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Complications of Open Tibial Fracture Management: Risk Factors and Treatment

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Abstract
Introduction: *Open fracture of tibia is a common occurrence in the orthopedic treatment arena. Open fractures of tibia are classified into Type I, II, IIIA, IIIB and IIIC. Open tibial fractures result in high rates of complications.* ***Objective:*** *The aim of this study was to evaluate the Complications of Open Tibial Fracture Management.* ***Methods:*** *This was an observational prospective study. In total 51 patients with tibial fractures were selected as the study population. The total cases were randomly selected for the study, it was conducted in the Department of Orthopedics of Khulna Medical College Hospital, Khulna, Bangladesh. Clinical examination and evaluation were done from July 2018 to June 2019. Statistical analysis of the results was obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-22).* ***Results:*** *Over a period of one years, 51 patients had sustained open tibial fractures and undergone operative treatment at a single institution. All surgical data was gathered retrospectively through online medical records. Nine patients (17.9%) had sustained post-operative bony complications, while infective complications were reported in 11 patients (21.4%). Patients with Gustilo type III fractures were found to be more than three times as likely to sustain post-operative infective (p=0.007) or bony (p=0.015) complications, compared to Gustilo type I or II fractures.* ***Conclusion:*** *The fracture location and time taken to fixation did not significantly affect the complication rate, but results were trending towards significance. The commonest cause of infective complications was hospital-acquired organisms.*

Key Words: *open tibial fractures; infection; complications; antimicrobial.*

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I. Introduction

The majority of open tibial fractures result from high velocity trauma such as road traffic accidents and falls from height. The management of these fractures can be complex due to the relative lack of soft tissue coverage and blood supply of the tibial shaft. [1] The management of these fractures requires a multi-disciplinary approach in order to achieve quick healing and early ambulation for the patient. Various classification systems have been proposed in literature, in an effort to grade the extent of the initial injury, and to offer useful prognostic clues to aid in deciding on the optimal management [2-7]. Prognosis depends on the amount of initial bone displacement, comminution, and soft tissue injury. Advanced bone reconstruction and soft tissue coverage is usually required to achieve bone and soft tissue healing. [2] Thus, the rate of complications associated with open tibial fractures is high; infection, non-union and limb loss are the major causes of morbidity. Open fractures also result in high rates of infective complications, due to communication with the external environment. As such, antibiotic prophylaxis is usually administered before, during and after intraoperative surgical fixation. Although nosocomial organisms are usually implicated in deep surgical site infection [8], no study has yet evaluated the organisms grown in all grades of infected open tibial fractures. One of the aims of this retrospective study is to review the risk factors causing both infective and bony complications

in open tibial fractures. An understanding of these risk factors could assist in the formulation of protocols to reduce the rate of complications.

II. Objective

The aim of this study was to evaluate the Complications of Open Tibial Fracture Management.

III. Methods

This was an observational prospective study. In total 51 patients with tibial fractures were selected as the study population. The total cases were randomly selected for the study, it was conducted in the Department of Orthopedics of Khulna Medical College Hospital, Khulna, Bangladesh. Clinical examination and evaluation were done from July 2018 to June 2019. Statistical analysis of the results was obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-22)

IV. Results

Fifty -one patients were treated at our institution over a One-year period from 2018 to 2019, but 12 were lost to follow-up before radiographic bone union was achieved. As a result, 51 patients were included in this study. The mean age of the 51 patients was 38.4 years (18-60, standard deviation 14.5). There were 31 males (60.78%) and 20 females (39.22%). Figure I illustrate the risk factors affecting post-operative complications in open tibial fractures. Five patients (9.80%) had diabetes mellitus (DM). Seven patients (13.73%) had sustained a fracture located at the proximal third of the tibia, (47.05%) at the middle third, and (39.21%) at the distal third. In terms of Gustilo classification, (17.65%) sustained a Gustilo type I fracture, (33.33%) a Gustilo II fracture, and (19.6%) a Gustilo IIIa, IIIb or IIIc fracture in terms of the numbers of post-operative complications, (17.64%) obtained a bony complication, while (21.56%) sustained an infective complication (Table I). Tissue or bone cultures in another 16.2% grew organisms from the Enterobacter genus, while 8.1% grew Serratia marcescens, (Figure II). The odds of a patient with a Gustilo type III (a, b or c) fracture developing an infective complication were 3.72 times that of a similar patient with a Gustilo type I or II fracture, after adjusting for the fracture location, time to fixation, age and diabetes (p=0.007).

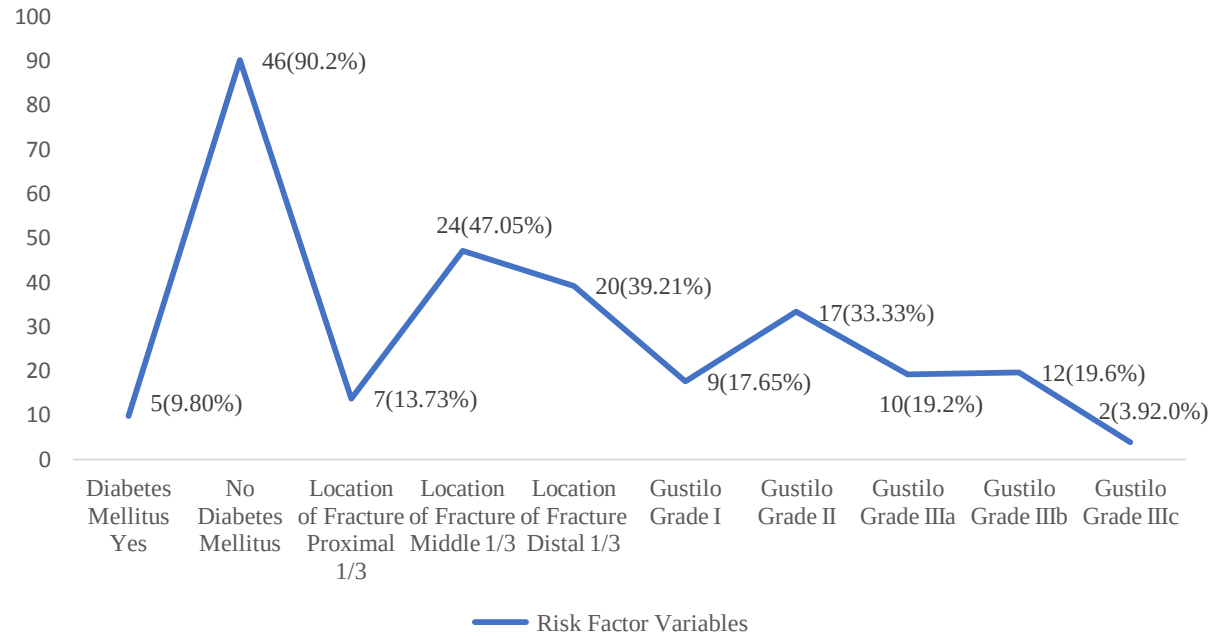

Figure I: Risk factors for post-operative complications

Table I: Post-operative complications of open tibial fracture fixation

Complication	n=51	%
Bony	9	17.64
Infective	11	21.56

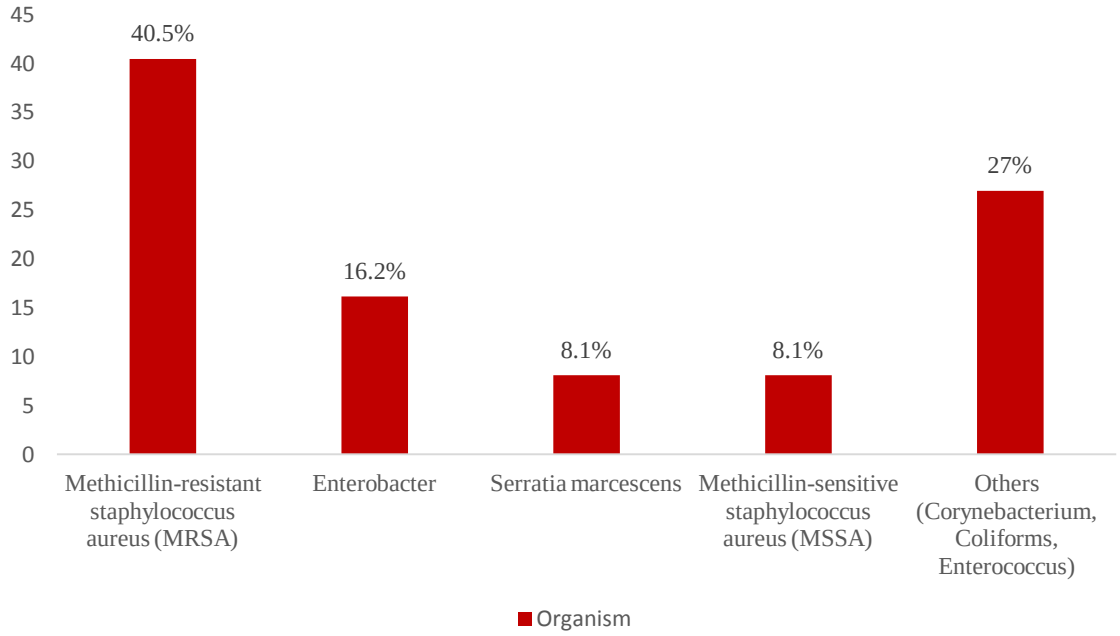

Figure II: Organisms grown in infective complications

V. DISCUSSION

This study has similarly found a strong correlation between the Gustilo classification of injury of open tibial fractures and the development of complications, which corroborates with current literature. The Gustilo-Anderson classification has been commonly used in guiding treatment and predicting outcomes of open fractures. Despite some questions about its limited inter-observer agreement, it is still the most useful tool to evaluate open fractures. [9] The time to fixation after an open tibial fracture has been the subject of continued debate in literature. Choudry et al noted that in patients with Gustilo IIIb fractures, early fixation (< 1 week) was associated with a non-union rate of 42%. This was in contrast to a rate of 74% in patients who had surgery later than 1 week from presentation. [10] Gopal and Tropet independently found that the rate of complications was lower in patients who had soft tissue reconstruction done within 72 hours. [11-12]

With regards to the organisms implicated in infective complications, this study found that most of the organisms grown were nosocomial organisms. As such, a single prophylactic antibiotic regimen directed against environmental wound contaminants does not provide cover for the organisms responsible for the majority of post-operative infective complications. Conversely, they may have instead depopulated the fracture site, promoting nosocomial contamination prior to closure. Better wound care and sterile conditions, which prevent the transmission of these organisms at the hospital level, appear to be essential in reducing the rates of infective complications. Various practical measures can be put in place, including screening patients prior to admission, hospital isolation programmes, proper hand hygiene and restricting certain antibiotic usage, particularly fluoroquinolones. [13-16] The Surgical Infection Society's guidelines recommend the use of a short course of first-generation cephalosporins. [17] However, our study illustrates the additional need for prophylaxis to be directed at nosocomial organisms.

Limitation of the Study

This was a cross-sectional study with a small sized sample. So, the findings of this study may not reflect the exact scenario of the whole country.

VI. CONCLUSION

The higher the Gustilo grade of an open tibial fracture, the higher the risk of post-operative complications. The location of the fracture as well as time taken from surgery to fixation did not significantly affect the rates of post-operative complications, but results were trending towards significance. A high rate of post-operative infective complications is due to nosocomial organisms. As such, antimicrobial prophylaxis against both nosocomial organisms and environmental contaminants should be used in order to minimize the rate of infective complications.

VII. Recommendation

This study can serve as a pilot to a much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence. Further studies with a larger sample size are warranted to determine the significance of their effect on complication rates.

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