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To evaluate the results of PFN in unstable proximal femoral fractures using Harris hip score

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Abstract
Introduction: Proximal Femoral fracture is one of the most devastating injuries in orthopaedic traumatology. In the past, these injuries were commonly noted in elderly person. With the industrial development, these injuries have become more common in young adults. This is mostly high velocity trauma and leads to unstable proximal femoral fracture. This has become a challenging fractures to treatment among the orthopaedic surgeons now a days
Material and Method: My purpose to conduct a non randomized prospective study of the Role of Proximal Femoral nail in 50 adults with unstable Proximal Femoral Fractures. This study were be conducted in the Department of Orthopaedics PCMS, Bhopal.
Result: One the basis of Haris Hip score functional assessment, at 1 year 33(66%) patients showed excellent results while 13(26%) patients showed good, 2(4%) patents fair, 2(4%) patients poor.
Conclusion: Surgeon may treat the demanding unstable proximal femoral fracture with any type of fixation device as long as He/ She remembered that the fixation device will never make up for surgical failure. Therefore improvement in the treatment of unstable proximal femoral fracture were predominantly in the hands of the surgeon rather than in the hands of industries.

Keywords: Unstable proximal femur facture - proximal femur nailing

Introduction
Fracture of Trochanter is one of the most common fractures of the hip especially in the elderly with porotic bones. By 2040 the incidence is estimated to be doubled. In India the figures may be much more. Problems of these fractures are,

1. Association with substantial morbidity and mortality.
2. Malunion
3. Implant failure, screw cutout of head, and penetration into hip.
4. Great financial burden to the family.
5. Associated medical problem like diabetes, hypertension.

Intertrochanteric hip fractures account for approximately half of the hip fractures in the elderly; out if this more than 50% fractures are unstable. Unstable pattern occur more commonly with increased age and with low bone mineral density. [1] Unstable intertorchanteric fractures are those in which communition of posteromedial buttress exceeds a simple lesser trochanteric fragment or those with subtrochanteric extension. The results of unstable fractures are less reliable and have a high rate of failure.-8%-25%.
Subtrochanteric fractures occurs “between lesser trochanter and a point 5cm distally and are seen as independent entities or as an extension of intertrochanteric fractures. The common problem for these fractures has been malunion, delayed union or non union. malunion in the form of shortening, angular deformity and rotational malalignment were common results after this injury. The main reason has been the area fractures is mainly a cortical bone and often the fracture is communited. Another factor responsible is a large bio-mechanical stresses are acting in the subtrochanteric region which results in failure of implant fixation before bony union occur [2, 3].
Over the past 50 years, a wide variety of implants and fixation strategies have been utilized for the surgical stabilization of inter trochanteric hip fractures.

The introduction of the sliding compression hip screw and side plate in the 1950's was considered a major advance over various nail-plate devices. The use of the sliding compression hip screw and side plate became the standard care for the surgical treatment of these fractures, although other methods continued to be available. Sliding hip screw devices have been developed to overcome the difficulties encountered in the treatment of unstable trochanteric femoral fractures. Until recently, most of these fractures were treated by a sliding hip screw system. Since this device performed less well in unstable trochanteric fractures, with high rates of failure [4-8].

In the early 1990`s, a new fixation device was introduced for the treatment of intertrochanteric fractures. Intramedullary fixation devices have become increasingly popular [9-11].

The variety of the implants for treatment of unstable trochanteric and subtrochanteric femoral fractures continues to increase. From the biomechanical point of view, 2 main alternatives are available. The first type of implant consists of sliding neck screw or bolt connected to a plate on the lateral femoral cortex; this is inserted after closed or limited open reduction. In unstable trochanteric fractures, an additional "antirotational" screw is recommended and in case with several fragments and/ or impaired bone quality, a trochanter stabilizing plate should also be used [12-14].

So many implants are available for treating these fractures. In our study we would be using proximal femoral nail for fixation because it combines the advantages of DHS and intramedullary nail. Hence it allows early weight bearing and mobilization of the joints.

Advantages of Intramedullary Nails

a. **Biological**

1. A closed reduction and less soft tissue dissection, therefore more biological fixation.
2. Shorter surgical time.
3. Less blood loss.
4. Improved early patient mobility at 1 and 3 months postoperatively.

b. **Mechanical**

1. The nail also has a shorter lever arm. Which decreased the tensile strain on the the implant and reduced the risk of mechanical failre. It is subjected to lower bending moment due to their intramedullary location. It is a load sharing device allowing early weight bearing.
2. Controlled fracture impaction is maintained
3. More stable fixation
4. Prevention of rotational deformity

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Material & Method

Material

The study conducted at PCMS & RC BHOPAL, M.P during 2006 to 2008 to evaluate the Role of Proximal Femoral nail in 50 adults with unstable Proximal Femoral Fractures. Result were evaluated by Harris hip score.

Inclusion Criteria

1. Fresh cases of unstable proximal femoral fractures with in one week after injury.
2. AO/ASIF 31A2 & 31A3
3. AO/ ASIF classification -32B & 32C.
4. Communited pertrochantric fracture

Exclusion Criteria

1. Unstable hip fracture with ipsilateral shaft fracture
2. Grossly abnormal femoral canal, in presence of infections & secondaries.
3. Inability to walking before fracture.
4. Other fracture include with rehabilitation
5. Pathological fracture.
6. Infection
7. Tumor/ Secondaries

Methods

Pre-operative workup include all routine investigation, preanesthetic check-up, measurement of the limb length and nail diameter on the healthy side.

After successful induction patient taken on fracture table and closed reduction of the fracture done under image control.

The incision begins at the level of the tip of the trochanter and extents proximally to about 5-8 cm, depending on the size of the patient. Incision is deepened through the fascia lata, splitting the abductor muscle immediately above the tip of the greater trochanter, thus exposing its tip.

Bony Entry Point

The determination of the correct entry point is preeminently tactile. Sagitally, the apex of the trochanter is by tubercular like a camel`s, back the palpating finger should stop in the middle between the two humbs, in the concavity of the apex of the trochanter. Transversly, the finger is halted just at the apex of the convexity of the trochanter, neither laterally nor medial, the mentioned entry corresponds to the junction of the anterior third and posterior two third of the greater trochanter. At this stage, it is important to check the position of the pointed Awl on the AP and lateral views with the image intensifier. A Correctly selected insertion point and angle are essential for good surgical result.Enlarge entery point with the reserve awl use the tissue protectoe to spare the soft tissue. Drive the awl over the guide wire into the femur until the marking on the awl shaft level with the trochanter tip.

After making correct entery placing the guide wire and over it proper reaming.

Then proper size nail inserted by Non Hammering technique.

Lag screw

Once the lag and antirotation screw lengths have been determined, both guide pin shseaths are removed. A larger screw 90 to 105 mm in the length and hip pin 10-15 mm shorter than lag screw. Lag screw inserted near the subchondral femoral head. The PFN fixed with two screws a larger lag screw is designed to carry most of the load in smaller screw (Hip Pin) is provided rotational stability. If the hip pin is larger than lag screw the vertical force would be increased on the hip pin and started cut out, a knife effect and Z effect. This might be forces of hip pin to migrate into the joint and the lag screw to side laterally.

Post operatively patient was mobilized on post operative day one.

Result & discussion

The unstable trochanteric fractures are particularly difficult to treat because of constant pull of the strong abductors of the hip and being a highly stressed region in the body with forces in the range of 2000 pounds psi operating along the medial cortex about 1 to 2 cms below lesser trochanter. In an experimental study, Gðtze *et al*. [15] compared the loadablity of osteosynthesis of unstable pertrochanteric fractures and found that PFN could bear the highest load of all devices.

The mean age of the patients is lower in this series than those

reported in western literature. In this series average age of patient was 39.18 years as compared to 76.7 years by Simmermacher [16], 80.1 years by Domingo [17] and 82.2 years by Schipper [18] and 63.7yrs Reska M *et al*[19]. This is because life expectancy is slightly higher in the western countries and osteoporosis sets later in life due to better nutritional status.

Males had this fractures more than in females. In our study there were Male 78% and female is 11% because of in our country men are more mobile and more involved in outdoor activity but the western series have quoted higher incidence in women. The ratios quoted are F: M 4:1 Pajarinen *et al*. [20] 8:1 Schipper [18]. And also on account incidence of RTA being higher in males.

In this series males were predominantly affected probably because road traffic accidents was the commonest cause and males are more commonly involved in outdoor activities.

According to Ecker [21] left hip is the predominant side to be involved. This study revealed right side was the more commonly involved side. This is only a statistical fact with no clinical relevance.

The mean time of operation day after fracture K.S Leunge *et al*. [22] 2 days in the Gamma nail and 2.2 days in DHS. In our series mean time of operation day after fracture was 3.82 days. Because they presented late in hospital

I.B S Chipper *et al* [18] and Christian Boldin *et al*. [23] used AO/ASIF Classification 31A2 to 1 to 3 & 3A3 1 to 3. In our series we classified the fracture according to AO/ASIF classification for intertrochanteric and subtrochanteric fracture into Type 31A2, -24%, 31A3-16%, 32B-24%, 32C-36%.

In present series some of the benefits of a minimally invasive surgery namely decreased blood loss & faster rehabilitation were obvious. The mean operative time was 73.2 mins (range 50mins to 90 mins) this compares with other published by studies. The average time being 55 minutes by Pajarinen *et al* [20]; 82 minutes by Christophe Sadowski *et al*. [24] According to Leung *et al*. [22] and DHS average time of surgery 52 minutes.

The average blood loss was significantly less than that seen during DHS. It was comparable to other series of blood loss in Proximal femoral nail. In this series the average blood loss was 130-150 ml (average) & it is comparable to 320 ml by Pajarinen *et al*. [20] 1043 ml by Leung *et al*. [22] & 440 ml by Sadowski *et al*. [24] Only 10 % of our patient required postoperative blood transfusion and is comparable to 15% by Christophe Sadowski *et al* [24].

Many authors have compared the results of PFN with DHS & DCS in terms of duration of surgery and blood loss. They found that there was not much difference in duration of surgery but the average blood loss was significantly less with PFN. Pajarinen *et al*. [20] have shown that average blood loss with DHS fixation was 495 ml and Sadowski *et al*. [24] showed that average blood loss in DCS fixation was 850 ml, while in our series with PFN the average blood loss was 130-150 ml.

Incidence of femoral shaft fractures has been reported by different authors

Pajarinen *et al*. [20] have reported 3.7% intraoperative & 2.2% postoperative femoral shaft fracture. Simmermacher *et al*. [16] has reported no intraoperative postoperative fracture of shaft femur. In this series no femoral shaft fracture either intra operative or postoperatively was found and this compares favorably over Gamma nail in which the fracture at the tip of implant can reach up to 18 % Butt M S [25]. Some author have reported Gamma nail for treatment of unstable Subtrochanteric fracture because of its higher loadability Guyer *et al*. [26] Leung *et al*. [22] Prinz *et al*. [27] Bridle *et al*. [28] While Radford *et al*. [29] did not recommended the use of the Gamma nail because of the high incidence of femoral Shaft fractures. The PFN has been shown to prevent of femoral shaft fractures by having a smaller distal shaft diameter which reduces stress concentration at the tip Simmermcher *et al*. [16]

Lustenberger [30] suggested that in unstable pertrochanteric fractures, upto 10% of the head neck fragments show radiologically identifiable rotation leading to a high number of cut outs in Gamma nail. The additional anti rotation hip pin in PFN seem to prevent these cut outs. No case of superior cut out of lag screw through superior surface of head & neck. Different authors have given different values for superior cut out of lag screw. Simmermacher [16] *et al*. has reported 0.8% cut out & Domingo *et al*. [15] has reported 1.35% cut out in his series. In our series there were no cut out of Lag screw.

Incidence of intra operative fracture or later fracture of femur is significantly less with DHS as compared to both Gamma nail and PFN and this has been reported by many studies. Incidence of cut-out of lag screw is controversial because many authors have reported cut-out more with DHS while others have reported it more with the PFN. Schipper *et al*. [18] have reported a cut out rate of 6.6% with gamma nail and 6.9% with PFN. Simmermacher *et al*. [16] have not reported any case of post operative of later fracture of femur with DHS while Radford *et al*. [29] have shown fracture in 1.0% operative fracture of femur and 3.0% cut out with DHS.

In Simmermachers *et al*. [16] study was anatomical reduction was found in 86% of the patient and full weight bearing stability achieved in 94% Christian Boldin, Franz seibert *et al* [23]. Study shown anatomical reduction was in 82% and immediate full weight bearing was allowed in 90%. In our series anatomical reduction was achieved in 64% patient. Full weight bearing was allowed in 80%.

In our study open reduction was done in 8% of the patients which had AO/ASIF Type32C 4% and 2% in AO/ASIF Type31A2. In comparison to other study and literature Schipper *et al*. [18] series open reduction in 8.1% in PFN and 3.1% in Gamma Nail. Friedle *et al*. [31] reported open reduction in 8% AO/ASIF classification of the 31 A1, 13% of the A2 and 53% A3 fractures.

In our study intra operative complication were seen in 12%. Local complication was of proximal screw in 4% and 2% in distal screw, breakage of K-wire in 2%. Logistic instrumental problem was 4% of patient. Other studies had shown IB Schipper *et al*. [18]. local problem in 6.1% in the PFN series that was included proximal screw complication in 1.8% complication in distal screw 1.4% and instrumental problem in 2.6% and breakage of K-wire is 0% in PFN series in Gamma nail series local problem were 5.6% that of proximal screw 0.46%, distal interlocking; 2.8% and instrumental complication in 1.4%.

Perception of surgery according to surgeon was operative time and blood loss and reduction. In our study showed perception of surgery was easy 24%, moderate -78%, difficult in 6% I.B Schipper [18] perception of surgery was easy 33.6% and moderate 48.8% and difficult 16% in PFN series in the Gama nail study perception of surgery was easy 34.3% moderate 54.5% and difficult 11.3%.

We had only superficial infection in 4% case, deep infection in 2% cases and Haematoma in 6% of Patients probable it was due to the fact that patient soiled the dressing post operatively. This superficial infection and haematoma resolved by antibiotic coverage & did not require prolonged

hospital stay.

The incidence of infection is very low in cases of PFN as compared to DHS and gamma nail. This is also shown by many authors. Probably the rate of infection is less because of less soft tissue trauma and closed technique in cases of PFN. The other studies showed Radford *et al*. [29] DHS 8% Schipper *et al*. [18] Gamma Nail 7.4% and in PFN 4.1%.

In Ib Schipper & E.W Styeberg *et al*. [18] study showed general complication in PFN series cardiovascular 14.8%, Pulmonary 6.3% and urogenetal 13%, Neruological 4.3%, Gastroinstestinal 0.5% and Thromboembolic 2.7%, Pressure sore 8.5%. Gamma nail series were shown cardiovascular 15.4%, pulmonary 5.5%, urogentital 13.3%, neurological 6.7%, gastrointestinal 6.3%, thromboembolic 0.5% and pressure sour 5.6%, K.S Lounge *et al*. [22] study showed in Gama nail chest infection 1.7% cardiovascular 0.8% renal complication 3.5% CVA 0.8% DHS series chest infection 2.6% cardiovascular 3.5% renal complication 0.8%, CVA 1.7%. In our study showed only gastroinstetinal 4% and pulmonary 2% of patients. General complications were low in our series because of early mobilization, less complication during surgery and better patient care.

Intraarticular screw migration was not seen in any case of this series.

The proper placement of lag screw was related to good functional out come. The cases where the lag screw was placed in the inferior quadrant on the AP & central or posterior in the lateral view along with subchondral placement at 6 months. Majority of patients in our series had a good reduction according to Baumgaertner classification because of meticulous interest was paid to the position of lag screw and tip apex distance which is the major predictor of cut out. The cut out rate in other studies is as follows Domingo *et al* (100) study in PFN - 1.35% Schipper *et al*. (101) study in PFN/Gamma nail- 6.9/6.6% In our study PFN cutout is 0%.

We had varus (<15°) deformity in 2 cases (10%) & in these cases the fracture was fixed in varus at the time of surgery and similar rate has been recorded in other literature e.g. 4% by Domingo *et al* [32]. These were our earlier cases which are related to its steep learning curve.

There was no difference in hospital stay for PFN as well as for DHS. Many authors have reported hospitalization of almost equal periods for both DHS and PFN.

Schipper *et al*. [18] study using in gamma/ PFN nail had an average of 19/21.7 days, Leung *et al*. [22] Study in using DHS had an average 28 days stay in hospital and Goldhagen *et al*. [33] DHS series average hospital stay was 12 days.

Domingo *et al* study in [17] using PFN had an average 15.4 days stay in hospital.

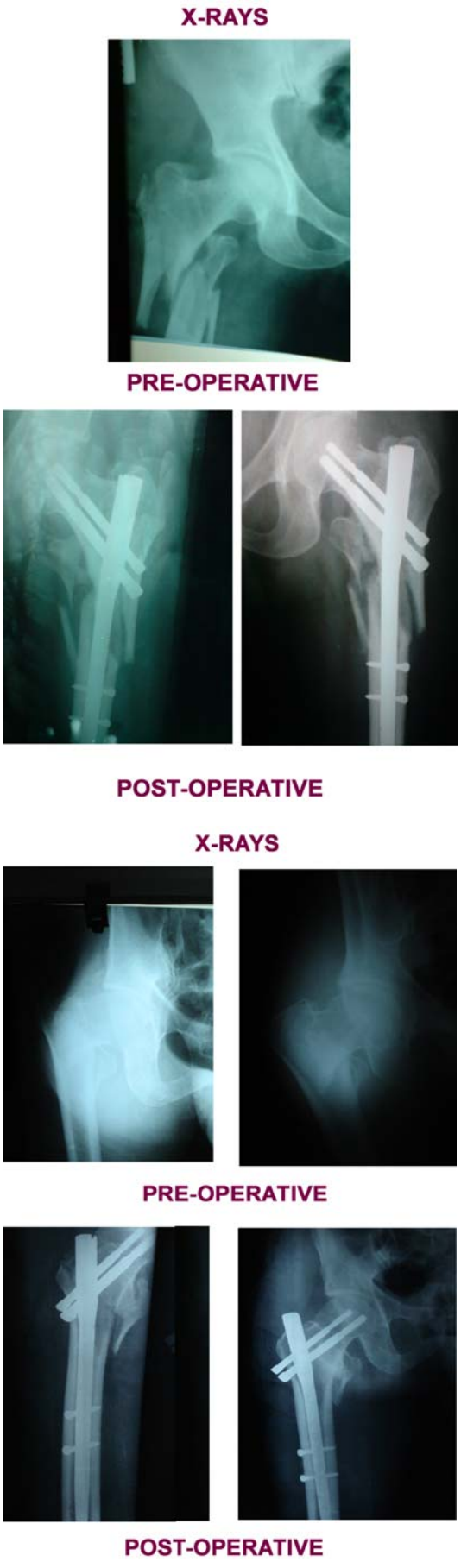
In our study average hospital stay was 14.24 days.

IB Schipper & EW STeyerberg [18] study were showed according to Harris hip score [34] PFN and Gamma Nail 4 month and one year.

In our study were showed according to Harris hip score [33] 3months 6 months and 1 year.

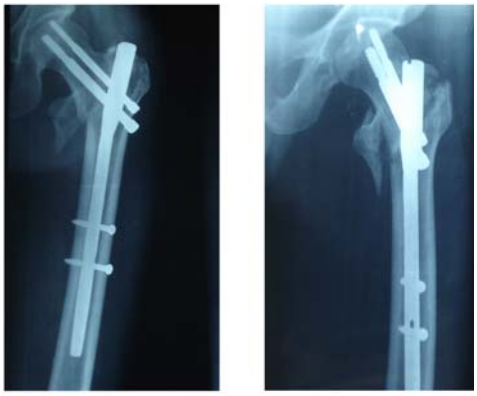
There was decreased the mean Harris hip score 3 month than progressive recovery after 6 Months and one year.

Mortality in old patients who already have a lot of medical problems is expected to be higher; Schipper [18] reported an incidence of 24.5% & Simmermacher [16] an incidence of 19%. There is no death reported in this series due to causes unrelated to fracture or its treatment.



X-RAYS

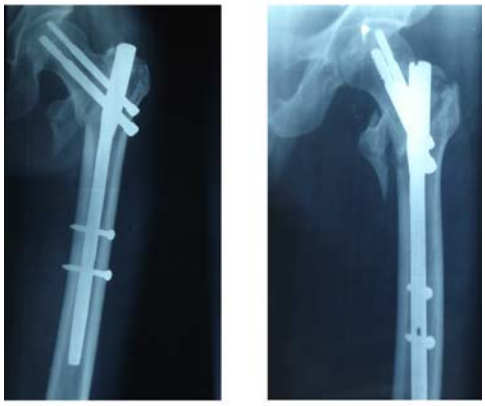
PRE-OPERATIVE



POST-OPERATIVE

X-RAYS

PRE-OPERATIVE



POST-OPERATIVE

Summary & Conclusion

In this series problem was encountered in fixation of reverse oblique subtrochanteric fractures because proximal fragment remained in abduction & lag screw passed through fracture site.

None of the cases in the series had superior cut-out of lag screw because the screw was placed in superior quadrant is AP. Better placement of hip screw would avoid this complication.

One case in this series had breakage of k-wire in femoral head between lag screw & Hip pin. It was left inside the head as it was >1cm of anterior surface.

One the basis of Haris Hip score functional assessment, at 1 year 33(66%) patients showed excellent results while 13(26%) patients showed good, 2(4%) patents fair, 2(4%) patients poor.

At the end of the study we came to the following conclusions.

1. PFN nail fixation for trochanteric fractures is a demanding procedure.
2. It provides adequate stabilization of fracture as has been observed by immediate mobilization of patients.
3. Its application produces minimal amount of surgical trauma to the patient & does not require blood transfusion and chances of post operative infection are less.
4. With PFN nail fixation, there is early functional recovery, no pain, stiffness & return of the patient to pre injury status in majority of patients.

PFN nail is new cephomedullary device and has proven advantages over DHS in unstable traumatic procedure and biomechanically better implant. Medial placement of the implant reduces the bending stress and axial torque by reducing the distance between the hip joint mechanical axis of the implant. It reduces better transfer of the stresses thus reducing the incidence of implant failure.

Early mobilization and weight bearing reduces muscle wasting, post immobilization osteoporosis joint stiffness etc, and also allows axial micro motion at the fracture site leading to early union.

Result of our study have shown that the newly developed PFN is good as compared to other studies and comparable complications.

At present we consider that the PFN is a good minimally invasive implant for unstable proximal femoral fractures. When closed reduction is possible. The modification of the PFN and careful surgical technique should reduce the high complication rate in our study.

Surgeon may treat the demanding unstable proximal femoral fracture with any type of fixation device as long as He/ She remembered that the fixation device will never make up for surgical failure. Therefore improvement in the treatment of unstable proximal femoral fracture were predominantly in the hands of the surgeon rather than in the hands of industries.

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