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A dilemma for management of third fragment of shaft femur fracture with closed intramedullary nailing: A retrospective study

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Abstract
Background: Aim of this study was to report the union rate of fracture shaft femur with third fragments after closed intramedullary nailing.
Methods: Sixty patients were analyzed retrospectively, AO/ASIF classification was done. Fractures were treated with closed intramedullary nail. Followed up in OPD until fracture united.
Results: Mean union time was 30 weeks which is longer than average time period for union of shaft femur fracture. There were two cases of non-union.
Conclusion: Use of closed intramedullary nail technique for treatment of shaft femur fracture with third fragments has predictable union rate and union of bone is related to the displacement of third fragments and irrespective of size of fragment.

Keywords: Closed IM nail, shaft femur fracture with third fragment, displacement, size of fragment

Introduction
Shaft femur fractures with third fragments account for 10-34% of all shaft femur fractures [1]. Close reduction with intramedullary nailing technique is the commonly performed surgery for femoral shaft fracture [2]. However there is a dilemma to manage the third fragment after closed IM nailing whether to keep it untouched or open the fracture site and fix the fragment with SS- wire or unicortical plate. But we know that opening the fracture site can leads to complications like infection, blood loss and longer duration of surgery etc [3, 4]. In order to avoid such complications of open reduction and fixation of third fragments, we had to study 60 cases of shaft femur fracture with third fragments managed by closed reduction with IM nailing retrospectively.

Methodology
This study was hospital based and conducted in the Department of Orthopedic at LLRM Medical College and S.V.B.P Hospital Meerut, Uttar Pradesh. The duration of the study was from June 2017 to February 2021 on an OPD basis. There were sixty cases of femoral shaft fracture with third fragments managed by closed reduction with IM nailing which were analysed retrospectively using discharged documentation and pre-operative and post-operative radiograph without control group. Patients with pathological fracture, open fracture and ipsilateral proximal and distal femur were not included.

Operative Procedure
Patient was positioned on the fracture table with traction after spinal anaesthesia, scrubbing, painting and draping done in aseptic condition. Closed reduction performed and guide wire were inserted and position of guide wire were confirmed by fluoroscopy image. Reaming was done only for the proximal fragment and the appropriate nail was inserted and locked.

Method of assessment
A fragment displacement was measured by determining the perpendicular distance of the proximal or distal end of the fragment to the nearest cortex of the shaft femur and the size of the third fragment was determine by measuring its longitudinal length using plain radiograph post-operatively.

Bone union was defined as bony continuity in 3 or more of the 4 cortical surfaces as observed in X-Ray of shaft femur AP and Lateral views. Non-union was defined as no sign of union since the last three months after the period of one and half years.

Results

There were sixty patients (54 males, 6 females); the median age was 23 years (range: 18 to70). The majority (62%, 37 patients) of fractures were the result of road traffic accidents; followed by fall from height (18%, 11 patients) were the common mechanism of injury. The right shaft femur was involved in 52 cases (87%). Table-1.

Overall 60 fractures were treated with closed locked IM nailing, mean union time was 30 weeks (range: 20-50 weeks) which is much longer than the average time period of fracture shaft femur without third fragment.

58 cases (96.7%) got united without any complications, but there were 2 cases (3.3%) which landed into non-union which was managed by autologous bone grafting.

Discussion

Intramedullary nailing is the ideal treatment for fracture shaft femur which will preserve the biology of soft tissue and will not interfere with the hematoma formation in fracture site [6]. But for fracture shaft femur with third fragment (AO-32.B & C) there is a dilemma, whether to fix or not, the third fragment after closed IM nailing, which is very much not described in the literature too.

In our setup closed IM nailing was performed in sixty cases of fracture shaft femur with a third fragment, where only proximal reaming was done [7, 8]. Hypothesis being - 1. Reaming only proximal fragments- bone marrow filled the void created by displacement of the third fragment and acted as graft. 2. Reaming through the fracture site will disrupt the periosteum and microvasculature which make the third fragment more displaced and rotated. (Fig-4).

Fifty eight cases (96.7%) out of sixty cases got united with mean union time of 30 weeks (range: 20-50 weeks) which was much longer duration in comparison to mean union time of fracture shaft femur without third fragment. Two cases (3.3%) with displacement of more than 1cm landed into non-union which was managed by autologous bone graft. Lin *et al.* [9] also found in their study that displacement of more than 1cm has a higher chance of non-union.

Recently J.R. Lee *et al.* [10] study concluded that non-union were found to develop where third fragments were 8cm or longer and displacement of 1cm or more but in our study it is observed that size of fragment has no role in non- union.

Giovanni Vicenti *et al.* [11] study concluded that the third fragment size is the leading parameter to influence the fracture healing within or in more than six months, which is comparable to our study.

Kempf *et al.* [5] also found in their study that risk of infection and non- union is low which is comparable to our study.

Daniel Layon *et al.* [12] concluded that the presence of flipped intercalary segments may not require different surgical management than the treatment of conventional femoral shaft fractures.

Pre-Op Immediate Post-Op

AT 3 months AT 9 Months

Fig 2.

Case-2 Open Reduction with SS Wire Augmentation

Pre-op

At 3 months

At 9 months without callous formation

Table 1: Population attributes

Population attributes	Value
Number of patients	60
Males	54 (90%)
Females	6 (10%)
Median age	23 (18-70)
Right Side femur fracture	52 (87%)
Left side femur fracture	8 (13%)
Mechanism of injury	
Road traffic accident	37 (62%)
Fall from height	11 (18%)
Others	12 (20%)

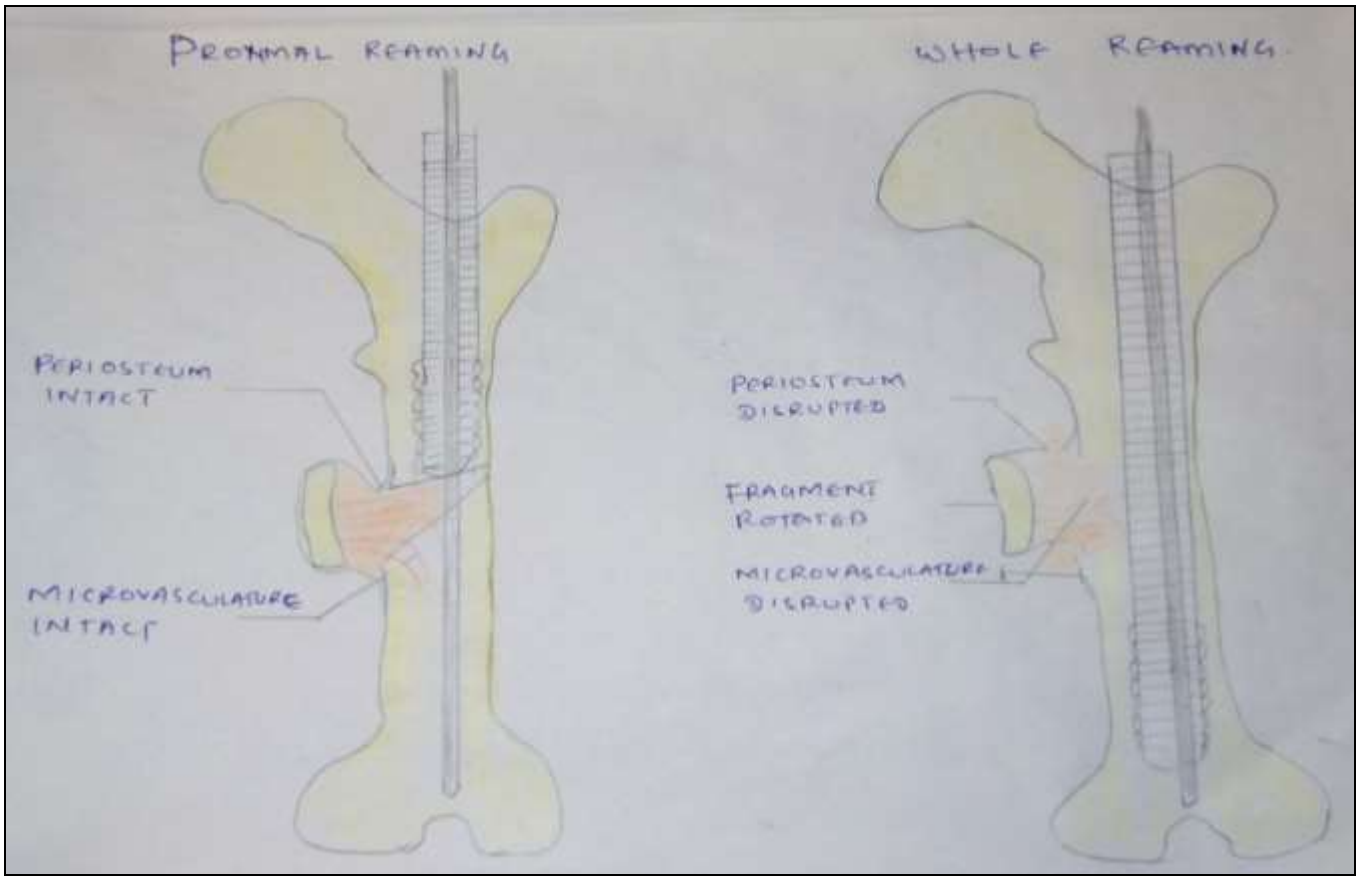

Fig 4: Diagram showing how reaming affect the third fragment

Conclusion

Closed locked IM nailing will be the ideal for management of fracture shaft femur with third fragment with excellent union rate and less risk of infection. Non–union rate may be directly related to displacement of third fragment but not the size of fragment.

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