 hours after injury, if early antibiotic therapy is administered within the first hour of injury, had not significant differences. This study aimed at investigating and comparing plating consequences and outcomes in open tibial shaft fractures (Gustilo type I and II) in two aforementioned plating groups under early antibiotic therapy scenario.

**METHODS**

This randomized clinical trial was conducted on patients with open tibial shaft fractures (Gustilo type I and II), visiting at the Shahid Rahnemoon Hospital between 2015 and 2016. The diagnosis and typing of the open fracture were made based on clinical examinations, size, contamination of the wound, radiography, and Gustilo classification. Physical examinations, completion of the questionnaire, and surgery were performed by a physician-scientist. Patients were informed completely of the research project, medications, and their associated complications. The inclusion criteria; patients aged 18-50 years and patients with extra-articular tibial shaft fractures (Gustilo type I and II). The exclusion criteria were patients with open tibial shaft fractures (Gustilo type III), patients with traumatic brain injury, intra-articular fractures, and patients with the previous fracture in the same tibia. Thirty patients, visiting at the Emergency Department of Shahid Rahnemoon Hospital in Yazd with open tibial shaft fracture (Gustilo type I and II), were divided into two groups, using random number table. The first group received intravenous antibiotic therapy on admission with a first-generation cephalosporin (cefazolin 2gr), wound cleansing, open reduction, and plating within 6 hours after the injury. The second group received intravenous antibiotic therapy on admission with a first-generation cephalosporin (cefazolin 2g and then every 8 hours), wound cleansing in the emergency department and then open reduction and plating between 6-24 hours after the injury. The timing pattern was based on the occurrence of the fracture. After the surgery, patients received intravenous antibiotic therapy in the hospital with a first-generation cephalosporin (2 grams per 8 hours) for 48 hours, followed by one-week home administration of oral antibiotics (Cephalexin capsules 500mg, per 6 hours). Then the patients were examined 1 week, 3 weeks, 2 months, 4 months, and 6 months after the surgery. The wound conditions were recorded on all visits. Radiography was performed in the second, fourth and sixth months. Patients who did not come for follow-up were excluded. The obtained results were analyzed with independent t-test, chi-square test, and Fisher’s exact test, using SPSS18.

**RESULTS**

The mean age of patients was 23.19 ± 6 years. 28 patients (93.3%) were male, and two patients (6.7%) were female. According to the frequency table of post-operative complications, no complications were observed in the 6h plating group; whereas one patient (3.3%) required reoperation, one patient (3.3%) developed a post-operative infection, and two patients (6.7%) had delayed union in the 6-24h plating group, and malunion and nonunion were not observed in the latter group (Diagram 1).

The chi-square test showed no significant difference between groups in terms of age, sex, post-operative infection, reoperation, and delayed union. two variables (malunion and nonunion) were not assessable (Table 1).

**DISCUSSION**

The aim of this study was investigating and comparing the consequences and results of the
open tibial shaft fractures (Gustilo type I and II) in 6h and 6-24h plating groups. Our findings showed no complication in the 6h plating group; whereas, delayed union (6.7%), infection (3.3%), reoperation (3.3%), malunion (0%), and nonunion (0%) were observed in the 6-24h plating group. On the other hand, there were no significant correlation between postoperative infection, reoperation, and delay union within the two groups. In addition, the malunion and nonunion were not assessable.

Previous comparative studies on plating with external fixator showed no significant difference between groups in terms of deep infection, malunion, and nonunion. These findings are consistent with ours.8

Rouhi M. et al. study(2007) on plating in patients with open tibial shaft fractures reported the prevalence of following complications: delayed union (38%), malunion (4%), infection (35%), and reoperation (69%). These findings are inconsistent with ours: delayed union (6.7%), malunion (0%), infection (3.3%), and reoperation (3.3%). This inconsistency can be attributed to the patient selection conditions and year of research conduction. Given the limitations existed in the past, there were more postoperative complications.

Another study compared plating and nailing techniques in open distal tibia fractures and showed that the two groups were not different in terms of infection and reoperation; however, the prevalence of malunion and nonunion was higher in the nailing group.9 These findings are consistent with our findings that showed the low prevalence rate of post-plating malunion and nonunion (0%).

Results of Soleimanha M. et al. study (2013) showed one case with post-plating malunion and no union and one case with post-plating infection.10 This study was consistent with our findings that showed one infection case and no malunion or nonunion case after plating.

Vallier HA. et al. study(2008) after delayed open tibial shaft fracture treatment, showed that 8.6% and 3.7% of patients developed infection and nonunion, respectively. Although these findings were not consistent with ours, both studies were consistent given the lack of a significant relationship between the treatment time and developed complications.11

William W. et al. study (2008) showed that early surgical treatment in the open fractures could be effective in the infection reduction rate; nevertheless, treatment after 6 hours post injury cannot reduce the infection rate. In this regard, findings of this study are not consistent with ours.12

CONCLUSION

According to the results of the debridement of open tibial fracture wounds that had not significant differences between less than 6 hours and 6-24 hours after injuries groups. It should be concluded that the treatment between 6-24 hours after injury does not increase the rate of infection. We compared the effect of plating within 6 hours and between 6-24 hours after injury on postoperative complications. Given the lack of significant difference between groups in terms of postoperative variables (reoperation, infection, delayed union). Since malunion and nonunion were not comparable, it could be concluded that the 6h plating and 6-24h plating had not any differences in terms of complications, and thus none of them had any superiority over the other.

RECOMMENDATIONS

The conduction of another study with a larger sample size of open tibial fractures is recommended to make a better comparison between 6h plating and 6-24h plating complications.

REFERENCES

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