

**ANALYSIS OF THE RESULTS OF IPSILATERAL HIP AND SHAFT FEMUR
FRACTURES TREATED WITH RECONSTRUCTION NAIL**

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ABSTRACT

Background: Ipsilateral fractures of hip and shaft femur are a complex problem. High rate of complications are inherent with this injury. To choose from wide variety operative techniques and hardware available makes a life further difficult for an average orthopedic surgeon. **Method:** We present a series of 25 cases with ipsilateral hip and shaft femur fractures treated by intramedullary reconstruction nail. Intraoperative complications and postoperative results were critically analyzed. **Results:** Difficulty in reduction was observed in thirteen patients, improper placement of cervical screws in eleven patients and there was postoperative distraction present at fracture site in seven patients. Seven patients had malunion at hip and three at shaft femur. Nonunion was present in three patients with fracture shaft femur and one patient with fracture neck of femur requiring secondary surgical procedures. **Conclusion:** Though reconstruction nail is a good option for undisplaced or minimally displaced fractures at hip. In patients with marked displacement and comminution at fracture site its results are good only in experienced hands and needs further evaluation. Experience of the surgeon in managing these kinds of complex injuries cannot be over emphasized.

KEYWORDS: Ipsilateral hip and femur fractures; Reconstruction.

INTRODUCTION

Complex ipsilateral hip and femoral shaft fracture have troubled orthopaedic surgeons for their inherent problem of high complication rate. These dual fractures are usually encountered in young, associated with high velocity injury and usually accompanied by multisystem involvement Ipsilateral femoral neck fractures occur in 2.5% to 5% of patients with femoral shaft fractures.^[1] In the literature incidence of missed injuries is as high as between 20-30%. Early recognition of this injury is required to prevent the inherent disabling complications like non union or avascular necrosis of head of femur. Recent advances in the primary resuscitation have permitted many patients to survive their multisystem injury and undergo definitive care of their bony injuries. A review of literature revealed various operative techniques and plethora of hardware available to manage this difficult problem, but still there is no consensus among the various authors regarding the best method and controversy still exists. The purpose of this study is to share our experience of 25 cases treated with third generation reconstruction nail.

MATERIAL AND METHODS

We are reporting a study of twenty-five patients with an ipsilateral femoral neck and shaft fractures, who were treated by us from 1996-2003. All patients were followed up for a minimum period of one year and average follow up period was 2.4 years. This included 22 males and three females with average age of 40 years (range 25-67 years). Twenty two patients had high velocity road traffic accident, among these fourteen patients were injured in automobile accident, eight were involved in two wheeler accidents and three had fall from height. Twelve patients had significant associated injuries. Two patients had head injury, six patients had intra-abdominal injuries and one patient had pulmonary contusions. Three of patients sustained fractures of other extremities, which included fracture pelvis, contralateral fracture shaft of femur and fractures tibia in one patient each. Femoral neck fractures were classified according to Garden's classification. Six were grade II and three were grade III. One patient presented with nonunion of fractures neck of femur with K nail in-situ. Intertrochanteric fractures were classified by Boyd & Griffin's criteria. Eight were type I, two were type II, one type III and four were type IV. There

were three fractures of shaft of femur in proximal third, fifteen fractures in mid third, and four fractures in

mid distal third and three were subtrochanteric. (Table I).

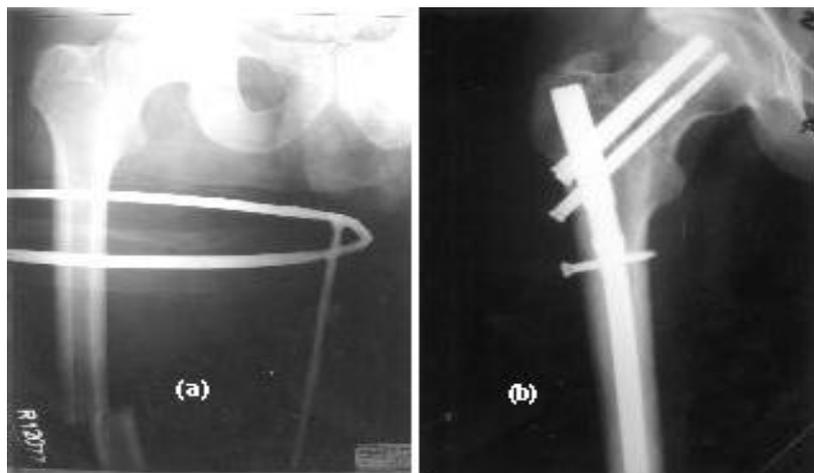


Fig 1: (a) Grade II fracture neck femur and shaft femur, (b) fixed with reconstruction nail.

Table 1: Distribution according to type of fractures.

Type of fractures	No. of patients	%age
A. Shaft of femur		
i. Proximal third	3	12
ii. Mid third	15	60
iii. Distal third	0	0
iv. Mid distal third	4	16
v. subtrochantric	3	12
B. Neck of femur		
i. Grade I	0	0
ii. Grade II	6	24
iii. Grade III	3	12
iv. Non union NOF with K nail in situ	1	4
C. Intertrochantric		
i. Type I	8	32
ii. Type II	2	8
iii. Type III	1	4
iv. Type IV	4	16

Treatment protocol: After the initial resuscitation with management of shock, splintage and traction, assessment of the orthopaedic injuries, associated injuries and medical ailments was made. Preference was given to the management of life threatening head, chest and abdominal injuries. Nineteen patients had no delay in surgery and were operated within 24 hours and four were operated within a week. In two patients surgery was delayed for more than one week depending upon the severity of associated non-orthopaedic injuries. Average hospital stay was 19 days. Determining the proper entry portal is crucial in femoral neck fractures because an entry far laterally may create varus reduction. Guide wire was introduced at the trochanteric fossa and an opening was made directly in the mid plane of femur under C-arm control. Femoral neck fractures were dealt on a priority basis and anatomical reduction was tried. We used a blunt medullary reamer as a nail blank in the metaphyseal canal and K wires were inserted

both anterior and posterior into the femoral head to stabilize the femoral neck fractures during reaming and nail insertion. After the insertion of appropriate sized nail, two guide wires were introduced in the neck and head and position of guide wires was carefully checked under C-arm. Seven degrees of anteversion is inbuilt in reconstruction nail used in our series. To get the posterior placement of screws, jig was rotated posteriorly in the horizontal plane. We tried to place the inferior cervical screw first and positioning it just above the calcar so that proximal cervical screw could be placed either in the middle or just superior to it in femoral neck (Fig. 1). The mean time for C-arm exposure was 2.63 ± 0.74 minutes and mean time for surgery was 3.00 ± 0.67 hrs.

RESULTS

All the Boyd and Griffin type IV intertrochanteric fractures and Garden grade III fractures of neck of femur (13 cases) had difficult reduction (Table II). Three

intertrochanteric fractures opened up when entry site was made, which resulted in varus reduction (Fig. 2). Five patients with Winquist grade IV comminution of fractures of shaft of femur had difficulty in reduction and insertion of guide-wire into the distal fragment. In ten patients there was difficulty in locating the entry site; out of these eight were comminuted fractures upper end femur with intertrochanteric extension. Next most common complication was improper placing of cervical screws in 11 patients. Most of them being in superior aspect of head or they were of inadequate length. Distraction of various degrees was present in seven patients. Out of four patients with distracted fractures of the neck of femur, two patients had associated intertrochanteric fractures as well. The patient only managed with spiral blade had distraction at fracture site. One patient with comminuted intertrochanteric fractures and two patients with fracture shaft of femur had distraction at fracture site. Iatrogenic comminution was seen in four patients. Post operatively one patients had superficial infection of suture line, which settled with intravenous antibiotics. One patient had deep vein thrombosis with pulmonary embolism. Patient recovered uneventfully.



Fig 2: Varus reduction and improper cervical screw placement of inadequate length.

Table II: Distribution according to intra-operative complications.

Complication	No. of patients	%age
Difficulty in locating entry site	10	40
Difficulty in passing Guide wire	3	12
Breaking of reamer	—	—
Iatrogenic comminution	4	16
Bending of nail	—	—
Difficulty in reduction	13	52
Distraction at site	7	28
NOF	4	16
SOF	2	8
I/T	1	4
Improper locking screws	11	44
Breakage of drill bit	—	—
Neurovascular injury	—	—

Delayed union (Table III) was seen in ten patients with fracture of shaft of femur and in two patients with fracture neck of femur. Both the femoral neck fractures united within six months from date of injury without any further intervention. Non-union was observed in three patients with fracture shaft of femur and one patient with fracture neck of femur. One patient had distraction, which required bone grafting to heal. In second patient fracture failed to heal with bone grafting and reconstruction nail was

exchanged with regular interlocking nail and repeat bone grafting and fracture healed on follow up. The third patient with non-union was also advised bone grafting but patients did not comply and still walking with nail in situ and non-union persisting. One non-union of neck occurred due to inadequate reduction of fractures neck of femur. She was operated and Meyer’s pedicle graft was done but fracture is still showing non union.

Table III: Distribution according to type of union.

Type of union	SOF	NOF	I/T
Delayed	10(40%)	2(8%)	-
Non union	3(12%)	1(4%)	-
Mal union	-	4(16%)	3(12%)

Three patients in our series had malunion of shaft of femur, one had valgus of $7 - 9^{\circ}$ and posterior angulation of 10° due to anterolateral shattering of cortex and other two patients had valgus of 10° due to lateral cortex shattering. These were clinically insignificant. Four fractures of neck of femur had varus malunion. One patients had cut through of cervical screws and fractures healed in varus position, two of the patients had varus reduction intraoperatively may be due improper entry site and one patients had early weight bearing which resulted in varus angulation and inferolateral comminution of neck. Three patients with type IV intertrochanteric fractures went into varus malunion due to opening up of fractures line laterally, while inserting the nail and hip abductors pulled up proximal fragment. One patient had avascular necrosis of head of femur.

Twelve patients had full range of motion at hip joint, five patients had 0-110 degrees ROM and six had ROM of 0-100 degrees. Only two patients had ROM less than 100 degrees. None of the patients had fixed flexion deformity at hip. Fifteen of one patient did not have any shortening in the leg, four had 1-2 cm of shortening, four had shortening of 2-3 cm and in two patients it was more than 3 cm.

DISCUSSION

Ipsilateral fractures of hip with fractures shaft of femur is a complex injury pattern, which needs special considerations. Although reports in the literature have often advocated one method over another but results are rarely, if ever documented adequately. Most important issues in orthopaedic surgeon's mind while treating these complex injuries are (i) Optimal timing of fracture stabilization (ii) type of hardware to be used, (iii) which fractures to be fixed first the neck or the shaft and how to achieve anatomical reduction at hip.

We present a series of 25 cases of ipsilateral hip and shaft fractures, which were fixed with third generation reconstruction nail with the three cervical screw options. Advantages of this modified nail over second generation nail include, multiple cervical screws options which provide added rotational and vertical stabilizing at neck, inbuilt 7° of antiversions angle which prevents the posterior placement of screws in the neck, anterolateral curve of nail matches with the normal curvature of the shaft of femur and lateral entry of nail from tip of trochanteric minimizes any further vascular insult to femoral head & neck. Incidence of missed fractures of neck of femur is shown as high as 20-30% in literature, but in our study incidence if missed fractures are nil. This is due to the fact that a very index of suspicious is kept in mind in patients with polytrauma fracture so shaft of femur and in patients who are unable to pinpoint pain. We routinely recommend X-ray

pelvis with both hips-AP view, X-ray of ipsilateral hip in 15° of internal rotation in all trauma patients on protocol basis. The least controversial aspect in the management of this injury is regarding the timing of fractures stabilization. Long bone fractures in polytrauma patients should be fixed as early as possible as it reduces the patient's morbidity, mortality and also reduced the hospital stay and cost. Early fixation reduces haematoma at fracture site thus minimizing the cascade of inflammatory mediators, which may lead to multisystem organ failure. Casey and Chapman reported in nine patients treated with traction after femoral neck fractures that developed life threatening pulmonary complications subsequently.^[2] In our series we have fixed all the fracture within 24 hours of injury unless patients were having other life threatening associated injuries. Patients were kept in traction for that period and there was no increase incidence of early or delayed complications seen in whom surgery was delayed due to associated injuries.

Anatomical reduction especially in cases with fracture neck of femur, precise entry point and proper placement of cervical screw were found to be most important surgical steps having important bearing on end results. In this series difficulty reduction was observed in thirteen cases. All the cases with B & G type IV intertrochanteric fractures and Garden grade III fractures of neck of femur with comminution had difficulty while reduction. In three patients, intertrochanteric fractures opened up while making the entry point, which resulted in varus reduction and four patients with fracture neck of femur had varus reduction. There were ten patients with difficulty in locating the entry point. Out of these eight patients were comminuted fractures proximal end of femur with intertrochanteric extension and two patients had comminuted intertrochanteric fractures associated with basal fracture of neck of femur. Malunion at hip especially varus reduction can be checked by making accurate entry point and inserting the nail to the precise depth. Fixation of fracture neck of femur should be given priority over fracture shaft of femur. Initial fixation with screws/K-Wires is mandatory to avoid loss of reduction of fracture neck of femur during the reaming and insertion of nail Next most common complication observed in our series was improper placement of cervical screws in 11 patients. Most of these were either in superior aspect of neck or they were of inadequate length. In third generation recon nail, since two or three cervical screws can be inserted so proper placement of distal cervical screws is very important otherwise the superior cervical screw cannot be placed properly or it will cut through at some part of the neck. We recommend passing distal cervical screw just above the calcar so that superior cervical screw can be placed in the center of the neck or just superior to this. Insertion of nail to the precise depth is a prerequisite to achieve this.

Position the zig slightly posteriorly in the horizontal plane to account for the anteversion of the neck and to prevent posterior placement of the screws in head and neck.

Delayed union was encountered in ten cases of fracture shaft of femur and two (8%) cases of fracture neck of femur. The cause of delayed union in fractures of shaft of femur was severe comminution of the shaft and associated soft tissues injury to the surrounding tissues. The comminuted fractures of shaft of femur are likely to undergo delayed union because of comminuted fragment due to tearing of blood vessels may loose blood supply and undergo avascular necrosis followed by revascularization takes significant longer time to unite. Non-union was observed in three patients with fracture shaft of femur and one (4%) patient with fracture neck of femur. All patients were having significant comminution at fracture site due to high velocity injury and had distraction at fracture site post-operatively. In two out of three patients with non- union of shaft femur, fractures united with secondary procedures like bone grafting in one and exchange nail with bone grafting in second patient. Third patient did not agree to further treatment. Non-union of fracture neck of femur still persisting inspite of intervention in the form of Meyer's pedicle graft being done.

Recent studies^[3-6] have shown 100% union rate inspite of initial displacement but critical analysis of intra-operative difficulties and post-operative complications, we have found high incidence of complications like malunion and nonunion in this injury pattern. This might be due to the fact that majority of the patients included in our study had high velocity injuries with extensive comminution of femoral shaft and displaced and comminuted hip fractures. Bennet et al had three non- unions in their series of 37 patients.^[7] All the three fractures were initially displaced and all were malreduced. Fractures that were anatomically reduced and internally fixed healed even when treatment was delayed in some of them which suggest that stable anatomic reduction not the early intervention is the key for union of fracture neck of femur.

High rate of complications are inherent in this injury pattern because of high-energy injuries to bone and soft tissues, associated injuries and comminution of shaft of femur in majority of cases. Though it might be easier to maintain reduction in minimally displaced fractures but to achieve reduction in displaced and comminuted fractures can really be challenging task even in most experienced hands. Hence we conclude that though reconstruction nail is a good option for undisplaced or minimally displaced fractures at hip but in patients with marked displacement and comminution at fracture site, its results are good only in experienced hands and needs further evaluation.

Experience of the surgeon in managing these kinds of complex injuries cannot be over emphasized.

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