

RISK MANAGEMENT

THE EFFECT OF TIME TO THEATRE ON INFECTION RATE FOR OPEN TIBIA FRACTURES

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Background: Open tibia fractures are an orthopaedic emergency. Surgical intervention has traditionally been recommended within 6 h of injury to decrease the risk of infection. There is little support for this time frame in published works, with no prospective randomized controlled trials to date. We sought to determine whether delay to definitive treatment affected the infection rate in open fractures of the tibia at our institution.

Methods: A retrospective review of 161 consecutive skeletally mature patients with open tibia fractures treated at Liverpool Hospital was carried out. Cases were reviewed using the department database and the medical records. Time between injury and surgery was recorded as 0–6, 6–12 or 12–24 h. The infection rate was calculated for each group, and statistical significance was calculated using the χ^2 -test.

Results: No increase in the infection rate was found with increasing time to theatre, as five of the six infections occurred in the 0 to 6-h group, and no infection occurred when treatment was delayed by more than 12 h. The infection rate was found to correlate with the grade of the open injury.

Conclusions: The infection rate after open tibia fractures is strongly associated with the grade of the open fracture rather than the time to initial surgery. It may be justified to delay surgery on open tibia fractures until an optimal operating environment can be provided.

Key words: infection, open fracture, tibia, time factors.

INTRODUCTION

Open tibia fractures are considered an orthopaedic emergency. Although it is commonly recommended that surgical treatment be carried out within 6 h of surgery,¹ recent studies have shown that the rate of complications from these injuries is not related to the timing of surgery.^{2–5} However, published works on this topic consists mainly of case series as no randomized controlled trials have been carried out. The purpose of our study was to examine the correlation between the time to initial surgery and the rate of infection in open tibia fractures. We sought to determine whether a delay to definitive treatment would increase the rate of infection.

METHODS

Liverpool Hospital is a tertiary referral trauma centre for south-west Sydney. We carried out a retrospective review of a consecutive series of open fractures involving the tibia that presented to our institution between 1 January 1998 and 31 December 2002. This series of cases included open ankle fractures that involved the tibia. Skeletally immature patients were excluded. A total of 161 cases treated during this time period were reviewed through

the use of medical records and the department database. Time to surgery was measured as the time between the injury and the commencement of definitive surgical treatment. This was prospectively categorized in the department database into three groups: 0–6, 6–12 and 12–24 h. These times were verified by examining the times recorded for the initial injury on the ambulance booking sheet and the times recorded on the operating theatre count sheet for the commencement of surgery.

Infection was defined as the prolongation or reinitiation of antibiotic therapy because of changes in the wound or the requirement for further surgical debridement for cellulitic or purulent wounds or collections, chronic infections or osteomyelitis. All cases were reviewed by an orthopaedic registrar upon presentation to the emergency department, and the open grade was defined contemporaneously according to the Gustilo–Anderson classification.⁶ All fractures were initially treated with appropriate splinting and prophylactic antibiotics.

RESULTS

The distribution of patients into each group according to time to theatre and the infection rate for each group is given in Table 1. The open grading of the fractures and the time groups are given in Table 2.

Six of 161 (3.7%) patients developed an infection, and all of these were in patients with grade III open fractures. Five of the six patients who developed an infection had their definitive surgery within 6 h of the initial injury, and one of the six had surgery between 6 and 12 h postinjury. No infections were reported in

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Table 1. Infection rate for each injury-to-theatre time

Time from injury to theatre	0–6 h	6–12 h	12–24 h
No. of patients	65	77	19
No. of infections	5	1	0
Infection rate (%)	7.8	1.3	0

Table 2. Delay to theatre for each grade of open injury

Time	Grade I	Grade II	Grade III
0–6 h	7	10	48
6–12 h	18	20	39
12–24 h	3	5	11
Total	28	35	98

patients treated 12–24 h postinjury. The majority of patients with high-grade open fractures were treated within 12 h of their injury (Table 2).

In four of the six cases complicated by infection, a consultant surgeon was present, compared with presence of 55.7% consultant for all cases of open tibia fractures.

As there was no increase in the infection rate with increasing time to theatre, a statistical analysis was not carried out.

DISCUSSION

The majority of patients (88.2%) with open tibia fractures received definitive surgery within 12 h of injury, and almost half of these were treated within the first 6 h. All reported infections occurred in patients who were treated within a time frame of 12 h post-injury; those who were treated after 12 h did not develop infection. Hence, our results do not show an association between delay to surgery and increased infection in open tibia fractures. Presence of a consultant surgeon was not a confounder as the cases with infections were more likely to have a consultant present.

Historically, there has been a 6-h rule for the treatment of open fractures with many orthopaedic surgeons believing that it significantly reduced infection and complication rates.^{1,2,7} More recent studies, however, have not shown any significant difference in infection rates between early and delayed surgical treatment of open long bone fractures,^{8,9} including studies specifically addressing open tibia fractures.^{10–12}

Our results show that the most significant prognostic indicator for developing an infectious complication is the Gustilo grade of open fracture. The infection rate was strongly associated with a higher Gustilo grade as all our infections arose in fractures with grade III wounds, and this is supported in the published works.^{1,5}

Limitations of this study include its retrospective nature and the relatively small number of patients. The study did not allow for possible confounders such as age, sex, diabetes, smoking and other comorbidities. However, it is likely that patients with significant comorbidities would have been treated later, biasing the results against later intervention. Furthermore, previous reviews of complications after tibia fractures have not shown a significant association with age or sex.^{13,14}

The findings of our study are only applicable to delays up to 24 h. Post-hoc review showed that five patients (over the same time period) were treated more than 24 h from the time of injury, and none of these cases developed an infection. These patients were not included in this analysis because we consider the first 24 h to be a reasonable and realistic time frame for intervention in patients with open fractures as it allows delay of the case until adequate resources are available.

The clinical implications of our findings relate to the timing of surgery for patients admitted after normal working hours. The complication rate for these complex injuries may be influenced by factors related to the after-hours operating environment, such as the availability of supervision, assistance, experienced theatre staff, equipment, sterilizing services and imaging services. A recent study from USA found that patients who had surgery after normal operating hours were more likely to have complications than those who had surgery carried out during usual daytime operating hours.¹⁵ Another study from UK suggested that the expertise of the operating team was more important than the timing of the surgical intervention.¹² Therefore, it may be prudent to delay definitive surgery in patients coming after hours with open fractures, so that better treatment can be provided.

More research in this area, such as prospective controlled trials, are required to provide higher level evidence regarding the association between the time to surgery and specific complications for patients with open fractures.

CONCLUSION

Increasing the time to definitive surgery for open tibia fractures may not increase the rate of infection. The strongest predictor for infection is the open grade of the fracture. It may be justified to delay surgical treatment in patients with open fractures until an optimal operating environment can be provided.

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