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Original Article

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Clinical outcome of femoral diaphyseal fractures in adults treated with open verses closed interlocking nail

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ABSTRACT

BACKGROUND & OBJECTIVE: There are different methods for treatment of the long bone fractures, including femoral diaphyseal fractures, ranging from closed intramedullary nail, open intramedullary nail to flexible nail, plating, and external fixator in open type 3 B and 3C fractures. The aim of this study was to compare the functional outcome of open versus closed techniques in treating femoral diaphyseal fractures in skeletally mature adults.

METHODOLOGY: A simple observational study was conducted at the Department of Orthopedics, Allied Hospital Faisalabad, from January 2018 to January 2020 with a total of 60 skeletally mature patients with mean age 38.4+1.2 who fulfilled the inclusion criteria were operated, and five patients lost in follow-up. Group A consisted of 27 patients (18 males and 9 females) who were operated with closed interlocking technique. Group B consisted of 28 patients (12 males and 16 females) who were operated with open technique. Both groups were followed prospectively for two years to evaluate the outcome. T-test was used for statistical analysis.

RESULTS: The rate of union in group A was better than in group B. Patients in group A had a reunion 1.99±0.86 weeks earlier than group B a significant difference between the two groups with $p<0.001$. Nonunion occurred in 02(7.40%) patients of group A and 03(10.71%) patients of group B. Only 01 (3.7%) patient from group A and 02 (7.40%) patient of group B suffered from deep infections.

CONCLUSION: Closed interlocking for femoral diaphyseal fractures provides earlier reunion of the bone and should be considered the treatment of choice. In case of lack of technical availabilities, open interlocking should be considered as a suitable option.

KEYWORDS: Femoral fractures, Intramedullary nailing, Treatment outcomes,

INTRODUCTION

Fractures of the shaft of the femur are the most common long-bone injuries seen in orthopedic units [1]. With increasing modes of injuries and road traffic accidents, the diaphyseal fracture shaft of the femur is a common injury (mostly a result of high energy trauma) treated at our emergency departments. Because of advancements in fracture care and orthopedic surgery, treatment options for femur shaft fractures are always improving. In the past, the fracture was treated with initial traction. Then surgery was chosen in the hopes of achieving better results by allowing for early mobility. Various implants, such as plates, flexible nails, and interlocking nails, were used as both locking and dynamic ways during surgery. Kuntsher nail, solid or cannulated, with proximal and distal interlocking were some of the options for surgical fixations of these fractures [2].

Open or closed techniques were utilized to manage the fracture depending on the surgeon's discretion, available equipment, and the type of fracture [3]. In most circumstances, the closed approach of interlocking nailing is a superior

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treatment choice than the open method owing to its high union rates with limited complications [4]. Complications such as compartment syndrome and peroneal nerve damage in the contralateral limbs may occur as a result of traction during closed intramedullary nailing [5].

Closed reduction was not achievable in some situations, and even expert surgeons employed the open approach for closed interlocking nailing. For closed method intraoperative C-Arm (X-ray) was necessary and some hospitals were not equipped with C-arm [6]. As a result, research was carried out to compare the effects of closed with open interlocking nail techniques. Furthermore, it was designed to assess the outcomes in government centers where the facility of c-arm was not available and in complex injuries' where comminution involves large pieces that require intervention to be reduced anatomically, the opening of the fracture was considered necessary to achieve anatomical reduction. So, we assessed the outcomes in both cases.

METHODOLOGY

This is an observational study with a total of 60 skeletally mature willing patients were enrolled in the study who reported in the Department of Orthopedics, Allied Hospital Faisalabad from January 2018 to January 2020. After obtaining approval from the Institutional ethical review committee (F NO 48.ERC/2018-19/PHRC/FMU). The study excluded all patients with open fractures, pathologic fractures (Gustilo types 2 and 3), patients less than 16 years of age, and those who had previously undergone femur surgery. The fracture of the patients was confirmed after clinical and radiological examination. After confirmation of the fitness for surgery, patients were stratified into two groups. Group A consisted of patients who were treated with closed interlocking surgery. Group B consisted of patients who underwent open Interlocking surgery.

All the related parameters like age, sex, open or closed injury, smoking history, infection, malunion, and non-union were recorded for all the patients. All patients underwent opened interlocking intramedullary nailing method was applied. In group A, antegrade nail insertion into the proximal part of the medullary canal of femoral shaft via a larger trochanteric approach while the patient was supine on fracture table. The nail was proximally locked with a jig, and the distal locking was done with a C-Arm. In group B, open surgery was performed with retrograde proximal and distal opening, and interlocking of proper size implant was done with a guide wire and proximal and distal screws without using C-arm. Quadriceps strengthening isometric exercises were initiated on the first post-operative day, and the patients were mobilized on crutches on the second post-operative day. On the third post-operative day, patients were discharged with oral antibiotics and analgesics. The first follow-up was on the tenth postoperative day, followed by monthly assessments of union and infection for the next six months. Patients were evaluated clinically and radiographically at follow-up visits.

Patients were followed for six months with mean follow-up of both groups18.43±0.86 weeks. At each follow-up, data was collected after the physical examination. Effect modifiers like age and sex were kept constants, and an independent t-test was used to compare both variables. p-value< 0.05 was taken as statistically significant.

Three patients in Group A were lost to follow-up, therefore, the findings of 27 patients were reviewed. Because two patients dropped out of the trial during the follow-up period in Group B, the outcomes of 28 patients were reviewed in this group.

RESULTS

Out of 60, 55 patients were analyzed. Our results showed that closed interlocking (group A) had superior clinical outcomes in terms of early reunion. Patients in group A had a reunion 1.99 ± 0.86 weeks earlier than group B (p<0.001) (Table II and III). Patients in group A had non-union in 2(7.4%), 3(10.7%) of the patients in group B had a nonunion, and two patients from each group had delayed union. One patient in the closed interlocking group had a deep infection, and two patients from the open interlocking group had deep infections. Deep infections were treated with the removal of interlocking nails, wound debridement, fracture external fixation, and antibiotics based on culture and sensitivity reports.

Table-I: Outcome of patients of groups A & B.

Categories	Group A n=27	Group B n=28
Nonunion	2(7.40%)	3(10.71%)
Delayed union	2(7.40%)	2(7.14%)
Deep infection	1(3.70%)	2(7.14%)

Table-II: Mean number of weeks for Union of Femoral Diaphyseal fracture in both groups.

Group	n	Mean	Mean±SD	Std. Error
Group-A	25	17.43	0.782	0.157
Group-B	25	19.42	0.934	0.187

Table III: t-test for difference in Mean number of Weeks for reunion of fracture in Group A and B.

T-value	d.f	p-value	Mean Difference	Std. Deviation Difference	95% Confidence Interval of the Difference	
					Lower	Upper
8.156	48	≤0.001	1.99	0.861	1.52	2.48

DISCUSSION

Following the development of intraoperative radiography (C-arm), closed nailing has gained popularity and frequently requires the use of a fracture table. Various studies have shown that closed femoral nailing outperforms open femoral nailing in terms of fracture healing and infection rate [7,8]. However, in some situations, especially in countries with limited resources, the availability of C-arms becomes a significant limiting factor.

Our study compared the mean time of union in patients treated with closed interlocking nails versus open interlocking nails for femoral fractures. A systematic review and meta-analysis, encompassing 1299 patients, concluded that closed interlocking nail treatment resulted in earlier reunion, higher union rates, lower infection rates, and slightly better functional outcomes compared to open interlocking nailing [9]. Our findings align with the conclusions of this inquiry, demonstrating a statistically significant decrease in the meantime of union for patients who underwent closed interlocking nail treatment. However, the meta-analysis indicated that open interlocking nail treatment showed superiority in terms of bone alignment [9].

Nonunion in femoral shaft fractures following interlocking via intramedullary nailing can be influenced by factors such as fracture location, fracture reduction, and nail diameter. The decision to use open or closed nails depends on the specific fracture site and the required degree of reduction. Numerous studies have consistently demonstrated that closed intramedullary nailing is superior to other treatment modalities for fractures in the middle third shaft of the femur in adults, as well as in emergency cases involving polytrauma and obese patients [10-22].

Our study also observed that the percentage of the patients suffered from the deep infection following closed interlocking nails were half (3.7%) as compared to (7.4%) after open interlocking nail. This finding is again in consistent with a recently done meta-analysis which also reported better outcomes after closed versus open intramedullary nailing in terms of infection [23].

Our study's results are consistent with the findings of the existing literature, particularly highlighting the advantages of closed reduction in terms of reunion time. However, open nailing remains a viable option when resources are limited or when dealing with complex fractures.

In summary, the available literature strongly supports closed intramedullary nailing as the preferred treatment for femoral shaft fractures in specific patient populations. Nevertheless, open nailing may still be considered in cases where resource availability is limited or when managing intricate fracture patterns.

CONCLUSION

Close nailing is the gold standard and brings out the best clinical outcomes in femur diaphyseal fractures. However, open nailing should be considered in situations with limited resources, and fracture reduction is unsatisfactory, as results are fairly similar to closed IM nailing for femoral diaphyseal fractures.

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Author's Contribution:

Mazhar Mahmood: Substantial contributions to the conception and design of the work.
Abdul Hannan: Acquisition, analysis, and interpretation of data for the work.
Usama bin Saeed: Study design, data collection, and drafting of the manuscript.
Asad Ramzan: Drafting the work or reviewing it critically.
Hamza Tariq: Acquisition of the data for work.
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