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## Open reduction and intramedullary nailing of shaft femur, an advantage or disadvantage? A prospective study

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### Abstract

Aim of this study is to evaluate results of open technique in the treatment of femoral shaft fracture with interlocking intramedullary nailing. In this prospective study, the patients were admitted to the department of Orthopedics, Bangalore medical college and research institute. We assume that open technique is not a disadvantage during union process over closed technique in treatment of femoral shaft fracture with interlocking nailing. 25 patients that were consulted for adult femoral shaft fracture between October 2016 to November 2017 were included. Patients with open fractures, neurovascular injuries, and patients that did not have isolated femoral diaphysis fractures were excluded from the study. Clinical and radiological results of the patients were followed up periodically. The open interlocking intramedullary nailing was used in treatment. Complete union rate was 84% in 21 patients who were treated with open interlocking intramedullary nailing for adult femoral shaft fracture, and nonunion rate was 16% in four patients. Mean union time was 22 weeks. Evaluation of 25 patients according to Thoresen criteria was excellent in 10 patients, good in 7 patients, moderate in 5 and bad in 3 patients. We think that open technique is an acceptable technique and advantages of open technique over closed technique cannot be ignored.

**Keywords:** Open reduction, intramedullary nailing, shaft femur

### Introduction

Femoral shaft fractures can result in extended morbidity, and disability. Intramedullary fixation is the most reliable method in comparison to other treatment methods. The purpose of this study is to ascertain the advantages and results of using the open reduction technique for interlocking intramedullary fixation, in comparison to using a closed technique.

### Methodology

A prospective study comprising twenty five patients treated with open interlocking intramedullary nails were included in the study. Seventeen (68%) of these patients were male, 8 (32%) were female, and the mean age of patients was 42yrs. Patients with neurovascular injuries were excluded from the study. Patients underwent a sequential systemic examination according to ATLS. Femoral shaft fractures were classified using AO/OTA classification. The continuity of reduction, alignment of femur bone and callus tissue development were investigated with the help of radiological assessment. Patients with neurovascular injuries, and open fractures were excluded from the study. Clinical results were assessed based on clinical examination and evaluation criteria set by Thoresen *et al.* Results were classified as excellent, good, moderate, and bad. Parenteral antibiotherapy was given for 3 doses during the postoperative period.

Open reduction without periosteal stripping using lateral incision was the surgical technique used for all patients. The reamed content left into the fracture site because of its osteoconductive and osteoinductive properties. Position of the nail was checked using an intraoperative fluoroscopy. All patients were started on isometric quadriceps exercises. Mobilization without load was allowed for patients within the week before discharge. Patients were given a home program. Clinical and radiological followup was done every monthly for first 6 months and then every 3 monthly regular appointments were given. The range of motion

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of the knee, the state of the wound, and the level of pain in the fracture region were examined at check-up. In terms of radiology, the reduction, fracture union (at least three cortices union was accepted as union) and the configuration of the nail were checked in the x-rays. The range of motion for the knee was recorded in degrees using a goniometer.

### Results

17(68.0%) patients were male and 8 (32.0%) were female. The average age of patients was 42 yrs. The mean follow up time for patients was 14.75- months (12–17.5 months). four (16.0%) of the femoral shaft fractures were in the proximal 1/3 part, 18 (72.0%) of the femoral shaft fractures were in the middle 1/3 part, and 3 (12%) of the femoral shaft fractures were in the distal 1/3 part. 20 (80.0%) patients had a femoral shaft fracture in their right side, and 5 (20%) had a femoral shaft fracture in their left side. All patients had closed fractures. The fractures of (84.0%) patients healed completely, and nonunion was seen in 16% patients. The average healing period was 22.8 weeks (ranging between 14 and 32 weeks). During the last follow-up appointment, 16 patients had a knee flexion of 110° and above, 5 patients had a knee flexion between 80° and 110°, and 4 patients had a knee flexion below 90°. According to rotational deformity measurements, two patients had a 12° internal rotation deformity, six patients had a varus deformity below 10°. 8 patients developed a surface infection in the entrance region of the nail in the hip which was controlled with parenteral antibiotherapy. According to the Thoresen measurements of the 25 patients monitored, 10 patients were excellent, 7 patients were good, 5 patients were moderate, and 3 patients were bad.

### Discussion

Orthopedic surgeon should be aware of the advantages and disadvantages of closed and open methods of fixation. Numerous studies report that a healing rate of 97–100% takes place within this period with interlocking intramedullar fixation [1]. The location of the fracture, magnitude of fragmentation, age, sex of the patient, the socio-economic demands of the patient help to determine the treatment method [2]. According to Literature the average clinical and radiological recovery period after standard fixation of femoral diaphysis is between 12 and 24 weeks [3]. Rokkanen reported better results for closed nailing over open nailing [4]. Leighton did not find any significant difference between open versus closed intramedullary nailing for femoral shaft fractures [5]. Harper reported that healing time of closed and open method was 14.3 and 13.9 weeks, respectively. He concluded that the difference of 0.4 week is not statistically significant. Harper *et al.* suggested that open and closed groups had similar incidence of postoperative complications except for rational malunion, which occurred more frequently in closed nailing group. The other results were similar in both groups [6]. Özsoy *et al.* proved that there is a risk that the superior gluteal nerve is damaged due to the different flexion positions of the hip during the closed intramedullar fixation procedure [7]. The issues of the correct entry point for antegrade nailing remains a matter of controversy [8]. A fracture may occur in the femur neck when incorrect entry point was chosen at the closed technique. Wild *et al.* reported that the total rate of complications for intramedullary femoral nailing was low (4.9%), but a high rate of intraoperative femoral neck fractures was observed (1.4%) [9]. Pudendal nerve paralysis can be prevented by decreasing traction-based pressure [10].

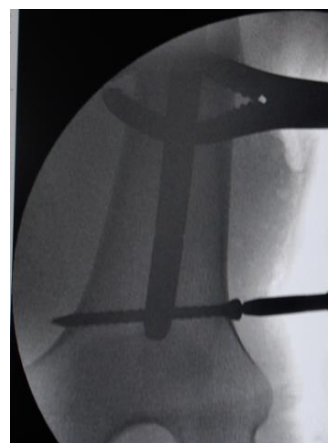
Klemm and Borner *et al.* in their study reported about the complications. Four patients (1.5%) experienced nonunion, seven patients (2.6%) developed a deep infection, and one patient (0.3%) suffered peroneal nerve paralysis [11]. Eghbali-Fatourech *et al.* concluded that the number of osteoblast progenitor cells in the circulation of adolescent individuals was higher in comparison to those of adults, and that the number of osteoblast progenitor cells increased in circulation of adults that had recently suffered a fracture [12]. Christie *et al.* [13] reported that the healing time using the closed technique was 17 weeks, Johnson *et al.* [14] reported that the healing time using the closed technique was 13.8 weeks. Our study results conclude that the average healing time using the open technique was 22.8 weeks. The fact that all our study results are close to those stated in literature regarding the closed intramedullar nailing method proves that the open method is an acceptable method.



Opening of fracture site and reduction



Antegrade nailing and wound closure



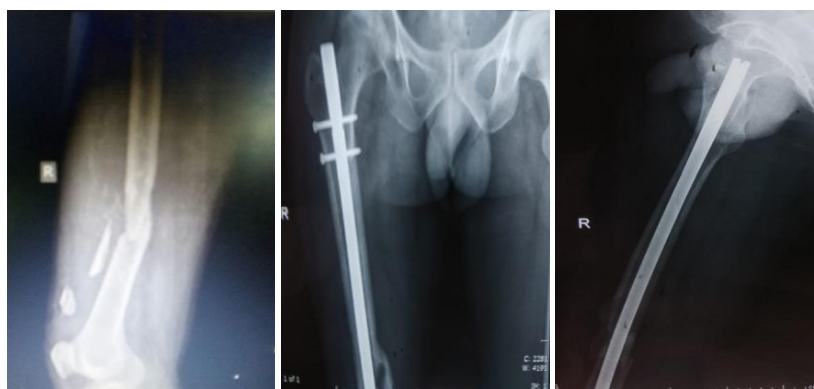
Fluoroscopic locking distally

**Fig:** Intra op clinical and fluoroscopic images



With complete union

**Case 1:** At 12 months follow up



Pre op and 20 weeks followup with fracture union in progress

**Case 2**



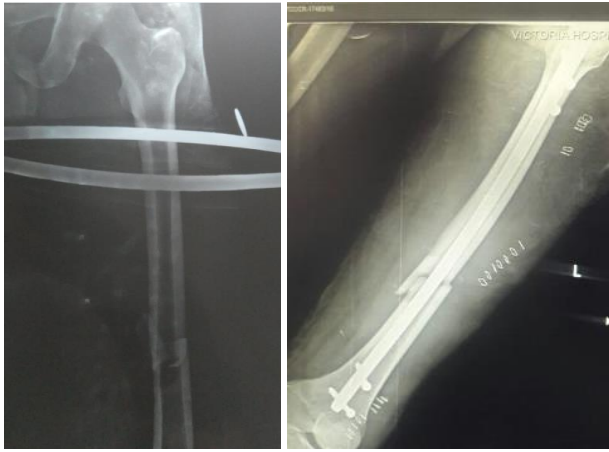
Pre op and 24 weeks followup post op

**Case 3**



Preop 3 month followup with implant failure & post exchange nailing with union in progress

**Case4**



Preop and immediate post op

**Case 5**

Pre and post op

**Case 6**

Pre op and exuberant callus at 12 months followup

**Case 7**

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