

Original Research Article

A prospective comparative study in the clinical outcome of trochanteric and subtrochanteric fracture femur with proximal femoral nail versus dynamic hip screw

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ABSTRACT

Background: Trochanteric fractures are the most common fractures encountered accounting for 50% of all hip fractures. Subtrochanteric femur fractures have high rate of complications associated with their management. 10%–34% of all hip fractures occur in the subtrochanteric region. The study was to compare the clinical outcome of trochanteric and subtrochanteric fracture femur with proximal femoral nail (PFN) versus dynamic hip screw (DHS).

Methods: A prospective study of 50 patients with intertrochanteric and subtrochanteric fracture among which 30 were treated with Proximal Femoral Nail and 20 with Dynamic Hip Screw at SSIMS-SPARSH Davanagere, Karnataka, India between June 2015 to November 2016. At final follow up results were assessed with Modified Harris Hip score.

Results: Among the PFN Intertrochanteric fracture group, 9 patients showed excellent outcome, 6 patients showed good outcome and 2 patients showed fair outcome and 1 patient showed poor outcome. Among the PFN subtrochanteric fracture group, 7 patients showed excellent outcome, 3 patients showed good outcome and 1 patients showed fair outcome and 1 patient showed poor outcome. Among the DHS intertrochanteric fracture group, 3 patients showed excellent outcome, 3 patients showed good outcome and 2 patients showed fair outcome and 2 patient showed poor outcome. Among the DHS subtrochanteric fracture group, 1 patients showed excellent outcome, 2 patients showed good outcome and 3 patients showed fair outcome and 4 patient showed poor outcome.

Conclusions: Fractures of the trochanteric region of the femur need a proper selection of implant based on fracture pattern. DHS has excellent results when used on stable fractures. For unstable fractures, PFN is the implant of choice. In case of subtrochanteric fractures PFN has better results in both stable and unstable fractures compared to DHS with less failure rates and restoring better hip biomechanics.

Keywords: Trochanteric fracture, Subtrochanteric fracture, DHS, PFN, Harris hip score

INTRODUCTION

Fractures of the proximal femur are the most common fractures encountered in orthopedic traumatology. Most proximal femoral fractures occur in elderly individuals as

a result of only moderate or minimal trauma. In younger patients these fractures usually result from high-energy trauma. High-velocity injuries are more difficult to treat and are associated with more complications than low-velocity injuries.¹

Intertrochanteric fractures usually unite if reduction and fixation are properly done as wide area of bone is involved, most of which is cancellous, and both fragments are well supplied with blood. Although malunions may be a problem, late complications are rare. When a high-energy intertrochanteric fracture produces comminution, a large fragment of the posteromedial wall of the femur, often including the lesser trochanter, splits free. This bony buttress is important to the stability in the intertrochanteric region; therefore, its comminution results in an unstable fracture.²

Subtrochanteric fractures, which account for 10% to 15% of proximal femoral fractures.¹ Following a fracture in the subtrochanteric region the proximal fragment to flexed, externally rotated and abducted. Distal fragment displaces medially and further aggravates the deformity and that's why 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 and furthermore the substance of the bone in the subtrochanteric region changes consistency as it progresses from the vascular cancellous bone of the intertrochanteric region to the less vascular diaphyseal cortical bone of the proximal shaft.^{1,3} Subtrochanteric fractures are associated with high rates of nonunion and implant fatigue failure because of the greater mechanical stresses in this region. The main goals for the treatment of these fractures are, to restore the pre-fracture activity status, to allow early full weight bearing.

Aims and objectives

To compare the clinical outcome of intertrochanteric and subtrochanteric fractures treated with proximal femoral nail (PFN) versus dynamic hip screw (DHS).

METHODS

A prospective study of 50 patients with Intertrochanteric and subtrochanteric fracture femur among which 30 were treated with proximal femoral nail and 20 with Dynamic hip screw at S.S.I.M.S SPARSH, Davangere, Karnataka, India between June 2015 to November 2016. Patients with Segmental fracture, pathological fracture, open fracture and fracture before physeal closure were excluded.

In this study OTA classification⁵ was used for intertrochanteric fracture considering fractures 31A1.1 through 31A2.1 as stable, and fractures 31A2.2 through 31A3.3 as unstable. For subtrochanteric fractures, Seinsheimer classification was used considering type I to type IIb as stable fractures and type IIc to type V.⁶

Among the 30 patients treated with PFN, 19 were male and 11 were female. 17 patients had fracture of right femur and 13 had fracture of left with 18 patients being

treated for intertrochanteric fractures and 12 patients being treated for subtrochanteric fracture femur.

Among the 20 patients treated with DHS, 11 were male and 9 were female. 12 patients had fracture of right femur and 8 had fracture of left with 10 patients being treated for Intertrochanteric fractures and 10 patients being treated for subtrochanteric fracture femur.

Operative technique

For PFN, the patient was placed in the supine position on a traction table.

The limb was abducted about 10 degrees. The fracture was reduced under fluoroscopy.

An approximately 4 to 7 cm proximal and longitudinal incision was made through the fascia and gluteus to expose the tip of the greater trochanter. The proximal canal was then opened by evenly applied force to avoid breakage of the greater trochanter. After insertion of a reamed nail, in anteroposterior fluoroscopy, the lag screw is located in inferior portion of the femoral neck and located central of the femoral neck by lateral fluoroscopy and then the ante-rotation screw was introduced. Distal dynamic locking was done.

For DHS, the patient was placed in the supine position on a traction table. The fracture was reduced under fluoroscopy. Direct lateral incision starting from trochanter was taken. Trochanteric flare identified and guide pin passed in central or inferior portion of neck in anteroposterior fluoroscopy and central in lateral fluoroscopy. Lag screw was then passed keeping a tip apex distance of less than 15mm and appropriate side plate was fixed.

Postoperative rehabilitation

The first day after the static quadriceps and ankle pump exercises had been performed, from post-op day two, patients were mobilized and dynamic quadriceps strengthening exercises were initiated and the patients' X-rays were reviewed.

All patients were followed at 1st, 3rd, 6th month and 1 year. Partial weight bearing was allowed with walker by 6 weeks and full weight bearing weight after the disappearance of the fracture line on X-ray.

RESULTS

At 1 year follow up results were assessed with Modified Harris Hip score.

Among the PFN intertrochanteric fracture group, 9 patients showed excellent outcome, 6 patients showed good outcome and 2 patients showed fair outcome and 1 patient showed poor outcome.

Among the PFN subtrochanteric fracture group, 7 patients showed excellent outcome, 3 patients showed good outcome and 1 patients showed fair outcome and 1 patient showed poor outcome.

Among the DHS intertrochanteric fracture group, 3 patients showed excellent outcome, 3 patients showed good outcome and 2 patients showed fair outcome and 2 patient showed poor outcome.

Among the DHS subtrochanteric fracture group, 1 patients showed excellent outcome, 2 patients showed good outcome and 3 patients showed fair outcome and 4 patient showed poor outcome.

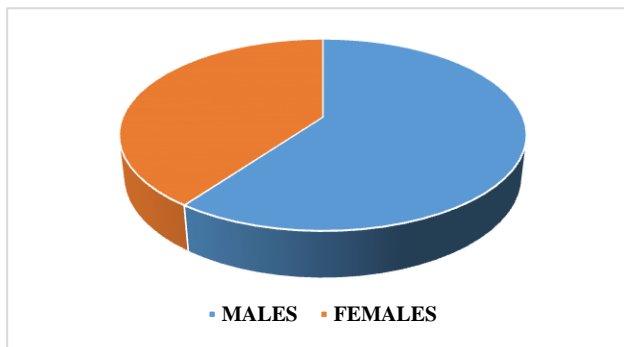


Figure 1: Pie chart diagram showing sex distribution of the patients included in the study.

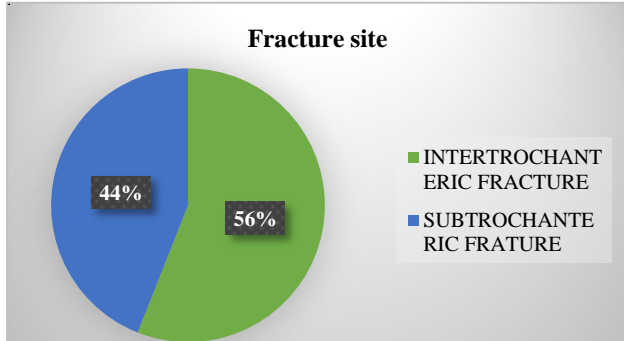


Figure 2: Pie chart depicting the fracture site of the patients included in our study.

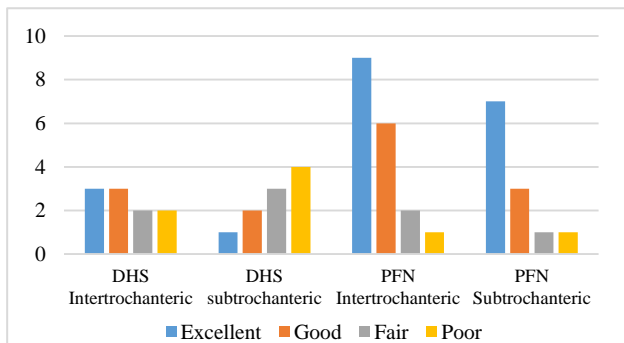


Figure 3: Bar diagram depicting results of the patients according to modified Harris Hip score.



Figure 4: Pre –op, post –op and follow up radiographs of a patient who sustained sub trochanteric fracture treated with PFN. (A) Pre Op x-ray; (B) Immediate Post Op; (C) At 3 months; (D) At 6months; (E) At 1year follow up.

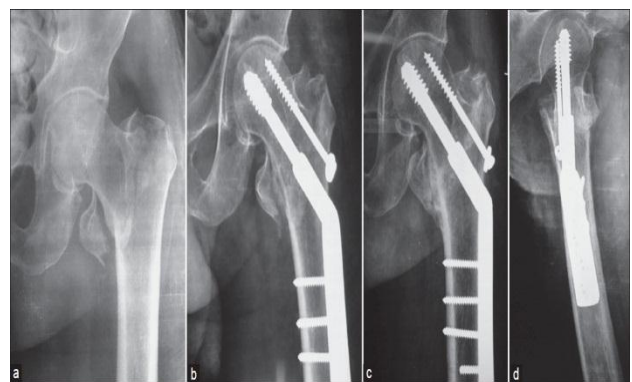


Figure 5: (a) Pre op x-ray (b) immediate post op (c) and (d) at 6 months follow up AP and lateral view of a patient who sustained left inter-trochanteric fracture treated with sliding hip screw with de-rotation screw.

Complications

In the PFN group, knee stiffness was the most common complication which occurred with 4 patients, outer thigh pain was encountered in 3 patients probably due to irritation of iliotibial tract by the proximal part of nail placed above greater trochanter, 1 patient had nonunion who were treated with bone grafting and one patient had proximal migration of ante-rotation screw into the joint at 6 months follow up who underwent implant removal as the fracture had united.

In the DHS group, superficial infection was the most common complication seen in 5 patients who were treated with antibiotics and regular dressings followed by implant failure was seen in 4 patients, who had posteromedial defect/ reverse oblique fractures which lead to varus collapse with cut out of lag screw and finally breakage/loosening of cortical screws. Nonunion was seen in 3 patients with subtrochanteric fractures. These patients were treated with different implants/procedures and Shortening was seen in 2 patients.

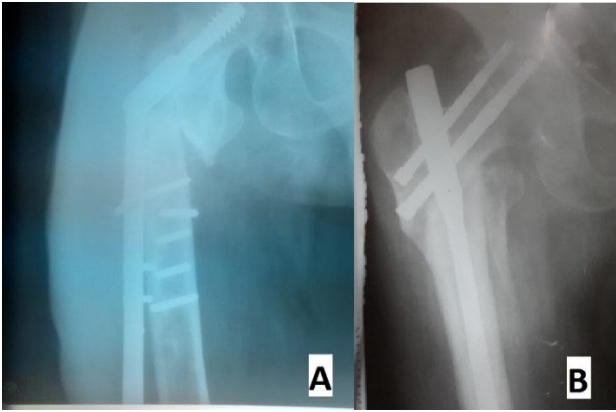


Figure 6: (A) DHS varus collapse with implant failure (B) PFN with proximal migration of derotation screw.

DISCUSSION

Hip fractures are the most commonly encountered fractures with trochanteric fractures seen in elderly individuals as a result of trivial trauma and unlike osteoporotic trochanteric fractures; subtrochanteric fractures are usually the result of high-energy trauma and often subjected to significant displacement and great difficulty in close reduction through traction.

Various implants are available for the fixation of these fractures with each having their own complications/failures which occur due to disregard for biomechanics, fracture type, associated injuries or due to overestimation of the implants capabilities to handle stress.⁷ The treatment choices of trochanteric and subtrochanteric fractures can be divided into two groups based on current management trends: cephalomedullary hip nails and lateral plate-screw systems. The use of intramedullary nail fixation in these fractures has been increasing because it is easy and fast to apply and can guarantee stability even in inherently unstable fractures. The result of these fractures in young and middle aged individuals is also influenced by the amount of trauma suffered at the time of injury.⁸

Dynamic hip screw a lateral plate screw system has been successfully over the past and is a gold standard for stable trochanteric fractures providing adequate compression at the fracture ends along with other surgeon advantages like less radiation exposure and shorter learning curve, but the use of it in unstable fractures without posteromedial support is associated with complications like varus collapse and lag screw cut out and partly associated with improper positioning of lag screw. Baumgaertner et al. showed that a small tip apex distance (TAD) – less than 25 mm – was associated with a lower probability for cutout.⁹ The DHS when used for subtrochanteric fractures, acts as a rigid load bearing construct as the fracture lies distal to the lag screw thereby locks the fracture in position. The fractures involving medial calcar or missing posteromedial corners or the fractures which are inadequately reduced result in

high varus strains at the fracture implant interface which leads to progressive loosening of screws or implant breakage. Other complications include increased blood loss and infection.

Proximal femoral nail has become the implant of choice for all trochanteric and subtrochanteric fractures due to various reasons like- closed procedure, load sharing device, minimal incision, early mobilization, decreased blood loss and due to its ability to provide stability to unstable fractures.¹⁰ PFN permits controlled collapse at the fracture site thus not making the fracture prone for varus collapse in cases of posteromedial discontinuity. The advantage of Proximal Femur Nailing fixation is that it provides a more biomechanically stable construct by reducing the distance between hip joint and implant.^{11,12} However the PFN does have its disadvantages like increased radiation exposure, Z-effect/reverse Z-effect, screw cut out, inability to place the lag and the anterotation screw in the femur neck due to narrow neck. The incidence of screw cut out can be minimized by placing the lag screw in the inferior portion of the neck in anteroposterior view parallel to the femoral neck calcar and centrally in lateral view and the tip at subchondral region. Herman et al. showed that the mechanical failure rate increased from 4.8% to 34.4% when the center of the lag screw was not in the second quarter of the head-neck interface line (the so-called “safe zone”) (p=0.001) and that the lag screw insertions lower or higher than the head apex line by 11 mm were associated with failure rates of 5.5% and 18.6%, respectively (p=0.004). They suggested that placing the lag screw within the “safe zone” could significantly reduce the mechanical failure rate when PFN was used to treat intertrochanteric fractures.¹³ The cause for outer thigh pain is due to irritation of iliotibial band by the nail protruding above greater trochanter which can be eliminated by carefully selecting patients with long femur and using PFNA-2 in short stature patients.

CONCLUSION

Fractures of the trochanteric region of the femur need a proper selection of implant based on fracture pattern. DHS has excellent results when used on stable fractures. For unstable fractures, PFN is the implant of choice. In case of subtrochanteric fractures PFN has better results in both stable and unstable fractures compared to DHS with less failure rates and restoring better hip biomechanics.

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Ethical approval: The study was approved by the institutional ethics committee

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