

## Original Research Article

# Complications following comminuted femoral shaft fractures treated with interlocking nail with or without inter fragmentary screw fixation for butterfly fragment: case series

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## ABSTRACT

**Background:** This case series is to highlight the complications following interfragmentary compression screw fixation for butterfly fragment while treating femoral shaft fractures with interlocking nail.

**Methods:** Twelve cases have been included in this study conducted in institute of orthopaedics and traumatology, MMC & RGGGH, Chennai. All patients had shaft of femur fracture with butterfly fragment for which open reduction and interlocking nailing done. For 6 patients we applied interfragmentary screws for the butterfly fragment and in rest of the patients (6) patients we left the butterfly fragment in situ without disturbing the soft tissue attachment and bone grafting for the bone gap where ever necessary. We followed up the patient at 3 weeks, 6 weeks and 12 weeks, 6 months and 12 months.

**Results:** All the six patients fixed with inter fragmentary screws had wound infection and went for infected nonunion for which appropriate management was done including revision nailing or LRS application. Union was achieved in 12 to 16 months after various surgical interventions. Remaining six patients in whom interfragmentary screws were not applied and primary bone grafting when and where necessary was done, showed radiological union by three months.

**Conclusions:** Blood supply to large butterfly fragment is the main key for the healing process not the near normal anatomical reduction using interfragmentary screw for the butterfly fragment. Relative stability is enough for fracture union. In bone defects arising out of comminution primary bone grafting is essential for the bone healing.

**Keywords:** Comminuted femur fractures, Interfragmentary screws, Bone grafting

## INTRODUCTION

Incidence of shaft of femur fracture has been increasing and becoming common fractures that Orthopaedic surgeons come across. The commonly observed fracture patterns are determined by the magnitude of applied load, rate of load application and strength of the femur. Nowadays due to high energy trauma the fracture pattern

occurs with a high degree of comminution which pose a difficult scenario for the treating surgeons.<sup>1,2</sup> In case of high energy traumatic injuries concomitant trauma to multiple internal organs occur in conjunction with fracture femur. Because of these associated injuries patient may have to be taken up for surgery after some period of time needed for stabilization of the general condition.

In Winquist and Hansen system, fracture comminution is categorized from grade 0 to grade IV based on the percentage of intact femur shaft at the fracture site.<sup>1</sup>

**Winquist and Hansen classification**

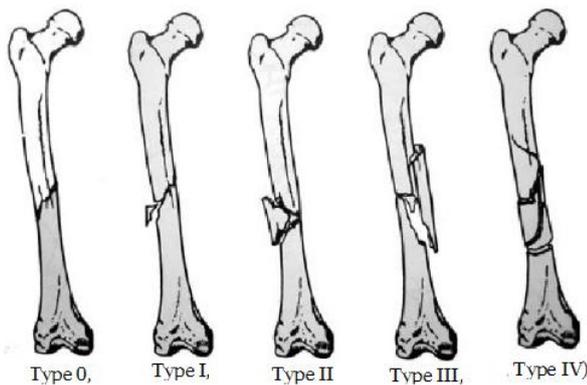
Grade 0- No comminution.

Grade 1- Small butterfly fragment (<25%) or minimally comminuted segment with at least 75% cortical contact remaining between the diaphyseal segments.

Grade 2- Butterfly fragment or comminuted segment (approximately 25–50%) with least 50% cortical contact remaining between the diaphyseal segments.

Grade 3- Large Butterfly fragment or comminuted segment (approximately 50–75%) with minimal cortical contact remaining between the diaphyseal segments.

Grade 4- Complete cortical comminution and there is no cortical contact between the diaphyseal segments.



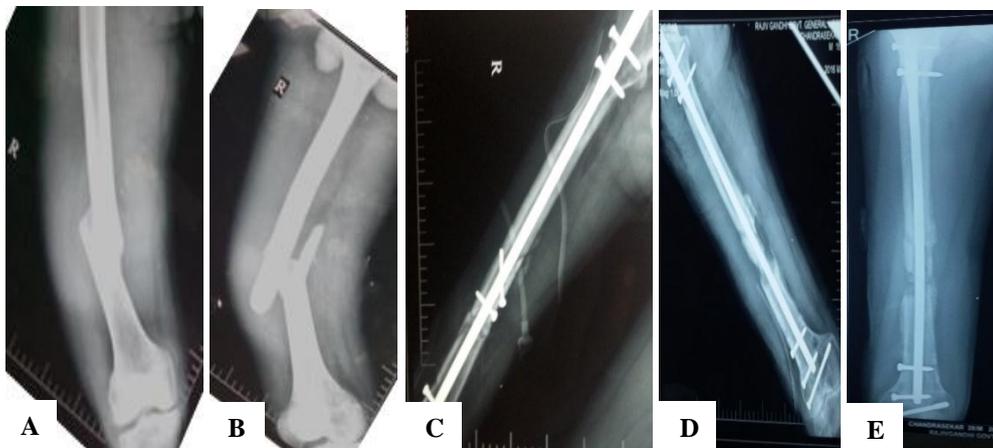
**Figure 1: Winquist and Hansen classification.**

Locked intramedullary nailing seems to be the best modality in managing these types of fracture pattern assuring satisfactory axial, rotational and bending stability.<sup>4,6</sup> It also aides early ambulation of the patient. There are numerus aspects in the technique of intramedullary nailing that require emphasis to ensure a good result with minimal complications. Many of the technical aspects of reduction such as interfragmentary screw application, bone grafting and various additive techniques to enhance fracture reduction are appreciated with increasing experience and is constantly evolving.<sup>5</sup> This is a prospective randomized study of twelve cases to analyze effectiveness / complications associated with comminuted femoral fractures treated by open inter locking nailing with or without inter fragmentary screw fixation of butterfly fragment Winquest type 3.

**METHODS**

In this prospective study 12 cases have been included which are done in institute of orthopaedics and Traumatology, MMC and RGGGH, Chennai during 2015 to 2017. Age of the patients ranges between 22 to 38 years. The inclusion criteria were Winquest and Hansen type 3 and Grade 1 open femoral fracture were included. The exclusion criteria were Winquest and Hansen type 1, 2, 4 and Gustillo Anderson grade 2, 3.

All cases had comminuted butterfly fragment for which open reduction was attempted by two different methods. In 6 patients (50%) Intra-medullary inter locking femoral nailing was done with interfragmentary screw for the butterfly fragments. In remaining 6 patients IM IL femur nailing was done without lag screws and bone grafting was done in addition for the defect wherever necessary. This study aims only about interlocking nail done with or without interfragmentary fixation for butterfly fragment in open reduction scenario for delayed procedure due to management of concomitant injuries.



**Figure 2 (A-E): Case I femur nailing with interfragmentary screw.**

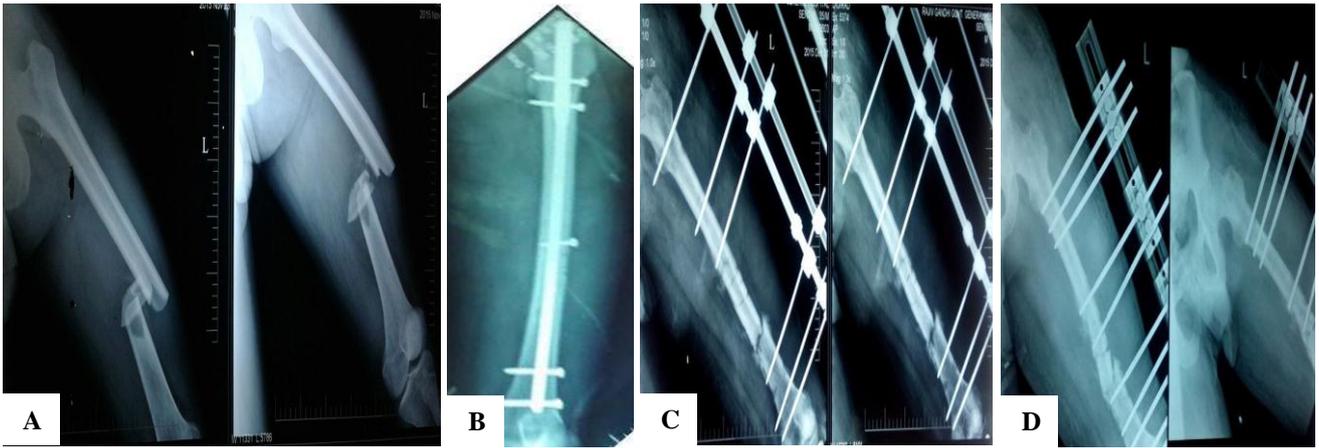


Figure 3 (A-D): Case II femur nailing with interfragmentary screw.

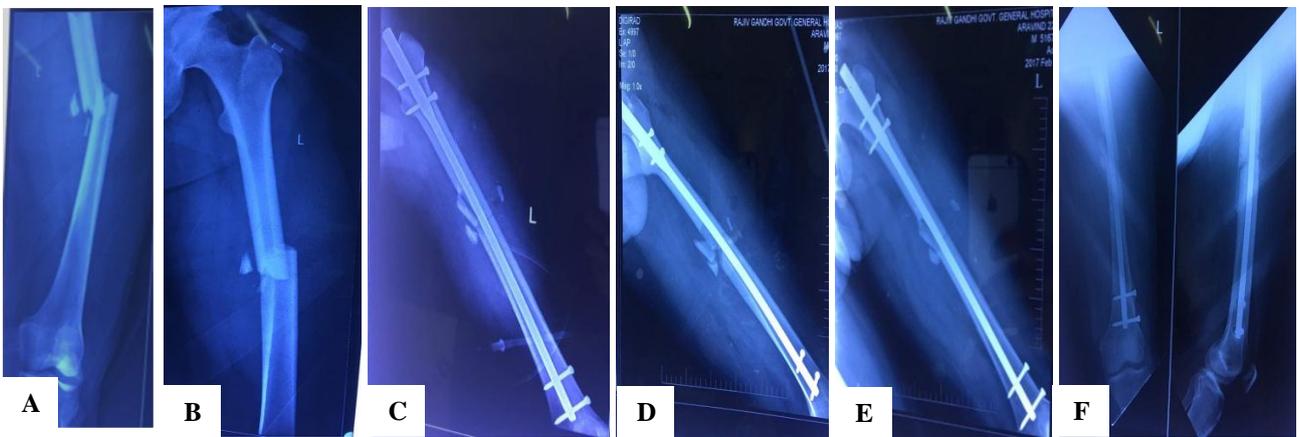


Figure 4: Case III with bone grafting.

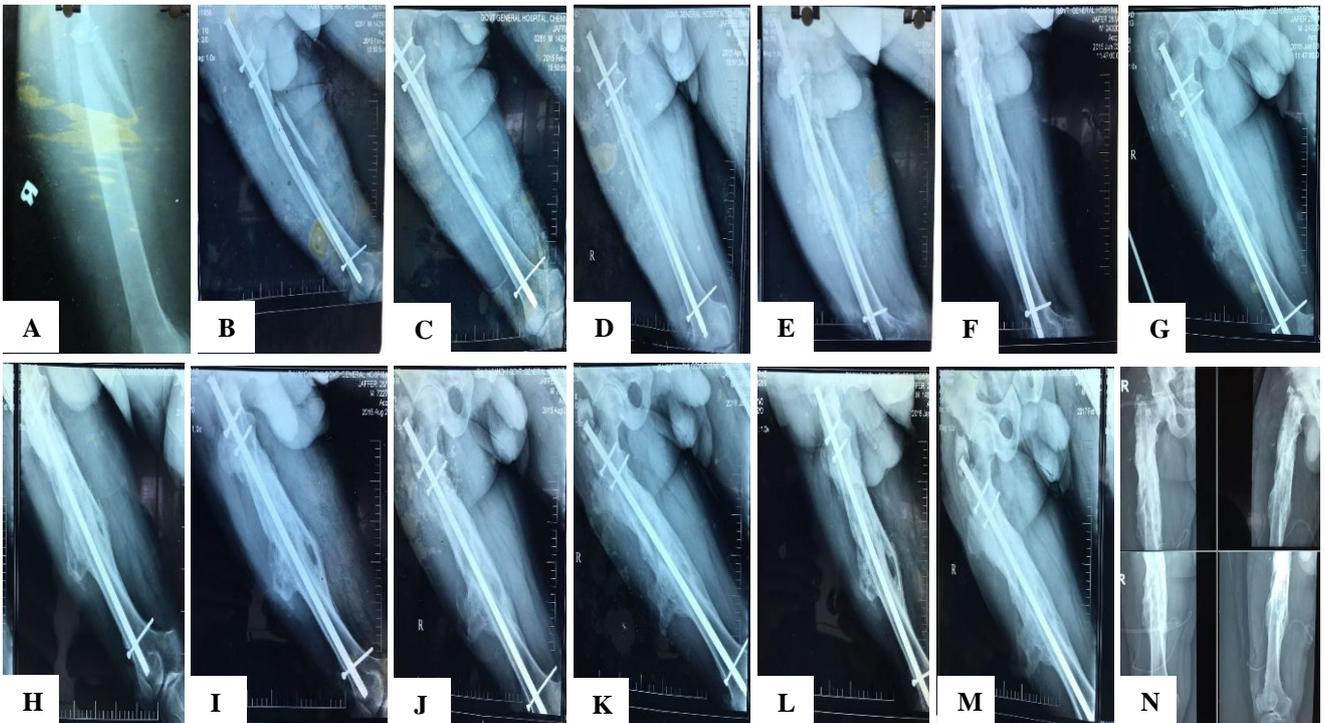


Figure 5 (A-N): Case IV femur nail with bone grafting.

### Surgical technique

With patient in lateral position: Through a posterolateral approach for the femur, fracture site opened and reduced, interlocking nailing done with or without interfragmentary screw fixation for the butterfly fragment without disturbing the soft tissue attachment. Wound wash given and wound closed with suction drain in situ. Intraoperatively when there is more than 1/3<sup>rd</sup> circumference of bone defect bone grafting was done which was harvested from ipsilateral iliac crest.

### Postoperative protocol

Drain removed on 2<sup>nd</sup> postoperative day and dressing done on 5<sup>th</sup> and 7<sup>th</sup> post op day, then patient sent home. In the second post op day knee mobilization started and quadriceps hamstring exercises started. On 12<sup>th</sup> Post Op day sutures were removed. Non weight bearing was

followed for first 6 weeks followed by partial weight bearing for next 6 weeks, full weight bearing from 3<sup>rd</sup> month. Patient was followed up on 6<sup>th</sup> week, 12<sup>th</sup> week, 6 months and one year.

### RESULTS

The study included 12 cases of comminuted diaphyseal fracture of femur treated surgically by intramedullary interlock nailing. The age ranges from 22 to 38 with mean age of 29.5. Most of the patients were bread winners for their family. Favorable results were obtained in patients fixed with IM IL nail without interfragmentary screw fixation. The mean time of fracture healing was comparable with normal hearing period of 12 to 16 weeks. Patients who were fixed with interfragmentary screws had to undergo multiple surgical interventions including LRS, Revision nailing with antibiotics.

**Table 1: Demographic data.**

Parameters	Values/mean
1 Age (years)	22-28 (29.5)
2 Female:male	0:12
3 Timing of surgery	10 to 14 days
4 Right:left	7:5
5 Interfragmentary screw	6
6 Primary bone grafting without interfragmentary screw	6
7 Fracture healing	12 – 16 weeks

**Table 2: Complications in our study.**

Complications	Interfragmentary screw (%)	Primary bone grafting (%)
Infection	6 (100)	0 (0)
Revision surgery (Iizarov/LRS/revision nailing)	6 (100)	0 (0)
Increase in hospital stay	6 (100)	0 (0)

### DISCUSSION

The treatment of the fracture shaft of femur has progressed from old conservative to the most recent intramedullary interlock nailing.<sup>6</sup> The interlock nailing has been done initially for transverse type of fractures. The IM nail can withstand better bending and torsional load than plates. Interlocking bolts give less tensile and shear stress in addition to rotational stability and load bearing. Thereby early immediate postop mobilization can be done. This early mobilization directly has positive economic impact as most of the patients are bread winners for the family. Early mobilization reduces complications related to prolonged inactivity. In long bone fractures comminution of fracture fragments should be taken into account in fracture management as larger fragments contribute to stability of the fracture that must be attended in planning the surgery.<sup>7</sup>

The main obstacles that we face in treating comminuted femoral fractures are preservation of length, rotation, alignment.<sup>8,9</sup> Advocates of AO technique of internal fixation advice interfragmentary compression screw for both unicortical and bicortical butterfly fragments. An important aspect while performing such a screw fixation for butterfly fragment is preservation of viability of fractured fragments. Blood supply of large butterfly fragment has to be preserved.<sup>10</sup> Butterfly fragment should not be detached from the soft tissues. Periosteum should not be disturbed while fixing the butterfly fragment. In bone defects arising out of comminution primary bone grafting is essential for the bone healing.

### Cases done without using the interfragmentary screws

For some case we left the butterfly fragment undisturbed and we did primary bone grafting for bone defects as in

Figure 4 and 5. For these cases there is no post op wound infection like previous cases were encountered.

## CONCLUSION

Blood supply to large butterfly fragment is the main key for the healing process not the near normal anatomical reduction using inter fragmentary screw for the butterfly fragment. Relative stability is enough for fracture union. In bone defects arising out of comminution primary bone grafting is essential for the bone healing. Butterfly fragment should not be detached from the soft tissues. Periosteum should be handled with utmost care for a better healing process of a fracture.

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