Original Article

Comparison of Open versus Closed Reduction and Intramedullary Nailing in cases of Closed Tibial Shaft Fractures

Abdul Rashid Napar[1]

[1] Assistant Professor, Department of Orthopaedics, Khairpur Medical College, Khairpur.

Author's Contribution
[1] Conception of study
[1] Experimentation/Study conduction
[1] Analysis/Interpretation/Discussion
[1] Manuscript Writing
[1] Critical Review
[1] Facilitation and Material analysis

Corresponding Author
Dr. Abdul Rashid Napar,
Assistant Professor,
Department of Orthopaedics,
Khairpur Medical College,
Khairpur
Email: dr.aries@yahoo.com

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Abstract

Objective: To compare the frequency of various postoperative complications in open versus closed reduction and intramedullary nailing in cases of closed tibial shaft fractures.

Settings: This Comparative prospective study was conducted at Orthopedic Surgery Department, Khairpur Medical College, Khairpur Mirs from 1st February 2019 till 30th June 2020.

Materials and Methods: Hundred and seventy patients selected for this study were divided into Group C (Closed percutaneous) and group O (Open). A closed percutaneous procedure was performed through a small stab incision. Reduction and stabilization of fracture were accomplished with large forceps and manual traction. Open reduction was achieved through an adequate incision for exposure and then directly reducing the fracture. The reduction was maintained with the help of clamps.

Results: Surgical site infection was seen in 5 (5.88%) patients in group C and 9 (10.58%) in group O (p-value=0.404). Deep infection was seen in 3 (3.53%) patients in group C and 7 (8.34%) in group O (p-value=0.329). Mal-union was seen in 4 (4.71%) and 2 (2.35%) patients in group C and O respectively (p-value=0.682). Delayed union was seen in 4 (4.71%) and 3 (3.53%) patients in group C and O respectively (p-value=1.0). Non-union was seen in 2 (2.35%) and 1 (1.18%) patients in group C and O respectively (p-value=1.0).

Conclusion: It is concluded in our study that there is no significant difference in the rate of postoperative complications in open versus closed reduction and intramedullary nailing in cases of closed tibial shaft fractures.

Keywords: Closed percutaneous nailing, Open intramedullary nailing, Post-operative complications, Tibial shaft fracture.

Introduction

Musculoskeletal injuries pose a significant share of the burden on the health care system all over the world. The overall incidence of musculoskeletal injuries has been recorded as high as 406 per 100000 population with lower limb fractures being the most common injuries, constituting over 50% of these injuries.[1] With an increasing incidence of road traffic accidents, many patients present with long bone fractures of the lower limb. The most commonly fractured long lower limb is the tibia.[2]

Patients with tibial and other long bone fractures suffer functional limitations, decreased quality of life, pain, and misery. They usually require extended hospital stays with several post-hospitalization follow-ups which in turn place a financial burden on individuals as well as on the health care system. Perioperative complications may further intensify these problems.

Two commonly followed operative techniques include open and closed and intramedullary nailing.[3,4,5] There are various pros and cons of both techniques. Common postoperative complications include but are not limited to surgical site infection, deep infections, mal-union, delayed or non-union, iatrogenic nerve injuries, etc.[6,7,8]

Hence, to improve the quality of life and reduce the cost of treatment, there is a dire need to chalk out a management plan that has minimum complications, requires reduced hospitalization, and has fewer follow-ups. We planned to carry out this study to compare the incidence of various complications of the two commonly used techniques i-e closed and open intramedullary nailing in cases of closed tibial shaft fractures.

Materials and Methods

This prospective comparative study was conducted at Orthopedic Surgery Department, Khairpur Medical College, Khairpur Mirs from 1st February 2019 till 30th June 2020. Prior permission was taken from the Ethical Review Board of the institute before the commencement of this study. The sample size was estimated to be 167 patients and was rounded off to be 170. The sample size was calculated using an online Sample size calculator[9] with a confidence level of 90% and a level of significance less than 5%, P1 as 1.6%, P2 as 7.1%.[10] Non-probability convenience sampling technique was used to select the patients for this study.

Patients were divided into two equal groups of C (Closed Percutaneous Group) and O (Open group) with 85 patients in each group. The lottery method was used to allocate the group to selected patients. Patients' age, weight, comorbidities were noted on a specially designed proforma.

Patients of either gender who presented with closed fracture of shaft of the tibia, with age range between 18 to 50 years were selected. Patients with multiple fractures or extensive trauma were excluded from the study. Patients presenting with compartment syndrome and fasciotomy incisions were also excluded from the study. Patients refusing to participate in the study were also excluded from the study. Patients with any chronic debilitating disease, morbid obesity, multiple comorbidities, immunosuppression, on steroid therapy were also excluded from the study. Patients with surgical time more than 120 minutes and those who were lost to follow-up were also excluded from the study.

A consent form was signed by all the patients before including them in the subject study. Demographic data including age, gender was body mass index (BMI) noted on a specially designed proforma. All patients were prepared for surgery. Written informed consent for anesthesia and surgery was taken. All cases were performed under spinal anesthesia. A closed percutaneous procedure was performed through a small stab incision of 1 centimeter in all patients. Reduction and stabilization of fracture were accomplished with large forceps and manual traction. Open reduction was achieved through an adequate incision for exposure and then directly reducing the fracture. The reduction was maintained with the help of clamps. Duration of surgery was noted. Post-operative follow up were carried out for six months to look for surgical site infection, deep infection, malunion, delayed union and nonunion, iatrogenic nerve injury.

Data were analyzed with Statistical Package for Social Sciences analysis program (IBM-SPSS version 24). Mean ± SD was presented for quantitative variables like age, BMI, and duration of surgery. Frequency and percentage of qualitative variables like gender and post-operative were computed. A Chi-square test was applied to compare both groups in terms of postoperative complications. A P-value of 0.05 or less was taken as significant.

Results

The age of the patients selected for this study ranged from 20 to 48 years, with a mean and standard

deviation of 31.24 ± 6.58 years. The age range in group C was from 20 to 45 years with a mean and standard deviation of 30.46 ± 6.21 years. The age range in group O was from 21 to 48 years with a mean and standard deviation of 32.02± 6.89 years. The difference between the two groups with respect to age was insignificant with a p-value of 0.122.

The gender of the patients selected for this study was predominantly male; out of 170, 143 (84.12%) were male and only 27 (15.88%) were female. In group C, 69 (81.18%) patients were male and 16 (18.82%) were female with a male to female ratio of 5.96:1. In group O, 74 (87.06%) patients were male and 11 (12.94%) patients were female with a male to female ratio of 6.73:1. The difference between the two groups with respect to gender was insignificant with a p-value of 0.402.

BMI of the selected patients ranged from 20 to 35 kg/m^2 with a mean and standard deviation of 27.11 ± 2.75 kg/m^2. In group C, BMI ranged from 20 to 35 kg/m^2 with mean and standard deviation of 27.41 ± 2.81 kg/m^2; whereas in group O, BMI ranged from 20 to 34 kg/m^2 with mean and standard deviation of 26.81 ± 2.67 kg/m^2. The difference between the two groups with respect to BMI was insignificant with a p-value of 0.156.

We found a significant difference in the duration of surgery between both groups. Mean operative time in group C was 64.71 ± 12.15 minutes, whereas in group O it was 52.34 ± 12.49 minutes. Though the real-time difference was of only 12 minutes it was statically significant with a p-value of 0.001.

Overall postoperative complications were seen in 28 (16.47%) patients, out of which 13 (7.64%) belonged to group C and 15 (8.82%) belonged to group O. There was no significant difference between the two groups with regards to postoperative complications. A detailed comparison is shown in Table 1 below.

Table 1: Postoperative complications

Complication	*Group C n (%)*	*Group O n (%)*	*p-value*
Surgical site infection	5 (5.88%)	9 (10.58%)	0.404
Deep infection	3 (3.53%)	7 (8.34%)	0.329
Mal-union	4 (4.71%)	2 (2.35%)	0.682
Delayed union	4 (4.71%)	3 (3.53%)	1.00
Non-union	2 (2.35%)	1 (1.18%)	1.00
Nerve injury	00	00	---

Discussion

Closed fracture of the tibia is not uncommon. The incidence has been recorded as high as 13 per 100000 population with male predominance.[11] It usually results from high energy impacts usually sustained during road traffic accidents. It is accompanied by soft tissue injury as well. It is associated with many complications including infection, bleeding, compartment syndrome, neurovascular compromise, thromboembolism, and fat embolism syndrome.[12,13.14]

The management of closed tibial shaft fractures remains a topic of debate in many researchers with no consensus on a single technique.[15] We studied the two commonly followed surgical techniques i-e closed percutaneous intramedullary nailing an open technique for the management of closed tibial shaft fractures.[16,17]

In our study, we found out that both operative techniques do not increase the risk of post-operative complications. Two similar studies were conducted by Auston DA et al[10] and Grundnes O.[18] They concluded in their studies that carefully performed open or closed percutaneous reduction and nailing do not increase the post-operative infection, wound complications, and non-union rate.

A study carried out by Werner BC and colleagues concluded that patients with multiple comorbidities and obesity who undergo tibial fixation surgery have a significantly increased rate of postoperative complications including non-union, infection, and implant removal. In our study, we excluded the patients with age above 50 years and BMI over 40 kg/m^2 and those with multiple comorbidities, hence this difference was not seen in our study. This could be the limitation of our study. It is further recommended that more of such studies be carried out which include old age patients with multiple comorbidities to find out the difference of outcomes in those patients.

Conclusion

It is concluded in our study that there is no significant difference in the rate of post-operative complications in open versus closed reduction and per intramedullary nailing in cases of closed tibial shaft fractures.

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