Use Of Reconstruction Nail In The Treatment Of Bifocal Femoral Fractures- A Prospective Case Series

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ABSTRACT:

Introduction: The incidence of high velocity polytrauma leading to complex fractures is on rise. Bifocal femoral fracture include ipsilateral fracture of femoral diaphysis and either neck fracture or intertrochanteric fracture. These can be treated concomitantly by using single implant or two different implants to fix individual fractures. We present our results of treatment of these fractures using reconstruction nail.

Methods: We prospectively studied 50 consecutive cases with 38 males and 12 females who were in age group of 22 to 60 years (average age = 35.4 years), which were treated with reconstruction nails for ipsilateral fractures of neck and shaft femur during the period from June 2005 to June 2008. There were 22 femoral neck fractures, 28 femoral intertrochanteric fractures. Surgeries were done with minimal incisions and by the closed technique under Image intensifier. The results were evaluated based on the average union time for fractures, functional outcome based on criteria of Friedman and Wyman[1] and complications.

Results: The mean follow up was 2 years; mean union time was 6 months. We had 82 percent Good 14 fair and 2 poor results. The poor results were cases of non union shaft femur that required plaint over the nail for fracture union. There were 4 delayed unions, and 3 malunion (2 coxa vara, 1 shaft malunion) and two cases of infections.

Conclusion: Reconstruction nailing in these fractures is a considerably less invasive procedure than conventional open fixation modalities. The use of reconstruction nail provides excellent mechanical stability with predictable results and low complication rates

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INTRODUCTION

Bifocal femoral fracture include fracture of femoral diaphysis associated with ipsilateral femoral neck or intertrochanteric fracture. Diaphysial fracture may be in the upper third, middle third or lower third. The first description of this combined injury was given by Delaney and Street in 1953 [(1)]. There is a 1% to 6% incidence of concomitant femoral neck fractures with femoral shaft fractures [2]. Other more common patterns include ipsilateral inter trochanteric and shaft fracture and, much less common, neck, inter trochanteric, and shaft fractures [2]. The mechanism of fractures shaft of the femur sustained in automobile accidents involves the knee or distal thigh striking the dashboard which may be combined with other injuries of the same extremity or of the pelvis. The femoral neck fracture is relatively vertical, frequently minimally displaced, and unfortunately unrecognized in the initial examination of 20% to 30% of patients [3]. A coexisting fracture of the femoral neck may be overlooked because either it is undisplaced or the original roentgenogram does not include the hip. Femoral neck fractures also can be difficult to detect because of external rotation of the hip or because a bar of traction splint obscures the femoral neck [2].

Treatment of bifocal femur fractures is still debatable. This is due to low incidence, variety of different fracture patterns and the application of a wide range of different implants and techniques that have gained, and often subsequently lost, favor over time. Femoral neck nonunion and varus malunion are more common complications than alignment problems of shaft [(4)]. Symptomatic varus nonunion of femoral neck fracture has been reported in as many as 18 % of these injuries [(4)]. The incidence of osteonecrosis in the ipsilateral femoral neck and shaft fractures (3%) is lower than that in the solitary femoral neck fractures(10%)[4]. This may be for three reasons; first, the energy of trauma is dissipated in shaft fractures. Second, most of the femoral neck fractures are basal and nondisplaced that affect the blood supply to a lesser extent. Third, there exists a different pattern of neck fractures, an almost vertical fracture. It is therefore important to give priority to the reduction and rigid internal fixation of the femoral neck fracture [5]. Unstable displaced high neck

fractures are especially prone to redisplacement.

There are various modalities of treatment for bifocal femoral fractures, including open reduction and fixation with two different implants or with a single implant for both fractures .Conventional treatment modalities include simultaneous transcervical screws and shaft plating, Intramedullary nail with additional transcervical cancellous screws, Retrograde intramedullary nailing with femoral neck lag screws, Ender pins with percutaneous Knowles pins, Angled and straight plate fixation and Reconstruction nailing [4,5,6,7,8]. The reconstruction nail is a closed procedure and various advantages like less blood loss, less soft tissue striping, less operative time, hematoma are reported. Better union rates and decreased infection rate are mentioned as significant advantages over other modalities [7]. We report the results of our series of bifocal femur fractures treated with reconstruction nailing.

MATERIALS AND METHODS

During the period from June 2005 to June 2008, 50 consecutive skeletally mature patients with closed bifocal femoral fractures were treated surgically with fixation using a reconstruction nail. 5 patients with similar fracture but open wounds were excluded.

Emergency management was carried out in casualty with respect to – Airway, Breathing and Circulation, Monitoring of vital parameters, CVP if required, Blood transfusion, Immobilization of affected extremity in Thomas splint with skeletal traction, Management of associated injuries to vital organs like chest (n=5), abdomen (n=1), head (n=6) injury were treated. Radiographs of the affected extremities was carried out, The fracture pattern was grouped according to Gardens classification for neck femur; Boyd and Griffin for intertrochanteric fracture; Winquist Hansen classification for shaft femur fracture.

OPERATIVE PROCEDURE

Spinal epidural anaesthesia was used with patient positioned in lateral position on a radiolucent table top to facilitate the use of image intensifier. Painting, draping was done after scrubbing the extremity with betascrub and savlon. Lateral approach was taken with slightly curved incision made from the level of trochanter proximally. The entry point was through the greater trochanter. To accommodate the proximal diameter of the nail the proximal 8 cm of femur was reamed up to 15 mm. The intertrochanteric or neck fracture was initially fixed with K-wires, then 3.2 mm guide wires are passed to maintain the reduction. Shaft reaming was done using flexible reamers in 0.5mm increment till 1-1.5 mm size greater than the size of nail to be inserted reached. The selected nail was attached to the appropriate proximal drill guide with the hexagonal bolt when assembled properly, the nail had an anterior bow, and the keyed post of the proximal drill guide pointed laterally. After assembling the drill guide to the nail and guide pin or drill bit was passed through the sleeves into the locking screw holes in the nail to be sure, accurate placement of the screw will occur later.

The nail was inserted over the guide wire. The proximal drill drive connecting bolt was retightened. Using a percutaneous knife the skin and fascia was incised to the inferior pole of the proximal drill guide. The drill sleeves were pushed to the bone. The 2.4 mm drive pin was inserted through the drill sleeve and advanced it into the femoral head at least 4 mm superior to the calcar to a level 5 mm below the subchondral level of femoral head. The positon of the guide pin within the head was confirmed on c-arm and the same procedure was used for the superior hole. The inner sleeve was removed and the cannulated step drill was inserted through the outer sleeve into the femoral head within 5 mm of the subchondral bone. The screw length was measured and 6.5 mm lag screw was inserted through the drill sleeve into the femoral head by means of cannulated hexagonal screw driver. The drill sleeves were removed and superior screw inserted in a similar manner. The distal locking screws were inserted by free hand technique with the use of image intensifier.

Limb elevation was given on Bohler's frame and on pillows if Thomas splint was used. Intravenous antibiotics in the form of third generation cephalosporin, aminoglycoside were given for 3-4 days. Oral antibiotics were given after intravenous for about 5 days. Drain removal and radiographs were done after 48 hrs. Static quadriceps exercises from day 2 were begun for those who were not immobilized. Non weight bearing was started as soon as tolerated, usually 2nd or 3rd post op day. Hip and knee range of motion exercises were started from day 5. Suture removal was done at 2 weeks.

For those with comminuted fractures, Winquist-Hansen type III or IV, Thomas splint was continued for three weeks and then mobilization was started. Partial weight bearing was started 6-8 weeks post op after assessing radiological signs of union and gradually converted to full weight bearing after checking serial radiographs.

Assessment of functional outcome was done as per system used by Friedman and Wyman [(1)] and was graded into three types good, fair and poor. Good outcomes had no limitations of activities of daily living, no pain, < 20% loss of hip or knee function. Fair had mild limitation of activities of daily living, mild to moderate pain, 20-50% loss of hip or knee function. Poor had moderate limitation of activities of daily living, severe pain and more than 50% loss of hip or knee function.

RESULTS

The demographic data of the study included 38 males and 12 females in an age group of 22 to 50years (mean = 35.4 years). The mechanism of injury in 44 patients was Road Traffic Accident while 6 patients have history of fall from height. The duration of surgery was in range of 2.00 to 3.30 hours average duration of surgery was 2.35 hours. The time interval from injury to surgery was in range of 1 to 16 days, the average was 1.6 days interval as given in (Table 1). The mean follow-

up was 1.8±4.3 years [range, 13 to 27months]. There were 22 femoral neck fractures, according to Garden's classification: seven were type I; eleven were type II; four were type III. There were 28 femoral intertrochanteric fractures, according to Boyd and Griffin classification: twelve were type I; sixteen were type II. The diaphyseal fractures were according to Winquist and Hansen classification: eighteen were type I, twelve were type II, Fourteen were type III, and six were type IV.

Table No. – 1 Demographic Data

Sr.no.	Variable	Range	Mean
1	Age	22-60 yrs	35.4 yrs
2	Sex	M-38, F-12	
3	Fracture pattern: ICNF + Shaft Fracture IT + Shaft Fracture	 22 28	
7	Union time ICNF- IT- Shaft-	 4.3-6.5 months 3.5-5.4 months 3.3-7.2 months	 5.3 months 3.8 months 4.3 months

ICNF- intracapsular neck femur fracture, IT- intertrochanteric fracture, RTA- road traffic accident

Figure 1: a : Pre Op right b) post op , c)On follow up at 6 months radiograph bifocal fracture femur d) sitting cross legged .

Out of the 50 cases of fracture shaft femur 48 (96%) united with single procedure. The mean union time for the shaft fracture was 4.3± 1.2 months [range 3.3 months to 7.2 months]. Delayed union was seen in four shaft femur fracture which eventually united without intervention. Two fractures went into non union and were operated with plating over the nail. All the neck and intertrochanteric fracture united with mean union times given in Table I. There was malunion with coax vara in one neck and two intertrochanteric fractures. The functional assessment of the patients was done according to Friedman Wyman criteria as given in Table II. Good 41 (82%), fair 07 (14), poor 02 (4%)

Table No. – II Grading as per Friedman Wyman criteria

Sr. No	Grading	No. of cases	Percentage (%)
1	Good	41	82.00
2	Fair	07	14.00
3	Poor	02	04.00

Various complications encountered in this series are given in Table III. Delayed union in ICNF 4 (8%), IT 2 (4%), and shaft 6 (12%). There were two non-unions (4%) of fracture shaft femur which was treated with plating over the nail. Coxa vara developed in 2 patients who were operated with implant removal and valgus osteotomy. Malunion of shaft was seen in 1 patient (Photograph 2). 2 patients developed infection post operatively but were easily treated with antibiotic. None of the patients developed avascular necrosis till last follow up.

Table No. - III Complications

Sr.no.	Complication	No. of patients
1	Delayed union: ICNF	4
	IT	2
	Shaft	6
2	Nonunion	2 (shaft Fracture)
3	Coax vara	2
4	Shaft mal union	1
4	Infection	2
5	AVN Femoral Head	0

Figure 2 a : Pre Op right b) Post Op , c)On follow up at 6 months d) crosslegged at6 months in malunited shaft femur

DISCUSSION

These complex fractures are caused by high velocity trauma and 86% of cases in our series were due to road traffic accident. These fractures are more prevalent in the productive age group who are more prone to injury by this mode, 64% of patients in our series are in the age group 22-40 years and 82% of them are males. Similar age and sex distribution is also described by Ahlo et al [13].

In our series all the fractures were diagnosed before planning surgery. In many series the neck fracture was missed at initial presentation [4, 8, 15, 16, 17]. Radiographs of the ipsilateral hip should be done in all cases of shaft femur fracture to reduce the incidence of missed diagnosis [(7)]. We didn't have a single missed diagnosis. This may be attributed to high index of suspicion and routine use of radiograph of one joint above and one joint below. In suspected cases CT scan is carried out routinely.

Injuries to the knee are quite common with this mechanism of injury; we have one case of PCL avulsion fracture and one case of fracture patella. PCL avulsion was treated conservatively while fracture patella was treated with open reduction internal fixation with 2 k wires and tension band wiring. These injuries are frequently over looked, resulting in residual disability and less than optimal function [(1).] Therefore these injuries need attention at the time of surgery and should be fixed appropriately when ever required.

The bifocal femoral fractures are usually difficult to manage. Surgical stabilization of both the fractures is the consensus in most previous reports [6, 7, 10, 12, 18, 19]. Because the optimal treatment of one fracture may interfere with the treatment of other, this makes it controversial which fracture should be managed first [13, 14, 8, 20, 21, 24 and 25]. Lin et al in 2002 recommended fixation of the femoral shaft fracture first in cases with displaced femoral neck fractures [23]. They cited it as a technically easier procedure. Bucholz and Koldenhoven suggested the proximal fracture should be managed first [6, 7]. The purpose was to avoid the possibility of further displacement of femoral neck fracture and osteonecrosis of femoral head. We performed the reduction and interim fixation of the proximal fracture first, before fixing the shaft fracture. There has been no technical difficulty in doing this with no incidence of avascular necrosis.

Use of two different implants for fixation of individual fractures and use of single implant to fix both the fracture have been studied extensively [16, 17, 18] Following protocols have been reported using former technique; Antegrade nailing with use of cancellous screws to fix the proximal fractures, dynamic compression plate for shaft fracture and dynamic hip screw or cancellous screw for proximal fracture and retrograde nail for the shaft fracture with plate fixation of proximal fracture [1,5,9,12]. Single cephalomedullary nails like reconstruction nail has been used to fix both fractures by single implants. Proponents of the former technique quote technical ease and lesser complication rates by use of two different implants [26]. However authors using the reconstruction nail have reported good results in multiple case series. Jain et al in 2004 did retrospective study of the management of 23 cases conclude that though technically demanding, reconstruction nailing is alternative for concomitant fractures with less complication and good results [18]. Vidyadhara a et al in 2008 did prospective study of 43 consecutive cases found out that nailing with reconstruction nails is a good method as it gives a more stable fixation construct [27]. Russell et al in 1991in their retrospective study commented that cephalomedullary technique is demanding, but it offers an excellent solution for this problem. Lin et al recommended use of these implants for all types of displaced bifocal femur fractures with good results [23]. Use of reconstruction nail in this series has 96% excellent to good results. Bedi et al in their comparative study of use of single and dual implants showed increase chances of malreduction with use of single cephalomedullary nail [8]. The disadvantages of reconstruction nail technique are primarily related to technical errors during nail insertion. It is critical to pay attention to depth of nail insertion and rotational alignment of the nail to avoid malalignment of the proximal screws with femoral neck. In our series we had 3 cases (6%) of coxa vara deformity; however this did not affect the functional capability of the patients. The incidence of osteonecrosis in the ipsilateral femoral neck and shaft fractures (3%) [(5)]. Is lower than that in the solitary femoral neck fractures (10%) [(8)]. this may be for three reasons; First, the energy of trauma is dissipated in shaft fractures [(1, 16, 24)]. Second, most of the femoral neck fractures are basal and nondisplaced that affect the blood supply to a lesser extent.5 Third; there exists a different pattern of neck fractures, an almost vertical fracture [13].

Our study has few limitations. There was no control group and the follow up was short. However we can safely conclude that use of reconstruction nail provides excellent mechanical stability with predictable results and low complication rates.

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