

OUTCOME OF PROXIMAL FEMORAL NAIL FIXATION IN INTERTROCHANTERIC FEMORAL FRACTURES OF GERIATRIC POPULATION

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ABSTRACT

BACKGROUND

The purpose of this meta-analysis was to find out whether the proximal femoral nail was better implant for the treatment of trochanteric fractures with respect to operation time, blood transfusion, hospital stay, wound complications, number of reoperation and union rate.

MATERIALS AND METHODS

A prospective study was done from January 2015 to June 2017, which included 74 patients aged over 60 years with intertrochanteric fractures classified accordingly 'Boyd & Griffin' system, who underwent osteosynthesis using PFN. The results data were assessed clinically using Harris Hip Score and radiological findings were compared at 3, 6, 12 and 18 months post-operatively. The mean follow-up period was 18.5 months (range 6-24 months).

RESULTS

The mean operation time was 40.5 minutes (range 22-118 min.) and the mean blood loss was 225 ml (range 150-450 ml). Union was obtained in all cases. Reduction was poor in 2 (2.7%), acceptable in 25 (33.8%) and good in 47 cases (63.5%). Post-operative complications included secondary varus (n=4, 5.4%), Z effect (n=5, 6.75%) reverse Z effect (n=2, 2.7%), shortening (mean 8.2 mm, n=12, 16.2%), and cut-out of neck screw (n=3, 4.05%). The mean duration of fracture union was seen in 16-20 weeks (n=65, 87.75%). The mean Harris Hip Score was 77.6 and observed in category excellent (n=13, 17.55%), good (n=21, 28.35%), fair (n=19, 25.65%) and poor (n= 4, 4.05%).

CONCLUSION

Due to advantages of high union rate, early mobilization and short operative time PFN osteosynthesis is the method of choice for surgical treatment of intertrochanteric femoral fractures in geriatric population.

KEYWORDS

Intertrochanteric fractures, Geriatric population and Proximal femoral nail.

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BACKGROUND

Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly with osteoporotic bones, usually occurs due to low-energy trauma like simple falls.¹ The incidence of intertrochanteric femoral fractures has increased significantly during recent decades and this tendency will probably continue in the near future due to the rising geriatric population and increase in incidence of osteoporosis. The incidence of intertrochanteric fractures varies from country to country. Gulberg et al, has predicted that the total number of hip fractures will reach 2.6 million by 2025 and 4.5 million by 2050.² In 1990, 26% of all hip fractures that occurred in Asia were intertrochanteric fractures whereas this figure could rise to 37% in 2025 and

45% in 2050.³ The goal of treatment of these fractures is stable fixation, which allows early mobilization of the patient. These fractures are associated with substantial morbidity and mortality. Associated co-morbid medical problem like diabetes, hypertension, pulmonary, renal and cardiac problems add to the insult of the fracture. Elderly patients with trochanteric fractures are threatened with life-threatening complications such as hypostatic pneumonia, cardio respiratory failure and decubitus ulcer, which requires an urgent surgical solution for early rehabilitation and mobilization.⁴

Many treatment options (Conservative, External fixator, Extra medullary devices like DHS, intramedullary devices like Enders nails or Primary arthroplasty etc.) are described aiming for stable fixation & early mobilization of these geriatric patients, but these methods allow partial or restrict post-operative weight bearing.⁵ The usual problems of these fractures are malunion, non-union, implant failure, refracture and infection encountered after surgical correction. The treatments of these have prompted continued development of new devices and treatment protocols. PFN is one of the best methods of stable fixation of intertrochanteric fractures in geriatric population. In

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addition to all the advantages of an intra-medullary nail it has favorable characteristics like, it can be dynamically locked, allows early mobilization, rotationally stable and minimal soft tissue damage.

Aims and Objectives

We evaluated the radiological and early ambulatory functional results of the Proximal Femoral Nail (PFN) system in elderly patients with intertrochanteric femoral fractures.

MATERIALS AND METHODS

This was a prospective randomized study conducted at ACSR government medical college from January 2015 to June 2017. During this period 74 geriatric patients with intertrochanteric fractures of femur were selected according to the inclusion criteria: age more than 60 years, both sexes, closed fractures, fractures less than 2 weeks of duration, no medical contraindications for suitable anesthesia, those who gave written & informed consent to participate in the study. Exclusion criteria includes: pathological fractures, ipsilateral fracture shaft femur or tibial fractures or injuries around the knee, associated head injury (GCS < 12), active infection at fracture area and patients with co-morbid conditions like stroke that may hinder rehabilitation. Standard pre-operative planning was done. Radiographs of the pelvis with both hips antero-posterior view and traction-internal rotation view were obtained to confirm the diagnosis. The mean collodiaphysal angle was 136.7 degrees with range of 125-145 degrees.

Surgery was done on 2nd day for those patients who were fit otherwise. Depending on patient clinical condition and considering his co-morbidities, surgery was planned within a range of 2-21 days from the date of injury. A standard PFN length of 250 mm and 135° angle nail was used in all our cases. The diameter was determined by measuring diameter of the femur at the level of isthmus on an AP X-ray. All cases were operated on a single standard fracture table under spinal anesthesia using standard operating techniques. C-arm was used in all cases. As a standard protocol, intra-venous cefoperazone and sulbactam 1.5 gms was administered intravenously prior to the skin incision. The same combination was used for 48 hours postoperatively in standard doses. Intra-operatively the duration of surgery, the radiation exposure, intra-operative blood loss, size of the incision and any associated complications were noted. PFN requires a smaller incision (6.1 cm) to access the entry site into the medullary canal & three small stab incisions (2.5 cm) for locking screw. The average duration of surgery of PFN was 40.5 min, which was shorter than the average time required for other surgical procedures. Following surgery, all swabs and mops with blood contamination from the surgical procedure were weighed to determine the amount of blood loss, similar to the method of Lee et al.⁶

All patients in our study underwent a similar rehabilitation protocol involving mobilization from the second postoperative day depending upon the physical condition of the patient, static quadriceps, knee and ankle mobilization exercises. The wounds were inspected on the 2nd post-operative day. Stitches were removed on 12th day. Functional outcome was assessed using Harris Hip Score and radiological findings were compared at 3 months, 6 months, 12 months 18 months and 24 months post operatively. All patients were followed up for a minimum period of 1 year. There was nine drop-outs in the study.

RESULTS

Out of the 74 patients, 44 (59%) were males and 30 (41%) were females. In our study, the average age was 65 years. We found that the trivial trauma was the most common mode of injury. 48% of the fractures occurred on the left side and 52% on the right side showing no significant difference. All the seventy-four intertrochanteric fractures were classified based on Boyd & Griffin classification system (Fig. 1) and type 2 accounted the most (37.8%) followed by type 1, type 4 & type 3.

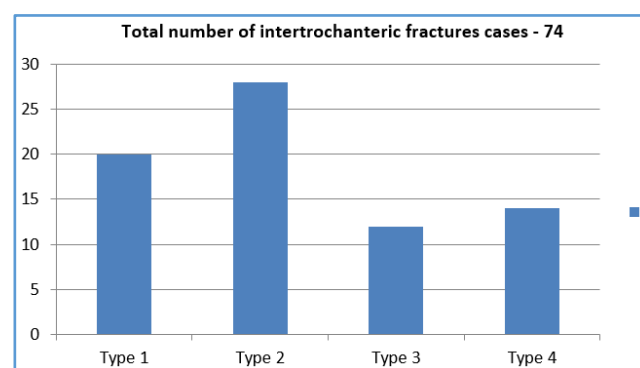


Figure 1. Classification of Intertrochanteric Fractures Based on Boyd and Griffin

The average blood loss during PFN procedure was 225 ml with range of 150-450 ml, which was significantly less. Since the incision was smaller and duration of surgery was shorter in PFN, there was less tissue damage and hence lesser blood loss. The average sliding of 4.1 mm was observed at the end of 1 year on the radiographs as described by Hardy et al.⁷ The average limb shortening was only 4.5 mm. The average hospital stay was 7.8 days (4-12 days). Return to pre-injury walking ability was on an average of 8-10 weeks.

Radiological outcome was assessed at 3, 6, 12 and 18 months post-op. At 3 months post-op, 15 patients had attempted callus formation (Fig. 2) and six patients were found to have attempted callus formation with a gap. These patients underwent bone grafting and showed good integration of the graft.

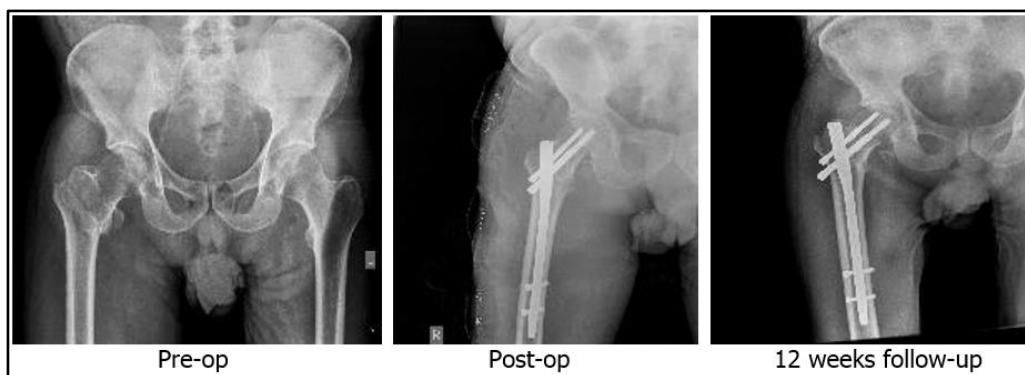


Figure 2. Case 2 Radiographs (Pre-operative, Post-operative and at 3 Months Follow-up Showing Good Union) of a 55 yrs. Old Male with Right Intertrochanteric Fracture Femur Operated with PFN.

At 6 months post-op, we found all the 30 patients showed good union of fracture (Fig. 3) while the other six patients who underwent bone grafting had good graft integration with union.

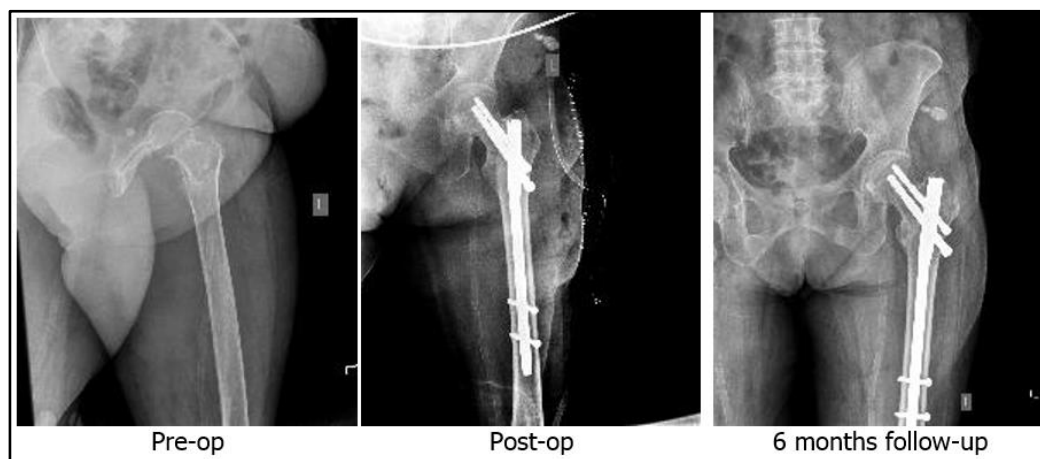


Figure 3. Case 1 Radiographs (Pre-operative, Post-operative and at 6 Months Follow-up Showing Good Union) of a 73 yrs. Old Female with Left Intertrochanteric Fracture Femur Operated With PFN

In our study we came across the implant related complications a bit more than other complications (Table 1).

Complication	No. of Patients	Percentage
Difficulty in distal locking	1	1.35%
Cut out of neck screw	3	4.05%
Z effect	5	6.75%
Reverse Z effect	2	2.70%
Bolt breakage	1	1.30%
Fracture greater trochanter	1	1.60%
Fracture below tip of Nail	1	1.35%
Breakage of nail	0	0%
Revision surgery	3	4.05%

Table 1. Implant (PFN) Related Complications

In our study, one patient had jig miss match while doing distal locking, underwent free-hand screw locking (Fig. 4a) and on follow up one patient had trivial trauma and fractured femoral shaft just below the tip of the nail (Fig. 4b) who underwent separate surgery with distal femoral locking plate. On follow-up five patients had Z effects who were re-operated (Fig. 5) and two patients had Reverse Z effect,

were also re-operated (Fig. 6). Four patients had varus malunion of 120 degrees due to excessive collapse. Average period of fracture union was seen in between 14 – 20 weeks of post-operatively (Fig. 7).



Figure 4(a) Showing Jig Miss Match While Doing Distal Locking. (b) Showing Fracture at the Tip of the Nail

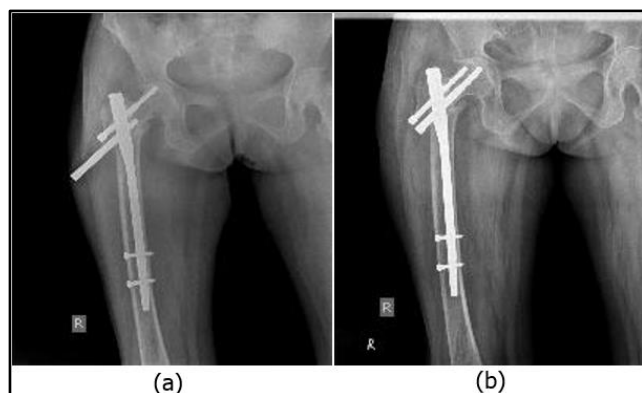


Figure 5 (a) Showing Z Effect and (b) After Re-operation

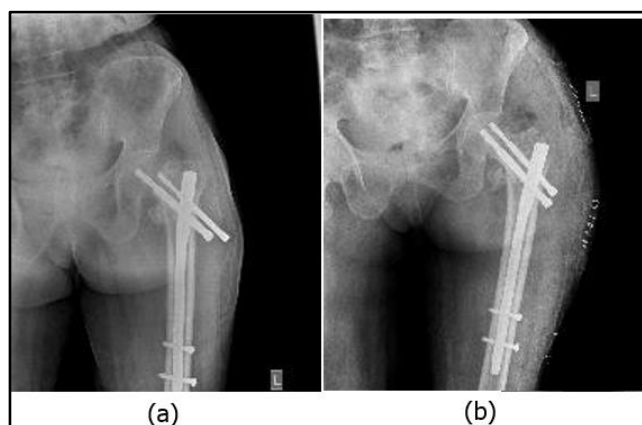


Figure 6. (a) Showing Reverse Z Effect and (b) After Re-operation

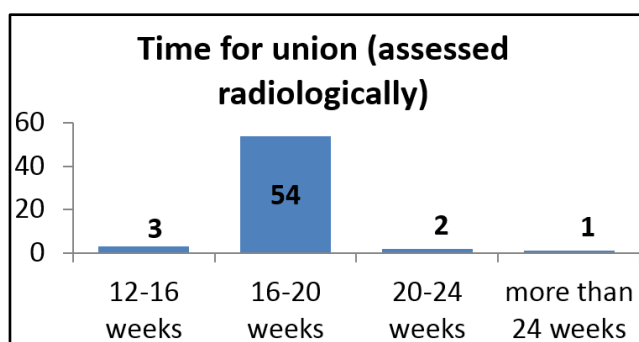


Figure 7. Fracture Union

At 12 months follow up, we found all the patients showed good union of fracture. At 18 months follow up, all the fractures united and with those patients still showing proximal screws back-out were taken for implant removal. The mean follow-up period was 18.5 months (range 6-24 months). Out of the 74 patients, ten patients were lost to follow up and four died due to reasons unrelated to surgery. Sixty patients were available for assessment of final functional outcome. At the end of 6 months, we found that the functional results calculated using the Harris hip score as shown in Fig. 8.

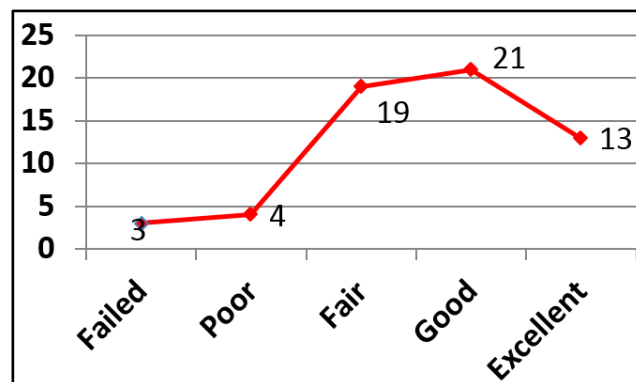


Figure 8. Harris HIP Score

Observed Mean Harris hip score was 77.6% and excellent to good results were seen in 56% cases and 66% showed fair to good results.

Total Points in Score	Remarks
90 – 100	Excellent
80 - 90	Good
70 - 80	Fair
60 – 70	Poor
Below 60	Failed

Table 2

DISCUSSION

In the last few decades, treatment of intertrochanteric fractures has evolved significantly. Various methods of fixation devices have come and gone. The treatment still merits the type of fracture and quality of bone. DHS has been the considered the gold standard of intertrochanteric fracture fixation for a long time, but results with PFN are excellent.

Historically, Smith Peterson nail and Jewet nail were introduced in the 1930's. In the 1950's and 60's Pugh and Massie modified sliding devices and dynamic hip screw (DHS) were developed. Kuntscher, Zickle, Grosse, Kempf and Russel and Taylor developed intramedullary nail (IMN) with sliding hip screw (SHS).^{8,9,10} In the early 90s intramedullary devices were developed for fixation of Intertrochanteric fractures. These devices had numerous biomechanical and biological advantages over the conventional dynamic hip screw. The advantages and disadvantages of the original design of the Gamma nail have been well established in several studies done in the past, usually by comparing the results with the dynamic hip screw (DHS).^{7,11,12}

Recent data suggests intra-medullary devices have been very good with union rates up to 100% compared with other extra-medullary devices which show union up to 80% only.^{11,12}

Kyle et al. has noted that increased forces are required to initiate sliding in intra medullary devices as compared to sliding hip screw with plate.¹³ Amongst all intra medullary devices the Gamma nail requires the largest force. The explanation lies in the barrel of the side plate, the barrel provides a free passage for the screw to slide, thus the

longer the barrel length the less the forces required to initiate sliding. The nail in the medullary canal provides a physical block to significant shortening of the head and neck segments in the fractures which explains the minimum shortening in the PFN as compared to DHS. Randomized post-op rehabilitation study by Pajarinen et al. comparing peritrochanteric femoral fracture treated with DHS or PFN suggested that the use of PFN may allow faster post-operative restoration of walking ability when compared to DHS.¹⁴ Cyril Jonnes et al, compared treatment of type II intertrochanteric fractures with PFN and DHS and revealed patients who underwent PFN returned to pre-injury walking status earlier than patients who underwent DHS.¹⁵

CONCLUSION

Proximal femoral nailing creates a shorter lever arm, which translates to a lower several folds higher cyclical loading than dynamic hip screw. The implant compensates for the function of the medial column. Proximal femoral nail also acts as a buttress in preventing the medialization of the shaft^{16,17}

PFN is one of the best implant in the treatment of intertrochanteric fractures of femur in terms of decreased blood loss, reduced duration of surgery, early weight bearing and mobilization, reduced hospital stay, decreased risk of infection and other complications.

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