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Closed Reduction and Internal Fixation With PFN(Proximal Femoral Nail) For Intertrochanteric and Subtrochanteric Fractures of Femur

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ABSTRACT

Background:- Intertrochanteric and subtrochanteric fractures are devastating injuries that most commonly affect the elderly, but it is not uncommon in younger age group, have a tremendous impact on both the health care system and society in general. Methods:- The present study consists of 20 adult patients of intertrochanteric and subtrochanteric fractures, who were treated with Proximal Femoral nail in peoples college of medical sciences and research centre Bhanpur Bhopal. After the patient with subtrochanteric and intertrochanteric fracture was admitted to hospital all the necessary clinical details were recorded in proforma prepared for this study. Results:- In our study maximum age was 92 years and minimum age 26 years. Most of the patients were between 60 to 75yrs. Over all 92.8 % of our cases had excellent to good results. Conclusion:- Good to excellent results are seen in 100% cases of trochanteric fractures and 87.5% cases of subtrochanteric fractures. From this sample study, we consider that PFN is an excellent implant for the treatment of proximal third fractures of femur.

KEYWORDS : Femur, Fracture, Intertrochantric, Subtrochantric.

Introduction

Intertrochanteric and subtrochanteric fractures are devastating injuries that most commonly affect the elderly, but it is not uncommon in younger age group, have a tremendous impact on both the health care system and society in general. Peritrochanteric fractures mainly comprise of fractures of trochanter and subtrochanteric region. Trochanteric fractures occur in the younger population due to high velocity trauma, whereas in the elderly population it is most often due to trivial. Trochanteric fractures are common in the elderly people. Trochanteric fractures treated without surgical intervention malunion with coxa vara deformity resulting in shortening of limb and limp are commonly seen. It is also associated with complications of prolonged immobilization like bedsores, deep vein thrombosis and respiratory infections. Since this fracture is more common in the elderly patients, the aim of treatment should be prevention of malunion, and early mobilization. Taking all the factors into consideration surgery by internal fixation of the fracture is ideal choice. There are various forms of internal fixation devices used for Trochanteric Fractures, of them the most commonly used device is the Dynamic Hip Screw with Side Plate assemblies. This is a collapsible fixation device, which permits the proximal fragment to collapse or settle on the fixation device, seeking its own position of stability. The more latest implant for management of trochanteric fractures is proximal femoral nail, which is also a collapsible device with added rotational stability. This implant is a centromedullary device and biomechanically more sound. It also has other advantages like small incision , minimal blood loss. Intertrochanteric and subtrochanteric fractures of femur posses clinical, structural, anatomical and biomechanical characteristics that distinguish them from intracapsular fractures. Subtrochanteric fractures comprises about 10 to 34% of hip fractures.[1] Subtrochanteric fractures are complicated by malunion and delayed or nonunion. The factors responsible for these complications in subtrochanteric fractures are high stress concentration, predominance of cortical bone and difficulties in getting biomechanically sound reduction because of comminution and intense concentration of deforming forces.[2] Many internal fixation devices have been recommended for use in subtrochanteric fractures, because of high. Incidence of complications reported after surgical treatment with each implant. A lack for satisfactory implant in surgical treatment of subtrochanteric fractures has led to series of evolution in design of a perfect implant. Subtrochanteric femoral fractures are associated with high rates of non union and implant failure, regardless of the method of fixation. Only recently has a better understanding of biology, reduction techniques and biomechanically improved implants allowed subtrochanteric fractures to be addressed with consistent success. With this background present study is conducted to analyze the anatomical and functional outcome of treatment of Intertrochanteric and subtrochanteric fractures using Proximal Femoral Nail.

Methodology

The present study consists of 20 adult patients of intertrochanteric and subtrochanteric fractures, who were treated with Proximal Femoral nail in peoples college of medical sciences and research centre Bhanpur Bhopal.After the patient with subtrochanteric and intertrochanteric fracture was admitted to hospital all the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital treatment patients were discharged and called for follow up (clinical and radiological evaluation), patients were followed up till fracture union and function recovery after surgery at regular interval.

Management of patients

As soon as the patient with suspected subtrochanteric or trochanteric fracture was seen, necessary clinical and radiological evaluation done and admitted to the ward after necessary resuscitation and splintage using skin traction. Inclusion criteria for selection of patients were 1. Sub trochanteric fractures, 2. Stable and unstable intertrochanteric fractures (Reverse oblique fractures and Inter trochanteric fractures with loss of posteromedial cortex). Exclusion criteria were 1. Open hip fractures, 2. Pathological fractures, 3. Periprosthetic fractures, 4. Peadiatric fractures (before physical closure). The blood urine and X-ray investigations were done routinely on all the patients preoperatively. All the patients were evaluated for associated medial problems and were referred to respective departments and necessary treatment was given. All the patients were operated on elective basis after overcoming the avoidable anaesthetic risks. In our study we used a standard length PFN of 250 mm with distal diameter of 10,11,12mm. the proximal diameter of nail is 14mm.The pxoximal derotation screw of 6.5mm and distal lag screw of 8mm.

Operative Technique

The patient was placed in supine position on fracture table with adduction of the affected limb by 10 to 15 degrees and closed reduction of the fracture was done by traction and gentle rotation. The unaffected leg was flexed and abducted as far as possible in order to accommodate to image intensify. The patient was then prepared and draped as for the standard hip fracture fixation. Prophylactic antibiotic was given to all patients 30 minutes before surgery. In Trochanter-

ic fractures we fixed the fracture percutaneously using two "k"wires which pass along the anterior cortex of greater trochanter and neck of femur into the head of femur. By doing so we can prevent the fracture opening up on adduction of limb for nail insertion. The tip of the greater trochanter was located by palpation in thin patients and in hefty patients we used image intensifier and 5 ems longitudinal incision taken pro>Cimal from the tip of the greater trochanter. A parallel incision was made in the fascia lata and gluteus medius was split in line with the fibres. Tip of the greater trochanter is exposed. In AP view on C-arm, the entry point is on the tip or slightly lateral to the tip of the greater trochanter. In lateral view, guide wire position confirmed in the center of the medullary cavity. Over the guide wire, a cannulated rigid· reamer is inserted through the protection sleeve and manual reaming was done. After confirming satisfactory fracture reduction an appropriate size nail as determined pre operatively was assembled to the insertion handle and inserted manually as far as possible into the femoral opening. This step was done carefully without hammering by slight twisting movements of the hand until the hole for 8mm screw is at the level of inferior margin of neck. In cases where satisfactory reduction · was not possible by closed means, open reduction was done. These are inserted with the help of the aiming device tightly secured to the insertion handle and using the drill sleeve systems. A 2.8 mm guide wire was inserted through the drill sleeve after a stab incision with its position in the caudal area of the femoral head for neck screw. This guide wire is inserted 5 mm deeper than the planned screw size. The final position of this guide wire should be in the lower half of the neck in AP view and in the center of the neck in lateral view. Proper positioning of the nail will aid in proper anteversion of the neck screw as there is inbuilt anteversion in the hole on the nail. A second 2.8 mm guide wire is inserted through the drill sleeve above the first one for hip pin. The tip of this guide wire should be 5mm deeper than the planned hip pin but approximately 25-20 mm less deep than planned. The hip pin is inserted first to prevent the possible rotation of the medial fragment when inserting the neck screw. The length of the hip pin is indicated on measuring device and is calculated 5 mm before the tip of the guide wire. Drilling is done over the guide wire with 6.5 rnm drill bit to a depth upto the length of hip pin previously measured. The same length 65 mm hip pin is inserted with the help of hexagonal cannulated screwdriver. A measuring device is inserted over the 2.8 mm guide wire until it touches the bone. The correct length is indicated on the measuring device and calculated to end approximately 5 mm before 1he tip of the guide wire. This length is set on the 8 mm reamer by securing the fixation sleeve in correct position. Drilling is done over 2.8 mm guide wire till the fixation sleeve prevents further drilling. Tapping is not done as the neck screw is self tapping. Neck screw is inserted using cannulated screw driver. Distal locking is usually performed with two cortical screws. For standard PFN , aiming was used. A drill sleeve system was inserted through a stab incision. A drill hole is made with 4 mm drill bit through both cortices length is measured directly from the drill marking. Locking screw is inserted through protection sleeve position confirmed with image intensifier. After the fixation is over, lavage is given using normal saline. Incision closed in layers. Sterile dressing is applied over the wounds and compression bandage given. Postoperatively, vitals were monitored. Only in very unstable fracture patterns weight bearing was not advised. Rest of the patients· was encouraged to weight bear partially with axillary crutches or walker depending on the pain tolerability of individual patient. Patients were discharged from the hospital when independent walking was possible with or without walking aids. All patients were followed up at an interval of 6 weeks till the fracture union is noted and then after once in 3 months till 1year. Functional status was assessed based on Harris Hip Scoring System (Modified).[1]

Statistical analysis

The data was entered in Microsoft office excel 2007. The data was analyzed using Epi-info software. The continuous variable was analyzed as mean and standard deviation while categorical data as percentage and proportion.

Result

In our study maximum age was 92 years and minimum age 26 years. Most of the patients were between 60 to 75yrs. Mean age of 61.4 years. Out of total 20 cases, 15(75%) were male and 5(25%) females. Cause of injury was 10(50%) due to slip and fall, 6(30%) fall from height and 4(20%) due to road traffic accident. 11(55%) had right and 9(45%) had left side affect. One patient had left knee (ipsilateral) effusion with septic artiritis with fracture surgical neck humerus (simple) on right which was managed conservatively. One patient had ipsilateral compound grade 2 comminuted fracture at junction of mid and lower thirds of right tibia treated with external fixator. One patient had ipsilateral fracture clavicle with fracture of 4, 5, 6, ribs, both were treated conservatively. Both the trochanteric and sub-trochanteric fractures were 50% each. Table no. 1 & 2 shows the trochantric and Sub-trochantric fracture classification. All the cases included in our study group were fresh fractures that underwent surgery at the earliest possible in our set up. The delay was due to associated injuries, medical condition of the patients. All the patients were operated at an average interval of 8 days from the date of trauma. We took more exposure time in case of comminuted fractures with difficult reduction. We took less exposure time in cases of intertrochanteric fracture where reduction was not a problem. We took more exposure time for the initial few cases .Duration of surgery was more for the initially operated cases and subtrochanteric fractures. Blood loss-measured by mop count (each fully soaked mop containing 50ml blood). Mean duration of screening (in seconds) was 90, Mean duration of operation (in minutes) was 90 and Mean blood loss(in milli-litres) was 130. Table no. 3 shows the intra operative complications. We had no cases of wound infection post operatively but we had one case of skin necrosis on medial aspect of operated thigh due pressure necrosis due to excess traction used on limb against the pelvic post, this wound healed with regular dressing. In delayed complication we encountered two cases of delayed union and one case of mal union. One case had shortening of leg who was treated with sole raise. We had no cases of nonunion or implant failure or cutting out of screws.

Assessment of Results

In our study the average duration of hospital stay was 19.33 days. The mean time for full weight bearing was 14.6 weeks. All patients enjoyed good range of hip and knee range of motion except one who had septic arthriitis knee. Post operative mobility was aided in immediate post operative period but later all patients were ambulatory independently with or with out walking aid after 6 weeks.

Follow Up

All patients were followed at 6 weeks, 12 weeks, 6 months and some patient's up-to one year and further if necessary. One patient lost for follow up. At each follow up radiograph of operated hip with upper half femur was taken and assessed for fracture union and implant failure and screw cut out.

Anatomical results

Anatomical results were assessed by presence or absence of deformities, shortening, hip and knee range of motions. In our study one patient had shortening >1cm, three patients had varus malunion <10 degrees. One patient had post septic arthritis knee stiffness.

Functional results

In our series of 20 operated cases 2 cases expired before first follow up due to associated medical problems and old age.1 case lost for follow up. Functional and anatomical results are assessed taking the remaining 17cases into consideration. Table no. 4

Discussion

The treatment of fractures of the proximal femur is still associated with some failures. The reasons are disregard for biomechanics, overestimation of the potentials of new surgical techniques or new implants or poor adherence to established procedures. High stress concentration that is subject to multiple deforming forces, slow healing time because of predominance of cortical bone, decreased vascularity, high incidence of complications reported after surgical treatment compels the surgeon to give a second thought regarding selection of the proper implant. The most common current modes of fixation are Blade plate systems, Sliding screw systems and Intramedullary devices. From the mechanical point of view, a combined intramedullary device inserted by means of minimally invasive procedure seems to be better in elderly patients. Closed reduction preserves the fracture haematoma, an essential element in the consolidation process. Intramedullary fixation allows the surgeon to minimize soft tissue dissection there by reducing surgical trauma, blood loss, infection, and wound complications. PFN is a novel, modern

intramedullary implant based on experience with the gamma nail. The currently used gamma nail as an intramedullary device also has a high learning curve with technical and mechanical failure rates of about 10%.The gamma nail is susceptible to fail at its weakest point, the lag screw-implant interface. Comparison of results: Simmermacher et al [3](1999), in a clinical multicentric study, reported technical failures of PFN after poor reduction, malrotation or wrong choice of screws in 5% of the cases. In our study poor reduction occurred in three cases, three with varus mal-reduction. A cut out of the neck screw occurred in 0.6% cases in the study conducted by simmermacher but we did not encounter such complication in our study. Anatomical fracture reduction was found in 86% of the patients and full weight bearing stability was achieved in 94%. In our study acceptable anatomical reduction was obtained in 85% cases .An intaoperative fracture displacement during manual introduction of the nail into the femoral shaft has not been reported with the gamma nail but this has been a problem with the PFN. One reason may be the entry point of the PFN at the tip of the greater trochanter is located directly in the fracture region which can cause intraoperative fracture displacement. However, Simmermacher et al. (1999)[3] had no cases of intraoperative fracture displacement using the PFN mainly in 31-A2 fractures. In our study we had no case of intraoperative fracture displacement after nail insertion. In comparision to gamma nail, we found no fracture of the femoral shaft and no break in the implant. Gadegone and Salphale[4] in 2007 reported a study on Proximal femoral nail - an analysis of 100 cases of proximal femoral fractures with an average follow up of 1 year .Postoperative radiographs showed a near-anatomical fracture reduction in 88% of patients. The fracture consolidated in 4.5 months. No perceptible shortening was noted. Of the patients, "1% had superficial infections which were controlled with antibiotics, 82% had a full range of hip motion. In our Study we had 85% near normal anatomical fracture reduction and fracture consolidated in 14.6 wks. One case we had shortening of more than 1 cm. Near normal range of hip motion. We encountered no nonunion. No cases of implant failure were observed. Metin Uzun[5]et al in 2009, in a study of 35 patients reported Long term radiographic complications following treatment of unstable intertrochanteric femoral fractures with the proximalfemoral nail and effects on functional results .Reduction was assessed as good or acceptable in all the patients. Complete union was achieved in all but two patients. The mean Harris hip score was 82. The results were excellent in 11 patients (31.4%), good in 15 patients (42.9%), fair in seven patients (20%), and poor in two patients (E>.7%). Radiographic complications mainly included secondary varus displacement in nine patients (25.7%).Secondary varus displacement was due to cut-out of the proximal screws (n=2), screw loosening due to collapse of the fracture site (n=2), and reverse Z-effect (n=5).Radiological complication chiefly include 3 cases of varus malunion· We had no implant failure or reverse z effect. Mean harris hip score 89.8. The aim of the study was to study the epidemiology of proximal third fracture femur in adults and anatomical and functional outcome with this newer method of intramedullary fixation with PFN. The assessment criteria for the efficiency of surgical technique included duration of surgery, number of intraoperative complications, blood loss and radiographic screening time. Clinical assessment includes post operative walking ability, hip and knee function, fracture union time, and implant bone interaction. The present study is comparable with result done by other authors.[6-10] In our study, peritrochanteric fractures were more common due to slip and fall. Age ranged from 26 to 92 years with mean age of 61.4 years. Males were more common contributing of 75% of cases. Right sided fractures were more common in our study accounting for 55% of cases. In our study Trochanteric fractures contributed 50% of cases, out of which boyd and griffin type 2 consisted of 60%, and 30% were type 1, 10% type3 .Subtrochanteric fractures accounted for 50% of cases out of which Seinsheimer[3] type 3a consisted of 40% cases, followed by 2b of 20%. The: mean duration of radiation exposure was 90 seconds, mean duration of surgery was 90 11inutes and mean blood loss was 130 ml. In the intraoperative period, one patient had fracture of lateral cortex of the proximal fragment; there was one case of drill bit breakage and one case of guide wire breakage. We were unable to put derotation screw in three cases. The mean duration of hospital stay was 19.33 days; mean time for full weight bearing was 14.6 weeks. Post operatively all patients were ambulatory of which three of them required walking aids. One patient had 2cms shortening after fracture union which was treated conservatively by sole rise. All patients enjoyed good range of hip and knee motion except in one who had stiffness of knee due to septic arthritis knee. In our study 2 cases expired before first follow up due to old age and associated medical problems. 1 case lost for follow up. Over all 92.8 % of our cases had excellent to good results.

Conclusion

Good to excellent results are seen in 100% cases of trochanteric fractures and 87.5% cases of subtrochanteric fractures. From this sample study, we consider that PFN is an excellent implant for the treatment of proximal third fractures of femur.

Table- 1:Trochanteric fractures are classified according Boyd and Griffin Classification

Type of fracture	Number of cases	Percentage
1	3	30%
2	6	60%
3	1	10%
4	0	0%

Table no. 2 Sub-Trochanteric fractures are classified according to seinsheimer Classification

seinsheimer classification	number	%
1	0	0
2a	1	10
2b	2	20
2c	2	20
3a	4	40
3b	1	10
4	0	0
5	0	0

Table no. 3 Intraoperative complications

Complication	Number of cases	Percentage
Fracture of lateral cortex	1	5%
Fracture displacement by nail insertion	0	0%
Failure to get anatomical reduction	3	15%
Jamming of nail	0	0%
Failure to put derotation screw	3	15%
Failure of distal locking	2	10%
Breakage of guide wire	1	5%
Breakage of drill bit	1	5%
Varus angulation	3	15%

Table no. 4 Functional results of trochantric and sub-trochantric fracture

Functional results	trochantric		Sub-trochantric	
	no.	%	no.	%
Excellent	6	66.66%	1	12.50%
Good	3	33.33%	6	75%
Fair	0	0%	1	12.50%
Poor	0	0%	0	0

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