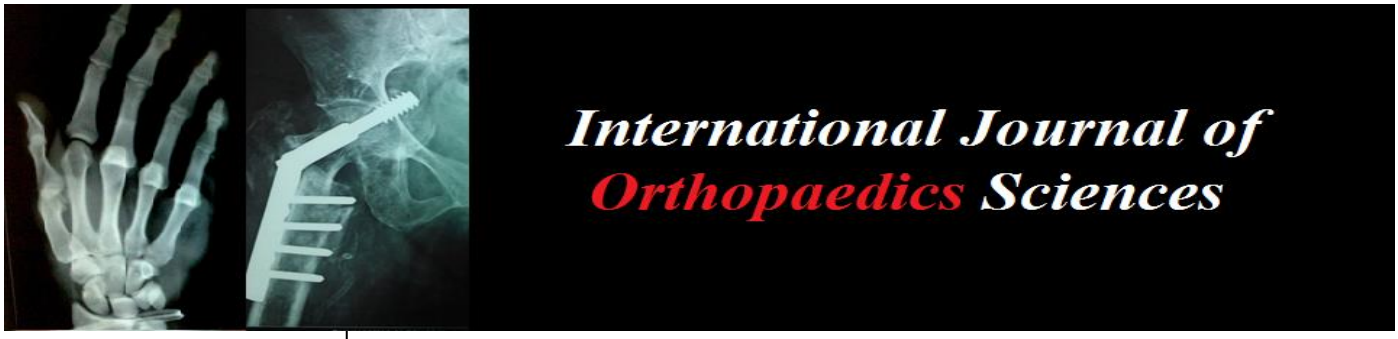

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Evaluation of peritrochanteric fractures of femur with proximal femoral nail: A prospective study

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Abstract
Peritrochanteric fractures of femur are most commonly encountered fractures in orthopaedic practice which can be treated by various modalities of management each having its own advantages and disadvantages. With advent of PFN we are able to overcome most of the complications associated with other modalities. The aim of the study is to analyze clinical, functional & radiological outcomes of peritrochanteric fractures of femur managed with proximal femoral nail and were followed up until complete fracture union. The patients were assessed periodically with HARRIS HIP SCORE. 12 patients had excellent results, 28 patients had good results, 5 patients had fair results and 5 patients had poor. Based on our study we found PFN is an ideal modality of management of peritrochanteric fractures of femur.

Keywords: PFN (proximal femoral Nail), PFF (peritrochanteric fractures of femur), DHS (Dynamic Hip Screw)

Introduction
Peritrochanteric fractures of femur are the most commonly encountered fractures in elderly, secondary to low energy trauma. These fractures also occur in younger individuals as a result of high energy trauma [1]. Management of these fractures have been vastly decided upon the age of the patient, fracture pattern, stability of fracture & amount of fracture displacement [2].
Trochanteric fractures can be managed by conservative methods provided suitable precautions are taken to prevent the fracture from mal-uniting, leading to varus & external rotation deformity at the fracture site & shortening and limitation of hip movements [3].
There are various modalities of internal fixation devices for trochanteric fractures of that most commonly we used devices is DHS with sliding screw and barrel side plate assembly. Peri & Sub-trochanteric fractures of femur posses clinical, structural, anatomical & bio-mechanical characteristics that distinguish them from intra-capsular fractures. Sub-trochanteric fractures comprises about 10 to 34% of hip fractures [4].
The most latest Implant of internal fixation device used to manage trochanteric fractures is PFN, which is also a collapsible device with added trochanteric stability. The implant is centro-medullary device and biomechanically more sound. It also has other advantages like small incision, minimal blood loss, reduces the procedure time, decreases morbidity and facilitates early rehabilitation.
In-spite of advances in anaesthesia, nursing care and surgical techniques, hip fractures remain a significant cause of morbidity and mortality in elderly population. In view of these consideration the present study of surgical management of peri-trochanteric fracture is taken up [5].

Aims of the Study
To analyze the clinical, functional & radiological outcomes of peri-trochanteric fractures using PFN.

Materials and Methods
This a prospective study consisting of 50 patients with peri-trochanteric fractures of femur

managed with PFN conducted at MVJMC&RH Bengaluru from May 2014 to April 2019. Patients were reviewed periodically both clinically and radiologically for 6 weeks, 3 months, 6 months to 1 year depending upon the fracture union. These findings are documented according to HARRIS HIP SCORE.

Inclusion Criteria

a) Patients who were in the age group from 20 and older.
b) Patients with clinically and radiologically diagnosed inter-trochanteric and sub-trochanteric fractures [Schensheimer's types 1, 2, 3A].
c) Patients who were willing to participate in the study.

Exclusion Criteria

a) Patients who were below 20 years of age.
b) Patients with compound fractures, pathological fractures and fractures over ipsilateral lower limb
c) Patients with neck of femur, Sub-trochanteric fractures [Schienshimer's 3B, 4 & 5] and shaft of femur fractures.
d) Patients who refused to participate in the study

Operative Technique

Patients aged 20 years and older presenting with peri-trochanteric proximal femoral fractures admitted to our hospital. A thorough history was elicited from the patient/attenders with regards of the nature of the injury (mechanical fall or due to any other causes). The affected limb was placed on skin traction over a Bohler - Braun frame till surgery to overcome muscle spasm. Consent for surgery was taken. All preoperative investigations were done. X-rays-of pelvis with bilateral hip antero-posterior and affect hip lateral view were taken. After anaesthetic fitness patient was posted for surgery. All other injuries were investigated and managed appropriately.

Patient Positioning: Patient lying supine on Albee's fracture table allows good roentgenographic control and enable manipulation of leg and application of traction.

Reduction of Fracture: After positioning the anaesthetised patient supine on fracture table, taking care to avoid undue pressure or tension on any part of the body, closed reduction of fracture is performed. The Uninjured limb is held in well leg holder so that it remains out of the way by putting it in 90 – 90º leg holder. Reduction is achieved by aligning distal fragment to flexed and externally rotated proximal fragment by rotating the foot of effected extremity. If Reduction is not achieved with ease, a unicortical 5mm threaded joystick is used to control proximal fragment after draping the patient. If closed reduction is not successful or not acceptable an open reduction is performed [6-9].

Procedure: A Slightly curved lateral incision is made from the level of trochanter proximally for about 6 to 9cm. The length of incision varies with the size of the patient. Under fluoroscopic guidance, a 3.2mm pin is inserted into the tip of greater trochanter, taking care to centre it on both antero posterior and lateral views. The pin is then driven 5cm into proximal femur. An alternative to this method is to use an awl, under fluoroscopic guidance to provide the opening. The awl should be inserted up to the point of largest outer diameter under fluoroscopic guidance and then removed. A guide wire is then inserted into proximal fragment.

The 9mm end cutting reamer is used above fracture site after the position of guide wire is verified by fluoroscopy. The cannulated manipulator for proximal fragment is then introduced over guide wire. Using the cannulated manipulator fracture is reduced and guide wire is passed into distal fragment. A unicortical threaded pin in proximal fragment can be used as joystick to help in reduction and can be used at this stage if reduction is difficult to achieve. Now distal fragment is reamed with 9mm reamer. Reaming must be carried out carefully in proximal fragment to avoid further comminution and lateral drift as the proximal nail diameter is 15mm. Loss of lateral portion of greater trochanter due to eccentric reaming precludes good proximal purchase and essential failure of fixation [10-14].

While reaming in lateral view care must be taken that it is as centered to head & neck as possible so that screws can be inserted without cortical penetration. The reaming process is continued at 0.5 mm increments until 1mm more than the selected nail size is reached and the proximal fragment entry point is widened with entry point widener. The selected nail is then assembled to jig and passed over the guide wire and pushed manually by rocking movements and the terminal position is hammered to the desired level and anteversion is adjusted by comparing with opposite hip or setting the anteversion of 15º. Skin is marked opposite to inferior hole of drill guide. Skin, fascia are incised and drill sleeves are inserted until they reach lateral femoral cortex and checked by image intensifier. Now a 3.2mm guide pin is inserted through inferior drill sleeves and checked under image intensifier so that it should be 4mm above the calcar and inferior in the neck. If not the position of nail is adjusted. Now sleeves are placed in proximal hole and guide pin is inserted and the final position of guide pins is checked under image intensifier before drilling.

Now the distal screw hole is drilled with 6.4 mm drill up to 5mm of subchondral bone. The length of screw to be inserted is read from calibrations on drill bit and it is tapped up to 5mm of subchondral bone and tapped with 8.0 mm tap and appropriate 8.0 mm screw is selected and inserted into the inferior hole of the nail. Now proximal screw site is drilled with 5.0 mm drill bit and tapped with cortical tap of 6.4 mm and the screw is inserted. Then the distal interlocking screw is inserted through the insertion handle. Skin is marked over holes and small incision in made in lateral thigh. Blunt dissection is carried out to the lateral cortex. Over the drill sleeve 4 mm drill bit is passed and is drilled across femur. This is checked on fluoroscopy in both anteroposterior and lateral views and appropriately sized screw is selected and inserted. Then the second interlocking screw is also inserted in the same manner [14-17].

Post-Op Care: Appropriate antibiotics and analgesics given. Staples were removed at the end of two weeks. Patients were advised to continue non weight bearing ambulation with a walker or axillary crutches. Partial weight bearing started at 6 weeks for stable fracture configurations and delayed further for unstable fractures / comminuted fractures. Serial Check x rays were done at six weeks interval. During follow up Clinical & radiological evaluation done to access fracture union. The functional outcome assessed as per Harris Hip Score & graded accordingly [18, 19].

Results

The following observations were made from data collected during study.

- Total cases: - 50

- Average age: - 58 yrs
- Male / Female: - 18/ 32
- Side: - Right: Left 20:30

We did not encounter any case with an open fracture during this study.

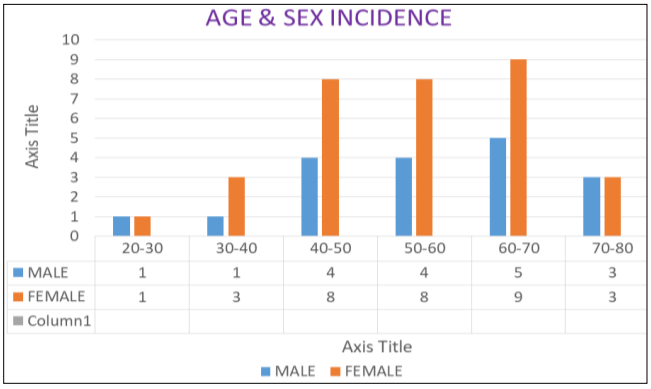

Fig 1: This was the age & sex incidence noted in our study.

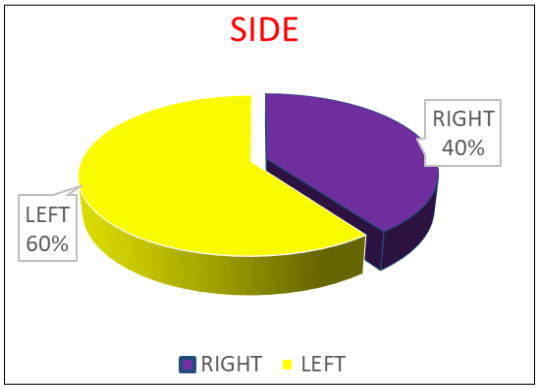

Fig 2: This was the side distribution in the study

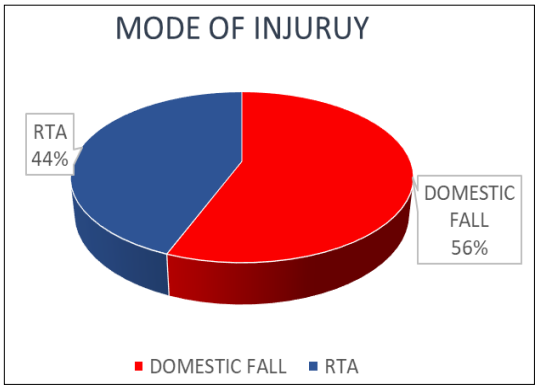

Fig 3: Domestic fall was the major incidence in our study

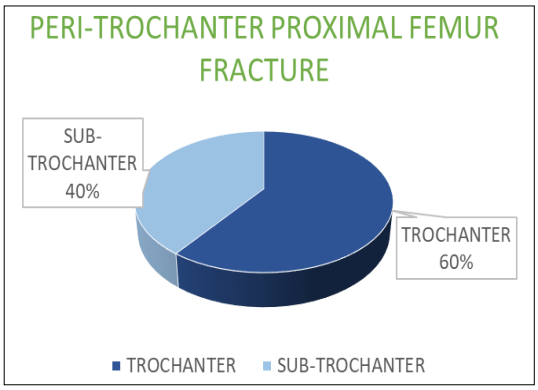

Fig 4: This was the incidence of type of fracture.

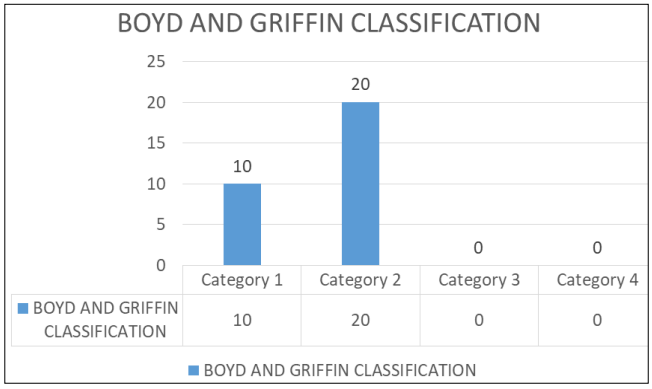

Fig 5: These were the incidence of trochanteric fracture noted in the study according to BOYD AND GRIFFIN classification

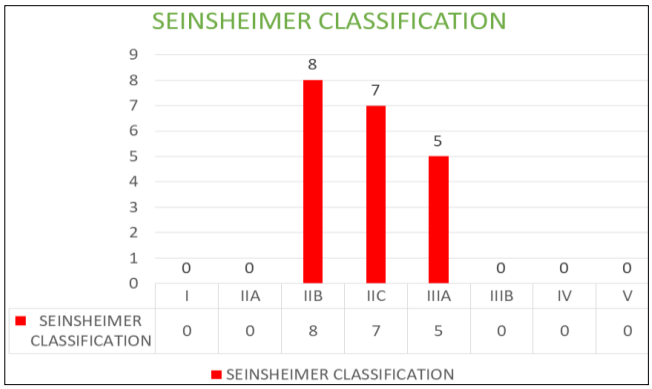

Fig 6: These were the incidence of Sub-trochanteric fracture noted in the study according to SEINSHEIMER classification.

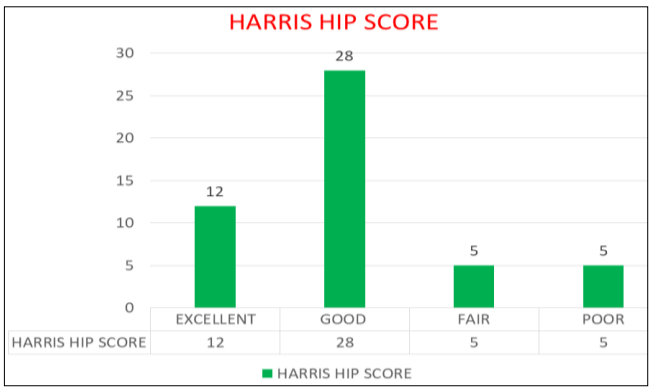

Fig 7: According to our study we had 12(24%) excellent results, 28(56%) good results, 5(10%) fair results & 5(10%) poor results.

Discussion

The treatment of peri-trochanteric fractures of proximal femur is still associated with some failure the most common current modes of fixation are BLADE plate system, Sliding Screw system, Intra-Medullary devices. From mechanical point of view a combined intramedullary device inserted by minimally invasive procedure seems to be better in elderly patients. Closed reduction preserves fracture haematoma & essential element in consolidation process. Intramedullary fixation allows the surgeon to minimize soft tissue dissection there by reducing surgical time, blood loss, infections & wound complications.

The Arbeitsgemeinschaft fur osteosynthesefragen (AO ASIF) in 1996, therefore developed the proximal femoral nail with an anti-rotation hip pain together with a smaller distal shaft diameter which reduces stress concentration to avoid these failures [20]. Proximal femoral nail has all advantages of an

intramedullary device, such as decreasing the moment arm, can be inserted by closed technique, which retains the fracture haematoma an important consideration in fracture healing, decrease blood loss, infection, minimizes soft tissue dissection and wound complications.

Simmermacher *et al*. (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, 2 with varus malreduction. Anatomical fracture reduction was found in 90% of the patients and full weight bearing stability was achieved in 92%. In our study acceptable anatomical reduction was obtained in 85% cases but we open reduced two fracture [21].

An intraoperative 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 that the entry point of the PFN at the tip of the greater trochanter is located directly in the fracture region which can cause an intraoperative fracture displacement. However, Simmermacher *et al*. (1999) 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 comparison to gamma nail, we found no fracture of the femoral shaft and no break in the implant [22].

The aim of the study was to study the epidemiology of peritrochanteric fractures 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. In our study, peritrochanteric fractures were more common due to slip and fall. Age ranged from 30 to 80 years with mean age of 60.1 years. Females were more common contributing of 56.6% of cases. Left sided fractures were more common in our study accounting for 60% of cases.

Age distribution

In our series, proximal femoral fractures was most common in 5th to 7th decade with mean age of 58 years. This result is well comparable with other series.

Table 1: Showing Age Distribution in Various Studies

Sl. No.	Series	Mean Age (Yrs)
1	Simmermacher R K J, Bosch A M *et al.* [23]	78
2	Christian Boldin. [24]	71
3	Shishir Murugharaj Suranigi *et al.* [25]	62.36
4	Gupta SKV *et al.* [26]	53.9
5	Ajay Kumar *et al.* [27]	52.66
6	Present study	58

The study conducted by us had similar age distribution when compared to other studies

Table 2: Showing Side Involved in Various Studies

Sl. No.	Series	Right	Left
1	Koyuncu *et al.* [28]	48%	52%
2	Shivanand C. Mayi *et al.* [29]	59.37%	40.63%
3	Present Study	40%	60%

In our study we found to have a left predominance which are similar to other studies

Table 3: Mode of Injury in Various Studies

Sl. No.	Series	Slip & Fall	RTA
1	Reddy Pln *et al.* [30]	45%	55%
2	Ajay Kumar *et al.* [31]	70%	30%
3	PRESENT STUDY	56%	44%

Domestic fall was major cause for pertrochanteric proximal femoral fractures as noted by our study.

PRE-OP X-Ray

Immediate Post-OP X-Ray

6 weeks Follow-Up X-Ray

Pre Op X-ray

Post-op Xray

6 weeks Follow-up x-ray

12 weeks follow-up x-ray

Summary and Conclusion

Peritrochanteric fracture is a leading cause of hospital admissions in elderly people. The number of such admissions

is on a raise because of increasing life span, sedentary habits and increased road traffic accidents.

Conservative methods of treatment results in malunion with shortening and limitation of hip movement as well as complications of prolonged immobilization like bed sores, deep vein thrombosis and respiratory infections. This study is done to analyze the surgical management of Peritrochanteric fractures using Proximal Femoral Nail.

In our series of 50 cases there were 18 male and 32 female, maximum age of 80 yrs and minimum age of 24 yrs, most of the patients were between 40 to 70 yrs. Mean age of 58 yrs. 56% of cases were admitted due to slip and fall and with slight predominance of left side.

Out of 50 cases, 30 were trochanteric and 20 were subtrochanteric. In Trochanteric class 63% were Boyd and Griffin type 2, in Subtrochanteric class 40% were Seinsheimer type 3a, 35% were 2b and 25% were type 2c.

From this sample study, we consider that PFN is an excellent implant for the treatment of Peritrochanteric fractures. The terms of successful outcome include a good understanding of fracture biomechanics, proper patient selection, good preoperative planning, accurate instrumentation, good image intensifier and exactly performed osteosynthesis.

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