FREQUENCY OF NON-UNION IN OPEN TIBIAL SHAFT FRACTURES PRESENTING IN TERTIARY CARE CENTER OF PUNJAB TREATED WITH AO FIXATOR

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Abstract: This study aimed to evaluate the frequency of non-union in open tibial shaft fractures presenting in the Tertiary Care Centre of Punjab, treated with an AO fixator. A descriptive study was conducted in the Department of Orthopedics, Aziz Bhatti Shaheed Teaching Hospital, Gujrat & Bakhtawar Amin Hospital Multan from 01-12-2020 to 30-09-2021. A total of 93 cases were selected for the study. Demographic data of patients were noted. All the patients were managed by the same orthopedic department team, including the candidate led by the consultant, to keep results unbiased. Patients ranged between 18-70 years of age, with a mean age of 38.12±1.12 years. There were 65 males (69.9%) and 28 females (30.1%). 33 patients (35.5%) were admitted 24-48 hours after injury. 32 patients (34.4%) had a third upper fracture. Non-union was found in 39 patients (41.9%) and malunion in 2 patients (2.1%). Based on the results, the AO external fixator is a good and viable option for open tibial shaft fractures. This is a versatile, cost-effective, satisfactory, and reliable method of stabilization of open fractures.

Keywords: Open tibial shaft fracture, Tibia fibula, Non-union, AO fixator

Introduction

Tibia fractures are the most commonly caused fractures worldwide. Open tibial fractures occur due to severe injuries, and treatment of these fractures is a crucial process that requires aggressive debridement, adequate fixation, and early soft tissue coverage. A high incidence of these fractures will occur in patients having multiple injuries. High infection and non-union rates are associated with these fractures, a common cause of limb loss. It is important to know the etiology and epidemiology of these fractures helps the surgeons to use resources appropriately, and adequate fixation and good soft tissue coverage ensure the best outcome for these patients (Duyos et al., 2017; Santos et al., 2018; Singh et al., 2018). Because the majority of open tibial fractures are due to high-velocity trauma such as falls from height and roadside accidents, and machine injuries. Management of these fractures is complex due to comminution at the fracture site, loss of soft tissue, and precarious blood supply. The prognosis depends on the comminution, soft tissue injury, and initial management. Bone reconstruction and advanced soft tissue coverage are usually required to get healing (Lua et al., 2017).

AO foundation popularized most external fixators and experts in the last ten years. It replaced the application of casts and splints, which caused unfavorable outcomes and a high risk of complications in open fractures (Iobst and Liu, 2016; Lawal et al., 2016). Piwani et al. conducted a study in Hyderabad on the patients with open tibia fractures treated with AO fixator; the rate of non-union was about 3.33% (Mangukuya et al., 2018). Ullah et al. conducted a similar study in Hayatabad and found that to be 7% (Sanaullah et al., 2016). Khan et al. also conducted a similar study in Lahore and found 40% (Khan et al., 2012). There is a difference in the frequency of non-union in the open fractures of the tibia treated with AO external fixators in the locally and internationally published data (3.33%, 7%, 40%). This may be due to the difference in the technique or difference in the experience of the operating surgeon. To resolve this conflict, there is a need to conduct this study again in the local population so that the conflict in these studies could be resolved. If proven to have low non-union frequency could help in continuing to use this procedure, or if proven to have high non-union frequency, it may have a different mechanism of action or different reaction to the AO fixator system.
frequency can help in abandoning his procedure and opting for other techniques, which could help reduce the morbidity in these patients. This study evaluated the frequency of non-union in open tibial shaft fractures in the Tertiary Care Centre of Punjab, treated with an AO fixator.

**Methodology**

A descriptive study was conducted in the Ortho department of the ABSTH Hospital, Gujrat, and Bakhtawar Amin Hospital Multan. A total of 93 patients with open fractures of the tibial shaft from the Outpatient department of the hospitals were selected for the study. Detailed history and written informed consent were taken from each patient. The ethical committee approved the research design. Under aseptic conditions, spinal anesthesia was given. The thorough lavage of the limb with at least 10 liters of normal saline to clean the wound. After proper preparation and draping, a thorough debridement was done to remove all dead, dying tissue and any foreign material, assessment of damage to soft tissue and bone was done. The necrotic tissue, including skin facia tendons and necrotic muscles, was excised, but more significant bone pieces with adequate soft tissue attachment were preserved. Next, fracture stabilization was done by applying the AO external fixator. Unilateral uniplanar and unilateral biplanar, the two unilateral modalities were applied; however, the former was preferred. The wounds were not covered, and second-look debridement was done within 48 hours. Once the wound was thoroughly cleaned, and granulation started appearing within 5-7 days, delayed primary closure was done. The patients were called for follow-up after every week for 4 weeks. All the data were noted and recorded. To eliminate bias, all the patients were managed by the same team of the ortho department led by the same consultant. SPSS version 21 was used to analyze the collected data. Mean, and standard deviation was used to present numerical variables, i.e., age. Categorical variables, i.e., gender and non-union of open fracture shaft of the tibia, were presented as frequency and percentage.

**Results**

Patients ranged between 18-70 years of age, with a mean age of 38.12±11.12 years. There were 65 males (69.9%) and 28 females (30.1%). 33 patients (35.5%) were admitted 24-48 hours after injury (Table I). 32 patients (34.4%) had a third upper fracture (Table II). Non-union was found in 39 patients (41.9%) and malunion in 2 patients (2.1%) (Table III).

<table>
<thead>
<tr>
<th>Feature</th>
<th>N (%)</th>
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<tbody>
<tr>
<td>Male: Female</td>
<td>65 (69.95%): 28 (30.1%)</td>
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<tr>
<td>Age</td>
<td>38.12±11.12 years</td>
</tr>
<tr>
<td>Time since injury</td>
<td></td>
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<tr>
<td>&lt;24 hours</td>
<td>32 (34.4%)</td>
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<tr>
<td>24-48 hours</td>
<td>33 (35.5%)</td>
</tr>
<tr>
<td>48-72 hours</td>
<td>28 (30.1%)</td>
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<tr>
<td>Diabetes</td>
<td>14 (15.0%)</td>
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<tr>
<td>Hypertension</td>
<td>13 (14%)</td>
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<tr>
<td>Smoking</td>
<td>24 (25.8%)</td>
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</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>N (%)</th>
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<tbody>
<tr>
<td>Upper third</td>
<td>32 (34.4%)</td>
</tr>
<tr>
<td>Middle third</td>
<td>31 (33.3%)</td>
</tr>
<tr>
<td>Lower third</td>
<td>30 (32.2%)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Morbidity and mortality</th>
<th>N (%)</th>
</tr>
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<tbody>
<tr>
<td>Wound infection</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Malunion</td>
<td>2 (2.1%)</td>
</tr>
<tr>
<td>Non-union</td>
<td>39 (41.9%)</td>
</tr>
<tr>
<td>Morality</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

**Discussion**

Fractures of the shaft of the tibia are the most common fractures among long bones fractures in developing and developed countries, with 20 people suffering this fracture among every 100,000 every year (Milenkovic et al., 2020). In significant number of cases, i.e., 15%-19%, the fracture does not heal and results in non-union despite modern advanced surgical techniques of early undreamed intramedullary nailing and result in significant physical handicap and psychological suffering (Ekegren et al., 2018). These fractures of the major cause of morbidity induce high hospital and financial costs on the patient. Compared to patients without non-union management, these patients result in a greater than two-fold increase in health care costs. It is substantial to identify the risk of non-union in patients and early management of this risk. Baseline characteristics such as smoking, skin integrity,
In conclusion, AO external fixator is a good option for open tibia shaft fractures. External fixators application is a versatile, cost-effective, satisfactory, and reliable method of open tibial fractures.

Conflict of interest

The authors declared absence of conflict of interest.

References


degree of cortical continuity, soft tissue injury, proper initial treatment, and immediate intramedullary nailing technique are important prognostic factors that affect healing (Stewart, 2019; Tall, 2018; Wildemann et al., 2021). However, a patient’s early healing response may be a more potent predictor factor for fracture healing. Lack et al. reported that any cortical bridging within four months postoperatively on radiographic assessment predicts the eventual fracture healing with an accuracy of 99%. (Raducha et al., 2019).

In open tibial fractures, AO external fixator provides a good fixation for the bone, helps solve complex soft tissue problems, provides access to wounds, and avoids damage to vital structures. AO external fixator provides safe and effective external fixation techniques, avoids damage to vital structures, and provides wound access (Kojima and Ferreira, 2011). A total of 93 patients were included in the study. The average age of the patients in the current study was 38.12±11.12 years. These findings were consistent with the studies carried out by Khan et al. at Peshawar and another study by McQueen et al (Association, 1996; Swiontkowski et al., 2000). The majority of patients in my study were males, 69.9%. These findings were closer to the study by Khan et al. (30.1%) patients. Khan et al. demonstrated comparable results with the current study; they reported a 14.2% rate of non-union in 14 cases and were absent in 23 cases. On the other hand, in females, 6 patients were non-union and absent in 10 cases. In the female gender, it is found in 1 case and absent in 6 patients. Similarly, male patients aged 31-50 had non-union in 14 cases and were absent in 23 cases. On the other hand, in females, 6 patients were non-union and absent in 11 cases.

Conclusion

In conclusion, AO external fixator is a good option for open tibia shaft fractures. External fixators application is a versatile, cost-effective, satisfactory, and reliable method of open tibial fractures.

Conflict of interest

The authors declared absence of conflict of interest.


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