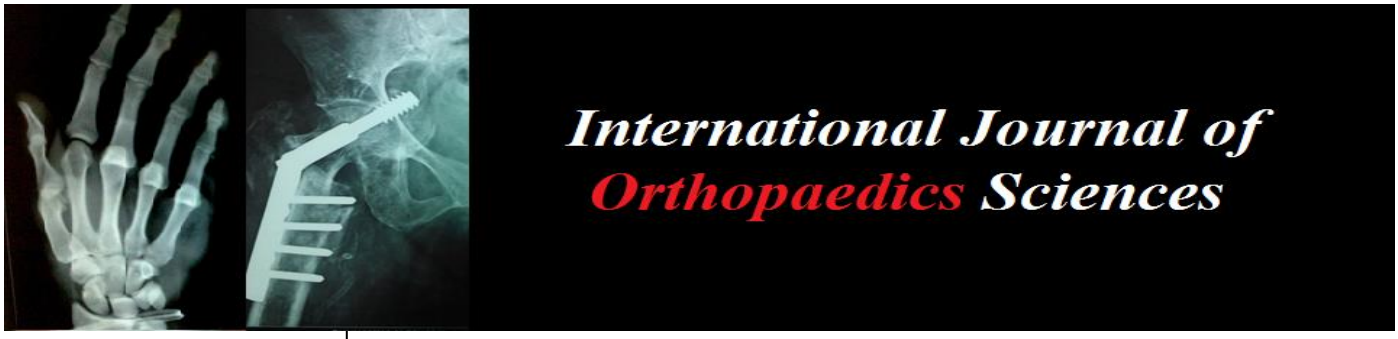

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Original Research article

Complications involved in treatment of sub trochanteric fractures by ORIF with long PFN

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Abstract
Background: Subtrochanteric fractures have a tremendous impact on both the health care system and society in general. Accurate reduction and internal fixation by DHS is the ideal choice.
Methodology: This is a prospective study of 20 cases of Subtrochanteric fracture admitted to Kims. Hubli between Nov 2008 to Aug 2010 treated with L.Proximal femoral nail by open method. Cases were taken according to inclusion and exclusion criteria, i.e fresh subtrochanteric fracture in adults. Pathologic fractures, multiple fractures, fractures in children, old neglected fractures were excluded from the study. Objectives of study was to study subtrochanteric fractures and to determine effectiveness of L.PFN in tretment of subtrochanteric fractures by ORIF.
Results: Our study constituted 20 subtrochanteric fractures of which, 40% were Russell and Taylor type IA, 35% were type IB, and 25% type IIA. Mean duration of hospital stay was 24 days and mean time for full weight bearing was 14 weeks. Good to excellent results were seen in 85% of subtrochanteric fractures.
Even though Proximal Femoral nailing is associated with Technical and mechanical complications, it were mostly related to the operative technique and the type of fracture and preoperative reduction of the fracture. Results of Proximal femoral nail fixation for subtrochanteric femur fractures are promising if a carefully pre-meditated operative plan is made.
Conclusion: Most of the complications of proximal femoral nailing are surgeon and instruments related which can be cut down by proper patient selection and good preoperative planning and restoring the anatomical alignment.

Keywords: Subtrochanteric femur fractures, complications, proximal femoral nailing, ORIF

Introduction
Subtrochanteric fractures occur typically at the junction between trabecular bone and cortical bone where the mechanical stress across the junction is highest in the femur, which is responsible for their frequent comminution. These fractures account for 10% to 34% of all hip fractures [1].
Subtrochanteric fractures are devasting injuries that most commonly affect the elderly population and also in young. In young individuals, the injury results from high-energy trauma, where as in the elderly and postmenopausal age group, it is due to the underlying osteoporesis, resulting from a trivial fall. These fractures have a tremendous impact on both the health care system and society in general [2]. Accurate reduction and internal fixation by DHS is the ideal choice. But, in case of unstablesubtrochiantric fractures the incidence of limb shortning is common. In some of the cases medialisation of distal fragments and implant cutouts are also common. Therefore this has led to the development of intramedullary devises. These &vices have the advantage of being an intramedullary device, shorter lever arm causing tensile strain on the implant, controlled fractures impaction due to dynamisation, shorter operative duration and less soft tissue dissection, minimal disturbance of fracture hematoma [3]. Closed management of these subtrochanteric fractures thus poses difficulties in obtaining and maintaining a reduction, making operative management the preferred treatment. The goal of operative treatment is restoration of normal length and angulation to restore adequate tension to the abductors [3].

The incidence of unsatisfactory results after operative treatment are due to inaccurate reduction. The intramedullary devices, which are commonly used, are introduced by closed reduction. On the table, it is very difficult to achieve accurate reduction in terms of angulation and rotation by closed manipulation. So there is need to achieve accurate reduction and to use the best intramedullary device, by minimlly exposing the fracture site. These fractures account for 10% to 34% of all hip fractures. The choice of treatment for all these fractures is open reduction and internal fixation. Many internal fixation devices have been recommended, but because of high incidence of complications like nonunion and implant failure, a series of evolution in designing a perfect implant has begun. Only recently after better understanding of biology and reduction techniques, biomechanically improved implants like Gamma nail, Russell Taylor nail, Proximal femoral nail are allowed for these fractures to be addressed with consistent success. Subtrochanteric fractures are known for their excellent union from the point of vascularity. It is becaust of the inaccurate reduction or by inadequate fixation, these fractures go for malunion. Therefore, there is need for accurate reduction and fixation by a good intramedullary device. Hence the purpose of this study is to to determine. The complications involved in the management of subtrochanteric fractures.

Materials & Methods

The present study consists of 20 adult patients with subtrochanteric fractures of femur who were treated with L.PFN by ORIF at KIMS, Hubli between Nov 2008 to August 2010. The fractures were classified according to Russell and Taylor classification. 20 cases were followed at regular intervals. This study was conducted with due emphasis for clinical observation and analysis of results after surgical management of subtrochanteric fractures of femur with long proximal femoral nail by ORIF.

Inclusion criteria: 1. Subtrochanteric fractures in adults. 2. Unstable intertrochantaic fractures (reverse oblique fractures and intertrochanteric fractures with loss of postero — medial cortex)

Exclusion criteria: Pathological fractures, Fractures in children**,** Old neglected fractures**,** Pen prosthetic fractures**,** Interochanteric fractures involving piriformis fossa**,** Stable interochantaic fractures.

Data collection: After the patient with subtrochanteric 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.

Management of patient: As soon as the patient with suspected subtrochanteric fracture was seen, necessary clinical and radiological evaluation was done and admitted to ward after necessary resuscitation and splintage with skeletal traction.

The following investigations were done routinely on all these patients preoperatively. Blood: Hb%, Bleeding time, Clotting time, Blood grouping and Cross matching, Fasting and Post prandial blood sugar, Blood urea and Serum Creatinine.

Urine: Albumin, Sugar, Microscopic examination

X-ray: Pelvis with both hips AP view, Chest X ray PA view in necessary patients.

All the patients were evaluated for associated medical problems and were referred to respective department and treated accordingly. Associated injuries were evaluated and treated simultaneously. The patients were operated on selective basis after overcoming the avoidable anaesthetic risks.

Pre Operative Planning

Determination of nail diameter: Nail diameter was determined by measuring diameter of the femur at the level of isthmus on an AP X ray.

1. **Determination of the neck shaft angle:** Neck shaft angle was measured in unaffected side in AP X ray using goniometer.
2. **Length of the rii1:** A standard length PFN (250mm) was used in all our cases except one case for which long PFN was used

Long Proximal Femoral Nail: The implant consists of long proximal femoral nail, self tapping 6.5mm pin, self tapping 1 lmm femoral neck screw. 4.9mm distal locking screw and an end cap**.** L.PFN is made up of either 316L stainless steel or titanium alloy. The nail is having 17mm proximal diameter. This increases the stability of the implant.

In our study we used the L.PFN of suitable lengths with distal diameter of 9, 10. II and 12. The proximal diameter of the nail is 17mm. Proximal derotation screw of 6.5mm and distal lag screw of 1 linm. Distal locking is done with self tapping 4.9mm bolts, one in static mode and the other in dynamic mode allowing lOmm dynamization. The nail is universal with 6 degrees of mediolateral valgus angulation and with neck shaft angle of 135 degrees. End cap was not used

Operative technique: The patient is placed in supine position on fracture table with adduction of the affected limb by 10-15 degrees and closed reduction of the fracture was done by the traction and internal rotation. The unaffected leg is flexed and abducted as far as possible or kept in wide abduction. The image intensifier was positioned so that anterior-posterior and laferal views of hip and femur could be taken. The patient is then prepared and draped as for any standard hip fracture fixation. Prophylactic antibiotic is given in all patients 30 mins before surgery. Open reduction is performed.

The tip of greater tronchanter was located by palpation in thin patients and in obese patients, we used image intensifier. About 15cms longitudinal incision was taken centering over the greater trochanter. A parallel incision was made in fascia lata and gluteus medius was split in line with the fibers. Vastus lateralis was split in line of incision. Tip of greater tronchanter is exposed.

Clamp assisted reduction: Once vastus lateralis was split, underlying bone was exposed and fracture site was visualised. Both fragments were held with bone holding clamps to achieve anatomical reduction.

Determination of entry point and insertion of guide wire: In AP view on c-arm, the entry point is on tip or slightly lateral to the tip of greater tronchanter. In lateral view, guide wire position is confirmed in the center of the medullary cavity. Medullary canal entered with a curved bone all, the guide wire is inserted into the medullary canal. Using a cannulated conical reamer proximal femur is reamed for a distance of 4; about 7cms. Distal femur is reamed with

successive no of reamers depending on the calculated nail diameter.

Insertion of L.PFN: After confirming satisfactory fracture reduction, an appropriate size nail as determined preoperatively is assembled to insertion handle and inserted manually. This step is 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 the neck.

Insertion of the neck screw and hip pin: Drilling is done over 2.8mm guide wire until the drill is 8mm short of tip of the guide wire. Tapping is not done as neck screw is self tapping. Neck screw is inserted using cannulated screw driver. Similarly appropriate length hip pin is inserted. Length and position of the screw is confirmed with c-arm image

Distal Locking: Distal locking is usually performed with two distal bolts. Locking is done with free hand technique by making drill hole using 4mm drill bit. Locking screw is inserted and position confirmed with image intensifier.

Closure: After fixation is over, lavage is given using normal saline and incision is closed in layers. Suction drain is used in case open reduction is performed. Sterile dressing applied over wound and compression bandage given.

After Treatment

Postoperatively, patient's pulse, blood pressure, respiration and temperature were monitored. Foot end elevation was given. Antibiotics were continued in postoperative period. Analgesics were given as per patients' compliance. Blood fr·: transfusion was given depending on the requirement. Suture removed on the 10th post operative day. Patients were encouraged to sit in the bed after 24 hrs following surgery. Patients were taught Qiiadriceps static exercise and knee mobilization in immediate postoperative period. Patients were taught gait training before discharge from hospital. Only in very unstable fracture pattern weight bearing was not advised.

Follow up: All patients were followed up at 4 weeks, 12 weeks and every 6 weeks thereafter till fracture union is noted, then at 6 months, 9 months and 1 year. At each visit, patient was assessed clinically regarding hip and knee function, walking ability, fracture union, deformity and shortening. Hip function was assessed by Harris Hip score.

Knee function was graded as: Good — full range of movements; Fair-restriction of 25% in any movement: Poor-Restriction of more than 50% of movements.

X ray of the pelvis with both hips was taken to assess fracture union and implant bone interaction.

Results

Most of the patients were between 21-40years. Mean age was 37.53 years. The no of male patients in our series were 16 and female were 4. In our study maximum age was 75 years and minimum age was 17 years. The most common mode of injury in our series were road traffic accidents accounting for 13 cases, followed by fall from height in 5 cases and trivial fall in 2 cases. The 20 subtrochanteric fractures in our study were classified according to Russell and taylor classification. In our study we had 8 cases of IA, 7 cases of IB and 5 cases of IIA Russell and Taylor classification. All the cases included in our study group were fresh fractures who underwent surgery at the earliest possible in our set up. The delay was due to associated injuries and medical condition of the patient. All the patients were operated at an average interval of 10.6 days from the day of trauma. Neck Screw Size used: In our study most commonly we used 75mm neck screw for 10 patients and 70mm neck screw for 5 patients. Table 1

Table 1: Neck Screw Size

Size	Frequency	Percent
65	1	5
70	5	25
75	10	50
80	3	15
85	1	5
Total	20	100

Intraoperative complications: In our study we encountered certain complications intraoperatively. Most of these complications occurred in the first few cases. They were commonly seen in Type IIA subtrochanteric fractures, and obese individuals. In 8 cases due to wide displacement of fragments, comminution of fragments and in another 4 cases with delay in surgery of 20 days due to comorbid conditions. Table 2

1. There was an iatrogenic fracture of the lateral cortex of proximal fragment in 2 of 20 cases. This occurred in initial cases probably due to wrong entry point and osteoporotic bone.
2. 2 of 20 cases, we failed to put antirotation screw, in 1 case it could not be accommodated in the neck after putting neck screw. In other case antirotation screw had to be removed after inserting as it was penetrating superior cortex of the neck.
3. In 1 case there was breakage of. Guide wire inside the neck while we were drilling over the guide wire for applying neck screw.
4. There were no instances of drill bit breakage or jamming of nail.

Table 2: Intraoperative complications of L.PFN.

Comlpications	No of Cases	Percentage
Fracture of lateral cortex	')	/0
Failure to put derotation screw	')	/0
Jamming of nail	0	0
Drill bit breakage	0	0
Guide wire breakage	1	5

Post operative Complications: In our series we had 2 cases of superficial wound infection which required intravenous antibiotics for 3 weeks period. No other complications like Deep Venous Thrombosis, systemic infection, Acute Respiratory Distress Syndrome, Fat Embolism etc.

Delayed complications: In our series we had 2 cases of delayed union. The cases of delayed union required dynamization which were followed up till bony union. One case with shortening of more than 1 cm was seen due to the excessive comminution noted in the fracture. Table 3

Stiffness of knee was noted in lease as he had got associated lateral condyle fracture which required vigorous physiotherapy, with full recovery of the range of movements. Stiffness of hip was noted in 3 cases, with incomplete improvement in 2 cases as other 1 case improved with physiotherapy.

Table 3: Delayed complications:

Delayed complications	No of cases	Percentage
Hip joint stiffness	3	15
Knee joint stiffness	1	5
Delayed union	2	10
Shortening	1	5

Condition at discharge: 8 patients were advised non weight bearing with bed rest due to associated injuries. Patients were discharged with partial weight bearing using walker or crutches depending on the pain tolerability.

Duration of Hospitalization: The average duration of hospital stay following surgery was 24 days ranging from 16-30 days.

Follow up: All patients were followed up at 4 weeks, 12 weeks and every 6 weeks thereafter till fracture union is noted, then at 6 months, 9 months and 1 year. At each follow up radiographs of upper femur and hip were taken to assess the fracture union, implant failure and screw cut out.

Radiological union: Radiological union was said to be achieved on the evidence of obliteration of fracture lines and trabecular continuity between the two fragments on anteroposterior and lateral x rays in three cortices.
Six cases showed union at 4 months, 9 cases at 5months and 3 cases showed union at 6 months duration.2 cases of delayed union for which dynamization was done and united at average of 7 months. Table 4

Table 4: Union in weeks

Union in weeks	Frequency	Percentage
0-12 wks	1	5
13-16 wks	5	25
17-20 wks	9	45
21-24 wks	3	15
25-28 wks v	0	0
>28wks	2	10
Total	20	100

Discussion: The most recent study evaluating the use of PFN is from Fogagnolo *et al.*, who reported 46 patients with an average rate of intraoperative technical or mechanical complications of 23.4%. They also reported 2 implant failures and 1 fracture below the tip of the nail [4]. Daniel F A Meiizes *et al.* and Axel Gamulin (2005) in a clinical study of 155 consecutive patients treited with proximal femoral nail, reported failure of fixation in 2%, femoral shaft in 0.7%, fixation failures included one cut out, one delayed fracture healing and one lateral displacement of the antirotation screw [5]. Christian Boldin *et al.* in his study of 55 patients of proximal femoral fractures with PFN noted 3 cases with Z effect and 2 patients with Reverse Z effect. 2 patients had screw cut-out without any relation to fracture pattern and 10% of open reduction [6].
Simmermacher *et al*. (1999), in a clinical multicenter study, reported technical failures of the PFN after poor reduction, malrotation or wrong choice of screws in 5% of the cases. A cut-out of the neck screw occurred in 0.6% [7]. In our study of subtrochanteric fractures treated with L.PFN by ORIF we encountered intraoperative complications like iatrogenic fracture of lateral cortex in 2 cases (10%) due to selection of wrong entry point, failure to put derotation screw in 2 cases (10%) and guidewire breakage in 1 case (5%). Delayed complications like hip joint stiffness in 3 cases (15%), knee joint stiffness in 1 case (5%) and shortening of more than one cm in 1 case (5%) and delayed union in 2 cases (10%).

Table 5: Mechanical complications of PFN system

	C Boldin *et al.* [6]	Simmermacher *et al.* [7]	Present Study with L.PFN by ORIF
No of patients	55	191	20
Cut out	2	1	0
Z effect	3	-	0
Reverse Z effect	2	-	0
Implant failure	-	1	0
Femoral fracture below the tip	-	-	0
Re operation rate	18%	7%	0
Open Reduction	10%	-	100

In our study mean frequency of radiaton exposure were 140 sec and mean duration of operation is 105 minutes and mean blood loss was 300m1.
Iatrogenic fracture of lateral cortex was seen in 2 cases, 2 cases antirotaton screw could not be put. Post operatively 2 of our cases had superficial infection Mean duration of hospital stay was 24 days in and mean time of full weight bearing was 14 weeks in our study.
In our 20 cases, excellent results were seen in 45%, good in 35% cases, fair in 15% cases and poor in 5% cases treated by L.PFN by open method.

Conclusion
Most of the complications of proximal femoral nailing are surgeon and instruments related which can be cut down by proper patient selection and good preoperative planning and restoring the anatomical alignment. Osteosynthesis with the Proximal femoral nail offers the advantages of high rotational stability of the head-neck fragment. Proximal femoral nail has the advantage of collapse at fracture site and is biomechanically sound as it's a intramedullary device. Post operatively early mobilization can be begun as the fixation is rigid and the implant design.

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