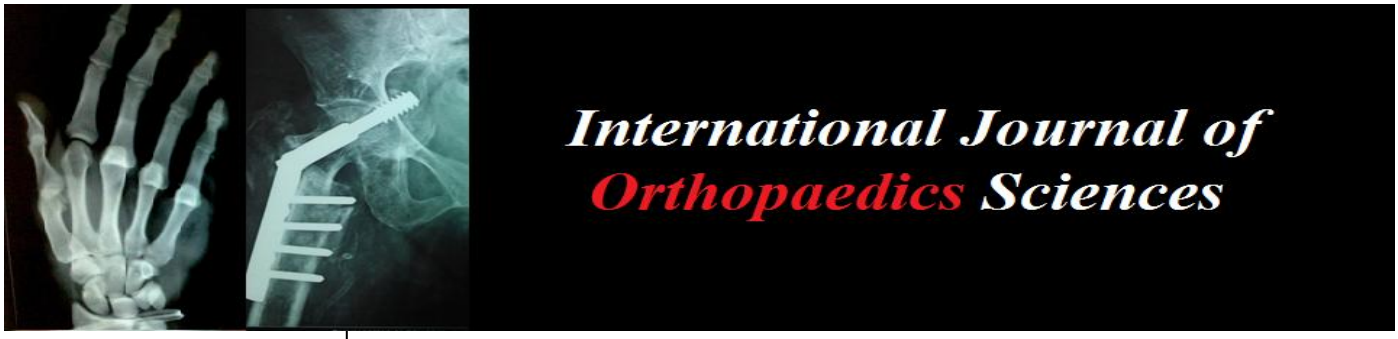

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Operative results of proximal femoral nailing in subtrochanteric fracture femur using pyriformis fossa entry

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Abstract
Introduction: Subtrochanteric fracture of the femur is a variant of the peritrochanteric fracture of the femur. It extends upto 5 cm below the lesser trochanter. The incidence is relatively much lower (3.9% of all the proximal femoral fractures). It is common in the older population with low energy trauma along with osteoporosis and in younger patients with high energy trauma [4]. Studies have shown that the subtrochanteric region is the most stressed area which concentrates stress on the implant and this is difficult to treat due to complications. With the improved knowledge and understanding of the fracture pattern, specific treatment options with successful results `1may be obtained.
Materials and methods: A total of 36 cases of subtrochanteric femur fracture patients were selected in our study and we did proximal femur nailing in all patients, where entry of nail was taken through pyriformis fossa. Among them, 22 fractures were successfully reduced with traction on a fracture table, but circlage wiring through a small incision was needed in 6 cases. The classification of fracture was based on Russell and Taylor classification. Blood loss, duration of surgery, functional outcomes were recorded. All patients' assessment of movement at hip was assessed by Harris hip score. Clinical and radiographic analyses were done at 3 weeks, 6 weeks, 3 months, 6 months and 1 year.
Results: Out of 36, 25 were males and 11were females. One patient had rotational malallignment of 12 degrees. There were no other malallignment or iatrogenic fracture comminution. The average operative time was 48 minutes. All fractures united eventually with no bone grafting needed in any patient. The functional hip outcome in terms of scoring by Harris hip score showed excellent results on follow ups.
Conclusions: A femoral nail with ante grade entry through the pyriformis fossa showed excellent results in terms of union and functional outcome of patients.

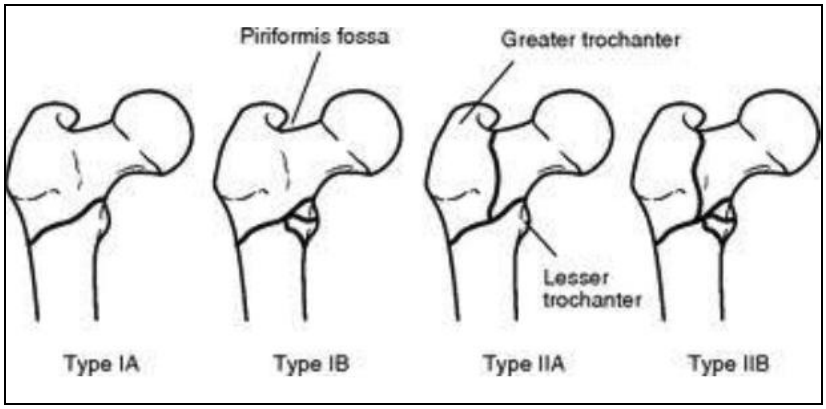
Keywords: Subtrochanter, pyriformis fossa, comminuition, femoral nail, union, encirclage

Introduction
Subtrochanteric fracture is one of the most challenging fractures to treat as treatment failure is common leading to complications of mal-union, non-union, shortening, angular and rotational deformity. This is attributed due to the muscular forces acting on proximal femur which causes a flexion, abduction and external rotation of the proximal femur. Antegrade nailing done in such situation using tip of trochanter entry proximal femoral nail (PFN) leads to varus, angulation and flexion deformities in many of the cases. This can be overcome by taking a pyriformis fossa entry using PFN.
Subtrochanteric fracture of the femur is a variant of peritrochanteric fracture of the femur [1]. The incidence is relatively much lower (3.9% of all the proximal femoral fractures) [2, 3, 5]. It lies in the area which is 5cm below the lesser trochanter. It may extend proximally into the intertrochanteric area and distally upto the isthmus of the shaft of the femur. Its incidence is much lower than that of the intra and extra capsular fracture of the neck of the femur. The incidence usually is six per 1 lack population per year, with a female preponderance [4]. It is common in older patients after low energy trauma along with osteoporosis and in younger patients with high energy trauma. This area is also the commonest site for pathological femoral fractures (17%) due to metastatic deposits from the lung, breast, prostate, myeloma and Paget's disease [4]. The mechanism of the injury is fall and direct lateral hip trauma, road traffics accidents, axial loading with torsional forces, fall form height.

Classification

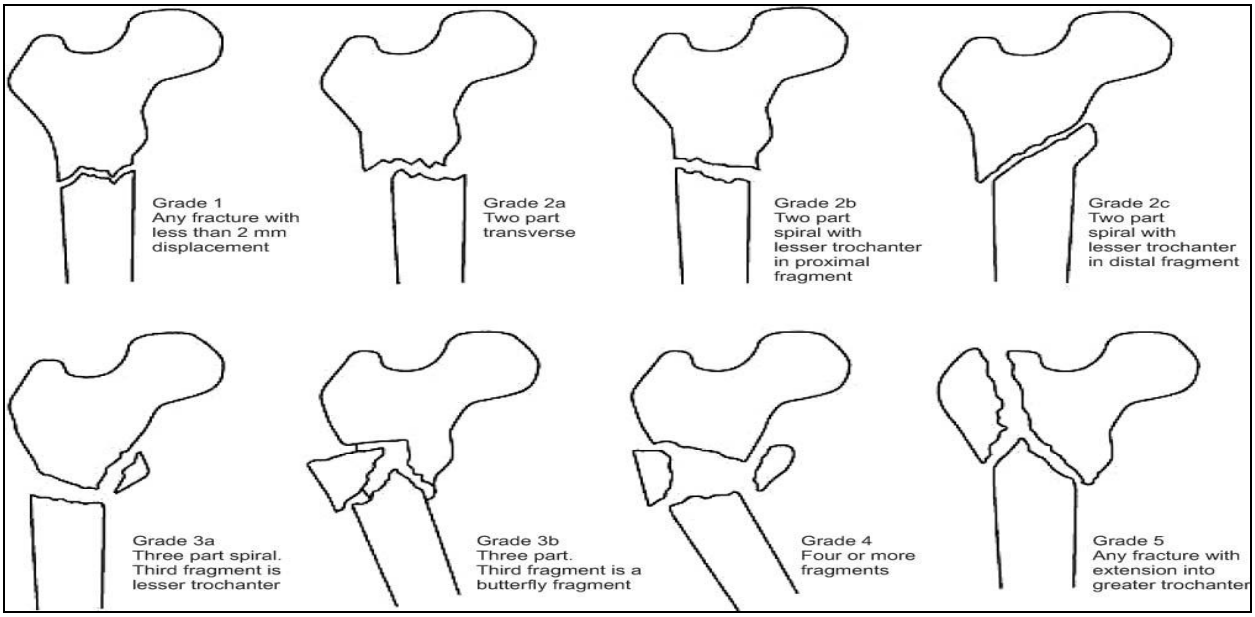
Many classification systems have been proposed, but Seinsheimer's (1978) [6] and Russell and Taylor's (1992) classifications have been used most commonly. This classification is based on integrity of the pyriformis fossa. It was designed to guide treatment of intramedullary nails using a pyriformis fossa entry.

Russel and Taylor classification



Seinsheimer's classification

Seinsheimer's classification is based on the number of fragments and the location and configuration of the fracture line. It classifies the fractures as Type I to type V [6].



Materials and Methods

A total of 36 patients with subtrochanteric femur fracture were studied from January 2014 till June 2016 at V.S. group of hospital, Ahmedabad, India after getting clearance from the ethics committee.

We evaluated 36 patients (25 males and 11 females), their age ranged from 23 years to 75 years (average 46.5yrs), who met the inclusion and exclusion criteria of the study. Informed consent was taken in all patients.

Inclusion criteria

1. Isolated subtrochanter fracture
2. Patient of either sex
3. Skeletally mature patients, age 18 to 75 yrs.

Exclusion criteria

1. Polytrauma patients with associated head, abdomen, pelvic injury or spine injury
2. Open fractures
3. Pathological fractures
4. Skeletally immature patients

Implant used: Indigenous use of standard proximal femoral nailing similar to PFN manufactured by A.O., recommended internationally.

Preoperatively

Patients were kept immobilized in form of skin traction and complete bed rest. Patients were positioned on fracture table after giving anaesthesia and closed reduction was attempted under fluoroscopic guidance confirming it on both antero-posterior and lateral views. All patients underwent fixation with proximal femoral nailing, entry through the pyriformis fossa, encirclage with tension band wiring was needed in 6 patients who had a large butter fly medial fragment. In most of the cases flexion component of the proximal fragment was corrected from the incision window made for the proximal screw insertion and external rotation was corrected simultaneously from the leverage done from the entry incision. It was ensured that the reduction was achieved before taking the entry and nail insertion.

Postoperatively

Physiotherapy in form of bedside knee bending and quadriceps strengthening exercises were started from the next day. Suture removal was done after 13-15 days of surgery. Patients were allowed non weight bear walker walking after 4 weeks, and at 6 weeks we allowed partial weight bearing, if signs of union was seen in postoperative x-ray. Full weight bearing was delayed for 3 months.

Follow up

The patients were followed up in the outpatient department of the hospital at 2 weeks post-op and then at monthly intervals for 3 months, then at 6 months and 1 year. Duration of follow up was 6 to 30 months (mean 18 months) in our study.

Radiographs, antero-posterior and lateral views were obtained for all patients at 1 month, 3 months and thereafter at 6 months interval. The range of motion of the hip and knee was examined during the follow-ups.

Results

Table 1: The average age of the female patients was 55 years and it was 43.5 years for the males. Encirclage with tension bending wiring was done in 6 PFN cases.

	Sex		Affected side		Total
	Male	Female	Left	Right	
21-30 yrs	5	0	2	3	5
31-40 yrs	6	2	5	3	8
41-50 yrs	7	4	6	5	11
51-60 yrs	3	3	2	4	6
61-70 yrs	2	2	2	2	4
>70 YRS	2	0	2	0	2
TOTAL	25	11	19	17	36

Table 2: The results were extrapolated as excellent in 32 patients (88.9percent) and good in 4 patients (11.1 percent) using the Harris hip scoring system.

Score	No. Of patients	Percentage
90-99 = excellent	32	88.9
80-89= good	4	11.1
79-70=fair	Nil	-
<70=poor	Nil	-

Table 3: All types of fracture, according to Russell and Taylor classification showed radiological signs of union by an average time of 4 months.

	No. Of cases	Union in months	Complication
1A	15	4	Nil
1B	10	4.5	Nil
2A	7	4	Nil
2B	4	5	Mild Varus

Discussion

In modern trauma care, there is no role of conservative treatment for sub-trochantric fractures as advocated by Delee *et al* [7]. The treatment of earlier subtrochanteric fractures was mainly fixed by open reduction using various implants with or without bone graft and encirclage wiring. Plating was blamed for extensive surgical exposure, severe soft tissue damage, severe blood loss, non-union and implant failure. Plating usually resulted in fatigue breakage due to a mechanical load shearing effect mainly in fractures having medial comminution. The intramedullary femoral reconstruction nails have gained popularity in recent years [9]. It has a more biological and mechanical advantage and it was accepted as an implant of choice with less complication rates of cut out, breakage of the implant or peri-implant fracture. The PFN nail has been shown to prevent the fractures of the femoral shaft by having a smaller distal shaft diameter which reduces stress concentration at the tip [8]. We consider that one of the most important aspect for the success in treating these fractures is the correct entry point; the medially shifted entry point should be on pyriformis fossa in the AP view and in line in the centre of the femoral canal in the lateral view. Long spiral fracture needs open reduction with circlage wiring especially large medial fragments.

In our series, we had used cephalomedullary interlocking nail, entry being through the pyriformis fossa, the fractures healed uneventfully and the walking and squatting abilities were completely restored with the bone union. The interlocking nail is preferred because there is a better control of the rotation and the length as confirmed by biomechanical and clinical studies. It is a load sharing devices allowing compression at the fracture site.

The lag screw of the PFN should be placed in the lower part of the femoral neck, close to the femoral calcar, with the screw tip reaching the subchondral bone tip apex distance, 5-10 mm below the articular cartilage in the AP view. In the lateral view, it should be placed in the centre of the femoral neck. Taking entry through the pyriformis fossa has an advantage which keeps the proximal fragment in valgus rotation in coronal plane and gives better reduction thereby achieving appropriate limb length. This increases the chances for union by achieving good alignment. Proper rotation of proximal fragment in valgus keeps the abductor lever arm mechanics in proper function and maintains normal gait.

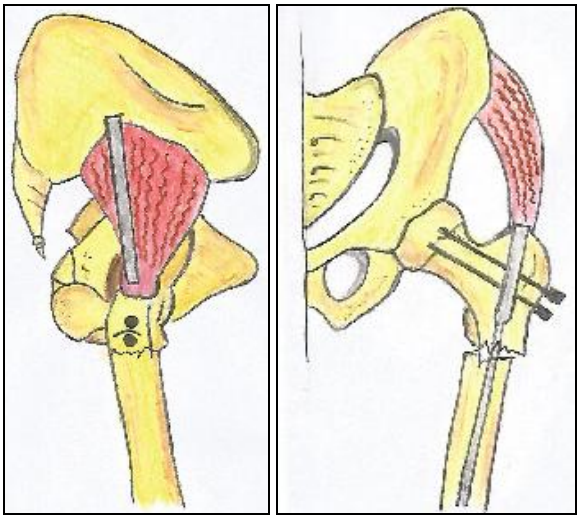


Fig 1: Showing lateral and anteroposterior view of nail entry through the greater trochanter. Abductor weakening and proximal fragment in varus malallignment.

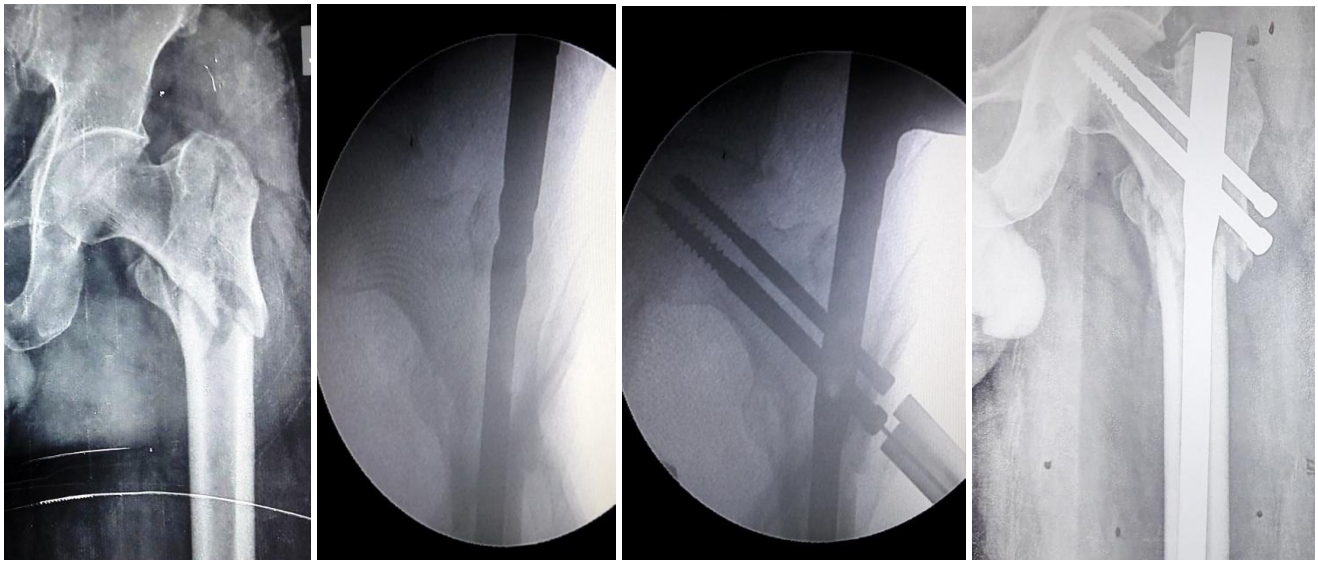


Fig 2: showing Preoperative, intraoperative and postoperative x-ray of PFN through greater trochanter entry showing varus deformity.

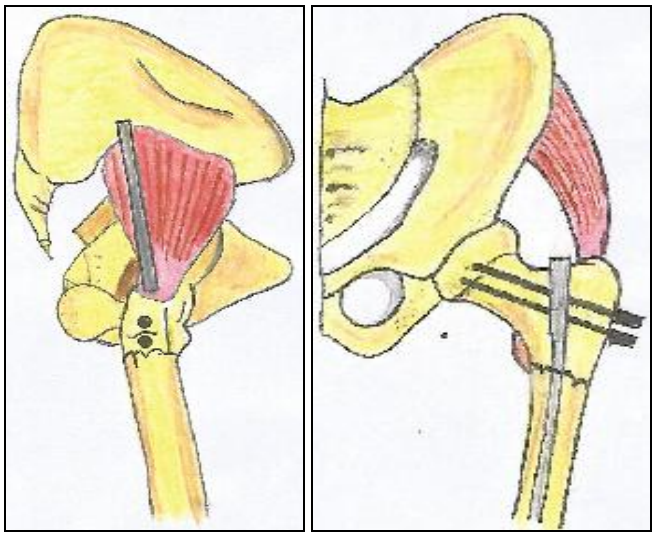


Fig 3: Showing lateral and anteroposterior view of proximal femoral nailing through pyriformis fossa entry. No malallignments and abductors strength is intact.

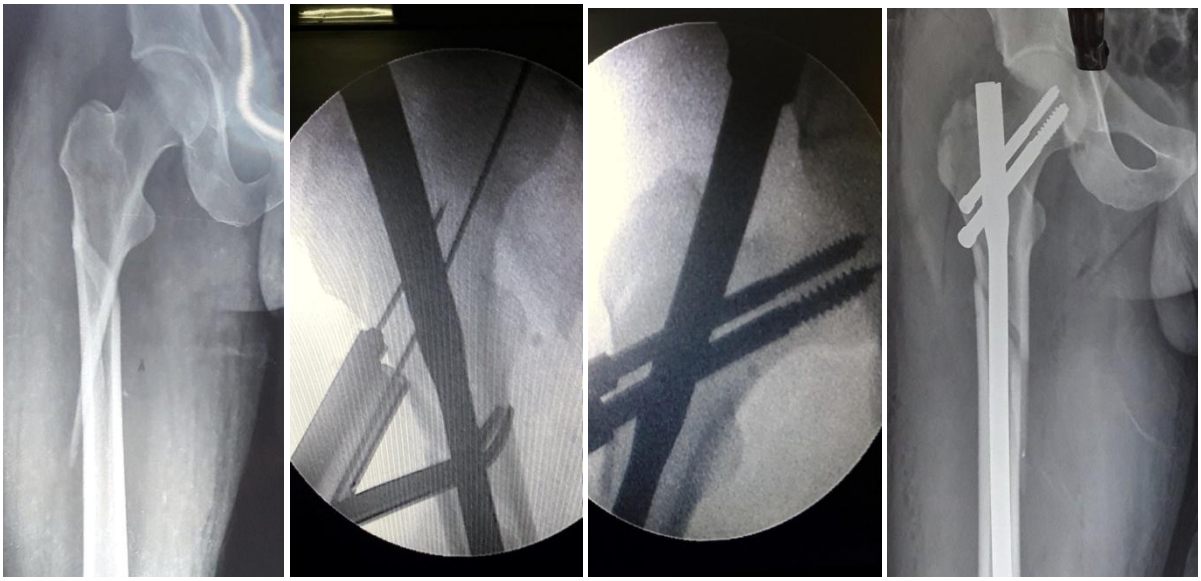


Fig 4: Preoperative, Intraoperative and postoperative x-rays of patient showing no varus deformity.

Patients can be allowed in bed mobilization from the very next day. The timing of the weight bearing will be partial up to 6 weeks and full weight bearing can be advised after 12 weeks if the lesser trochanter is attached to the proximal fragment.

Complications like non-union, failure of the implant, infection, and heterotrophic ossification were not encountered in our series expect for the mild to moderate painful restriction of the ROM of the hip in one case, mild varus deformity in one case.

Out of 36, one patient had rotational malallignments of 12 degrees, there were no other malallignments or iatrogenic fracture comminution. There was one infection complication, less blood loss. The average operative time was 48 minutes. All fractures united eventually with no bone grafting needed in any patient. Nailing through pyriformis fossa entry allowed early patient mobilization, decrease discomfort, facilitates nursing care, minimize joint stiffness and allows rehabilitation to proceed immediately, thus avoiding complications due to early recumbence, like pressure sores, deep vein thrombosis, pulmonary compromise and muscle atrophy. The functional hip outcome in terms of scoring by Harris hip scoring system showed excellent results on follow ups [10, 11].

Conclusion

Proximal femoral nailing in subtrochantric fractures is a gold standard in treating these fractures. PFN nailing done through pyriformis fossa helps in achieving better varus rotational control of the proximal fragment, giving better mechanical advantage and alignment which increases the chances for fracture union in anatomical position.

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