

Analysis of outcome of intertrochanteric femoral fractures managed with short proximal femoral nail - A prospective study.

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Abstract

Background: The treatment of intertrochanteric fracture aims to restore mobility at earliest and minimize the complications of prolonged debilitation. Although, Dynamic Hip Screw (DHS) showed good results, but complications were frequent particularly in unstable fractures including screw cut out, avascular necrosis of femoral head, fracture of the DHS system, femoral plate fracture, disengagement of the screw from the barrel, etc. Proximal Femoral Nail (PFN), being intramedullary has improved biomechanics, decreased femoral neck shortening, lesser failure rate, early mobilization and faster rehabilitation.

Material and Methods: This study included 30 patients with intertrochanteric fractures in skeletally mature in individual fit for surgery. Results were analyzed clinically and radio logically. Outcomes were assessed using Modified Harris Hip score.

Results: Patients belonged to age group 34-92 years, with majority between 60 to 85 years of age with mean age of 69 years, comprising 63% female and 37% male. The average Harris hip score was 83.76 at 24 weeks follow up with 33.33% excellent, 56.66 % good, 3.33 % fair, 6.67% poor. Post-operative complications included superficial infection, Z effect, varus collapse with screw backout, refracture and lag screw backout and broken

denotational screw, screw cut out, and peri implant fracture in 1 patient each.

Conclusion: Treatment with PFN for intertrochanteric fracture has the advantages of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and return to work. Osteosynthesis with short PFN resulted in good to excellent stabilization in stable as well as unstable fracture patterns.

Keywords: Intertrochanteric fractures, Proximal femoral nail, Dynamic Hip screw.

Introduction

Intertrochanteric fractures are defined as 'extracapsular fractures involving upper end of femur between greater and lesser trochanters may or may not extending into proximal femur' (1). These fractures forms a major chunk of patients presenting to casualty in any trauma setting. About 90% of community hip fractures in older individuals result from low-energy falls from standing height, with female patients having a larger proportion of these fractures (2).

With the increase of life expectancy in geriatric population, the intertrochanteric fractures are also on rise.

The International Osteoporosis Foundation estimates that approximately 1.6 million such fractures occur per year worldwide, a figure which may rise to six million by 2050.

Various treatment options available for intertrochanteric fractures include DHS, Bipolar Hemiarthroplasty, Proximal femoral nail, Trochanteric fixation nail and External fixation, all of which have their specific advantages and disadvantages (2). The purpose of the treatment is to restore early mobility while lowering the risk of long-term recumbency-related problems and

returning the patient to their pre-injury state as soon as feasible.

Adequacy of fracture reduction is the most important modifiable factors in the management of intertrochanteric fractures, regardless of the fracture pattern (3). When cortical continuity is restored, the cortex's capacity to withstand collapse in stable fractures is restored. The bone - implant interface experiences more stress in unstable fractures if the ability to recover this is constrained by comminution or the fracture configuration. Thus, implants used to treat unstable fractures must be able to support more weight in order to prevent loss of reduction due to collapse. A valgus reduction can lessen collapse and leg length discrepancy while improving interfragmentary compression and lowering bone-implant stresses (4,5).

It has been found that intramedullary implants, such as the proximal femoral nail, are advantageous in these fractures because their placement enables the implant to lay closer to the mechanical axis of the extremity, reducing the lever arm and bending force on the implant. This has led to internal fixation of these fractures to increase patient comfort, facilitate nursing care, minimize hospital stay and reduce complications. The PFN gives an advantage of minimally invasive surgery (6). The intramedullary position of PFN resists the bending strain and permits early weight bearing in unstable intertrochanteric fractures by preventing lateral translation of the proximal fragment. The aim of this study was to analyses the functional outcome of patients with intertrochanteric fractures managed with short Proximal Femoral Nailing.

Materials and methods

This prospective, time bound and hospital based clinical study included 30 patients with intertrochanteric

fractures in skeletally mature individual, fit for surgery, admitted to a tertiary care hospital from March 2021 to September 2022. Results were analyzed clinically and radiologically. Outcomes were assessed using Modified Harris Hip score. The complete data was collected from the patient in a case record form by taking patient's history of illness and by detailed clinical examination and relevant investigations. A note of associated injuries was made. After the diagnosis, the patients were selected for the study depending on inclusion and exclusion criteria. All the required pre op investigations and evaluation were done. Clinical and radiological evaluation were carried out to undertake fitness for surgery. The patients underwent surgery 'closed reduction and internal fixation with short PFN' for the Intertrochanteric fractures. All the patients were started with range of movement exercises for Hip and knee. Suture removal was done at the end of 2 weeks. The patients were followed up at 2 weeks, 6 weeks, 12 weeks, 18 weeks and 24 weeks post operatively. Patients were assessed for functional outcome and radiological union during each follow up and data were entered in the case proforma. Complications were recorded. Results were analyzed clinically and radiologically and outcomes were assessed using Modified Harris Hip score.

Inclusion criteria

The patients falling under following categories were included under the study.

1. Cases of intertrochanteric fractures, both stable & unstable.
2. Age more than 18 years.
3. Closed type of fractures.
4. Patients willing for treatment and given – informed written consent.

Exclusion criteria

The patients presenting with one or more of the following conditions were not included in this study:

1. Patients with advanced arthritis of hip
2. Compound fractures associated with neurovascular injuries, and pelvic fractures.
3. Patients medically unfit for surgery.

After admission & stabilization of the patient detailed examination of the patients was carried out. Then standard Antero - Posterior view X- Rays of Pelvis taken and the fracture configuration noted. Patients were initially managed with intra venous fluids, whole blood transfusion (if needed) and then limb rested in below knee skin traction to immobilize and maintain the length & alignment of the fractures. The fractures are classified according to Boyd and Griffin classification.

Post operative protocol

Following surgery, Intravenous antibiotics were continued for first 48-72 hours and then it was shifted to oral. Static and dynamic quadriceps exercises were started on post-operative day 1.

Dressing was done on 2nd post operative day and subsequent dressings based on wound condition. Sutures were removed on post operative day 12 to 14. Weight bearing as tolerated was started depending upon the stability of the fracture and adequacy of fracture fixation.

Statistical methods

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The one-way analysis of variance (ANOVA) is employed to determine whether there are any statistically significant differences between the

means of three or more independent (unrelated) groups. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for Qualitative data analysis.

Results

The mean age of the patients was 69.06 years (range 34 to 92 years). The average delay of surgery was 3.63 days (range 2 to 10 days), based on associated clinical conditions and comorbidities.

Out of 30 patients, 19 (63.3%) were females and 11 (36.7%) were males, showing a female preponderance with the ratio being Female: Male > 3:2.

Left side was involved in 16 (53.3%) patients and the right side was involved in 14 (46.7%) patients, thus showing a slightly higher incidence on left side.

In our series of study, patients were classified according to BOYD AND GRIFFIN type and AO/OTA type.

The Frequency distribution of patients studied according to Boyd and Griffin classification system depicted in table 1.

According to AO classification, 6 patients belonged to AO type 31A1, comprising about 20 % of the patients, 23 patients (76.7%) belonged to AO type 31A2 and 1(3.3%) patient belonged to 31A3. Hence, most of the patients belonged to unstable fracture pattern (80%) while 20% belonged to stable fracture pattern.

The Singh's index for osteoporosis showed that majority of the patients were in group 3 and 4 comprising about 80 % of the patients.

There were 27 (90%) patients with self-fall, and 3 (10%) patients with road traffic accidents. Closed reduction was achieved in all cases except one case where limited open reduction was carried out. The mean duration of surgery was 65 min.

The radiological and functional outcome is depicted in fig 1 and 2 respectively for a case of intertrochanteric fracture of left femur. The average duration for fracture union was 16 weeks.

Complications encountered post-operatively in 6 patients as depicted in table 2.

Revision surgery was required in 4 of the patients, 1 patient with varus collapse of femoral head with screw cut out, for which removal of proximal screws were done, as shown in fig.3. Two patients with implant failure (1 patient with lag screw backout and broken denotational screw, as depicted in fig. 4, and another with Z effect), 1 patient with peri implant fracture, and 1 patient had superficial infection, which was managed with regular dressing and antibiotic coverage.

There was an average of 63 mm of limb shortening at the final follow up.

The functional outcome results were analyzed according to modified HHS. The mean HHS at 3 months was 76.06 which increased to 77.83 and 83.76 at the end of 6 months as shown on table 3.

Modified Harris hip score at final follow up was excellent in 10 (33.3%), good in 17 (56.66%), fair in 1 (3.33%) and poor in 2 (6.66%) patients as shown in table 4.

Radiological outcomes



A

A. X ray showing Intertrochanteric fracture of left femur



B

B. Immediate post op x ray- fracture fixation with conventional short PFN



C

C. At 6 weeks follow up



D

D. 12 weeks follow up



E

E. 24 weeks follow up

Functional outcomes

Squatting



A

crossed leg sitting



B

Flexion



C

Figure 2: Functional outcome of the patient at final follows up

A. Squatting

B. crossed legged sitting

C. Flexion of Hip

Internal rotation



D

Abduction



F

External rotation



E

Adduction



G

D. Internal rotation of Hip

E. External rotation of Hip

F. Abduction of Hip

G. Adduction of Hip

Complications

Complication- 1



A



B



C



D

Figure 3: Complication- varus collapse with screw cutout

A. X ray showing intertrochanteric fracture of right femur;

B. Immediate post op x ray- fracture fixation with conventional short PFN;

C. 12 weeks post op- Varus collapse with screw cut out;

D. Revision surgery- Removal of proximal screws

Complication-2



A



B



C



D

Figure 4: Complication- Varus collapse with implant failure

- A. X ray showing intertrochanteric fracture of right femur;
- B. Immediate post op x ray- fracture fixation with conventional short PFN;
- C. Varus collapse with backout of lag screw and broken derotational screw
- D. Revision surgery- cemented Bipolar Hemiarthroplasty

Discussion

Success of treatment in Intertrochanteric fractures depends on large number of patient related factors as well as adequacy of fracture fixation. Some of the relevant factors include.

- Age of the patient
- General condition of the patient including comorbidities
- Time from fracture to treatment
- The adequacy of treatment
- Fracture patterns
- Stability of the fixation

Currently, it is recommended to fix all Intertrochanteric fractures internal fixation to reduce the morbidity and the mortality of the patient, unless contraindicated.

But the appropriate method and the ideal implant to fix the Intertrochanteric fracture is still debatable as each method has its own advantages and disadvantages.

In the present study 30 patients of either sex with Intertrochanteric fractures were studied.

In this series, intertrochanteric fracture was more common between 6th to 8th decade with an average of 69.06 years, which was comparable to most of the similar studies done for Indian population.

Most of them were comminuted, and unstable fractures requiring operative management. Since these fractures are associated with high morbidity, early fracture fixation and rehabilitation was indispensable.

Female preponderance with 19 female patients and 11 male patients was seen in this series and is comparable to similar series of studies.

Increased incidence in females is attributed to post Menopausal osteoporosis. The prevalence of osteoporotic fractures rises from 4% in women at age group 50-59 to 52% of women aged > 80 years according to a study by J Christopher Gallagher et al.

Out of 30 patients, maximum number of patients were seen in Type II of Boyd and Griffin classification, which is in accordance to other similar series of studies by Cyril Jonnes et al (9) and Arnik Purohit et al (10) and Rushikesh Loniker et al (8) compared in table no 5.

In this study, most of the patients were belonging to unstable fracture pattern (80%) while only 20% belonged to stable fracture pattern.

The average duration of surgery in our study was 65 minutes. The minimum duration of surgery was 55 min in 2 patients, with duration less than an hour in another

11 patients. Most of the surgeries were done within 75 min. 1 case where open reduction and cerclage wiring was required took around 100 min. It was comparable to other similar studies as shown in table 6.

The average amount of blood loss in our study was 170 ml which was comparable with similar series of studies done by Pul in Bihari Das et al. (7) which was 73.5ml and other similar studies shown in table 7. Functional outcome in the patients were assessed using Harris hip score and were categorized into 4 groups-

In our series, we had 33.3% of the patients with excellent, 56.7 % good, 3.33 % patient fair and 6.67% poor outcomes in terms of gain of functional ability, similar or comparable to pre injury ability. Patients, who obtained excellent results, had no residual deformities or pain. Range of motion was within the normal functional range and had no complications.

Patients with good results had minimal limitation of activities and occasional pain. Rest of their findings was within acceptable parameters. Patients with fair results had pain and limitation of activities.

The patient needed walker support for mobilization. 6.67% patients had poor outcome, due to implant failure and needed revision surgery. Functional outcomes were comparable to studies done by Pullin Bihari Das et al (7), which was 56% in excellent group, 18.7% good, 17.3% fair, and 8% poor results, Rushikeshloniker et al (8) with 28% in excellent group, 42% good, 18 fair, and 12% poor results. The results corelated well with other similar studies shown in table 8.

In our study, total 6 patients had complications post-operatively. 1 patient had Peri Implant Fracture, 1 patient had Screw Cut Out, 1 patient had Varus Collapse, 1 patient had Varus Collapse with Refracture and Lag Screw Backout and broken DE rotational

Screw, 1 patient had Z Effect, and superficial Infection in 1 patient.

These complications in the patient could be attributed to-

1. Unstable fracture pattern
2. Osteopenia
3. Lack of antero-medial buttress
4. Early weight bearing.

Superficial Infection was present in 3.33% of the patient, which was treated with antibiotics and regular dressing, which ultimately healed well.

The complications in this series was comparable to studies done by Arnik purohit et al (10) which had 16% patients with complications and other similar series of studies shown in table no 9.

Table 1: Boyd and griffin type- Frequency distribution of patients studied.

Boyd and griffin type	No. of Patients	%
I	6	20.0
II	18	60.0
III	1	3.3
IV	5	16.7
Total	30	100.0

Table 2: Com plications- Frequency distribution of patients studied

Complications	No. of Patients	%
Nil	24	80.0
Yes	6	20.0
Peri implant fracture	1	3.3
Screw cut out	1	3.3
Varus collapse	1	3.3
Implant failure with lag screw backout and broken derotational screw	1	3.3

Z effect	1	3.3
Infection	1	3.3
Total	30	100.0

Table 3: Harris Hip Score at 3 months and at final follow up

Harris hip score	Minimum	Maximum	Mean	Standard Deviation
3 months	70.000	81.000	76.067	3.921
Final follow up	40.000	94.000	83.76	12.47

Table 4: Functional outcome - Frequency distribution of patients studied

Functional Outcome	No. of Patients	%
Excellent	10	33.3
Good	17	56.7
Fair	1	3.33
Poor	2	6.67
Total	30	100.0

Table 5: Type of fracture based on Boyd and Griffin classification in similar studies.

Table 6: Duration of surgery in similar studies

Series	Duration of surgery in minutes
Pulin Bihari Das et al. (7) (2020)	57.47
K Harish et al (11) (2019)	100
Tribhuwan Narayan Singh Gaur et al (12) (2017)	73.2
Cyril jonnes et al (9) (2015)	91
Present study	65

Table 7: Blood loss during surgery in similar studies

Series	Blood loss during surgery (in ml)
Pul in Bihari Das et al. (7) (2020)	73.5
K Harish et al (11) (2019)	240
Tribhuwan Narayan Singh Gaur et al (12) (2017)	130-150
Cyril jonnes et al (9) (2015)	73
Present study	170

Table 8: Functional outcome in the patients were assessed using Harris hip score in similar studies.

Series	Excellent	Good	Fair	Poor
Pul in Bihari Das et al (7) (2020)	56%	18.7%	17.3%	8%
Md Faraz Jamil et al (13) (2022)	53.85%	30.77%	7.69%	7.69%
Arnik purohit et al (10) (2020)	6%	94%	-	-
Rushikeshloniker et al (8) (2016)	28%	42%	18%	12%
Present study	33.3%	56.7%	3.33%	6.67%

Table 9: Complication in patients with similar studies.

Series	Complication percentage
Pul in Bihari Das et al. (7) (2020)	16%
Arnik purohit et al (10) (2020)	16%
Rushikeshloniker et al (8) (2016)	36%
Present study	20%

Conclusion

Incidence of Unstable Intertrochanteric fractures is on the rise and is also compounded by various fracture dependent and independent factors. The results from our study suggests that proximal femoral nail can be opted as the most well-judged and reasonable method of treating intertrochanteric fractures.

Treatment with PFN for unstable intertrochanteric fracture has the advantages of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and return to work. It can be used in all grades of osteoporosis with good results.

- Proximal femoral nailing requires a good surgical skill. Besides that it also requires good fracture table, good instrumentation and good C-arm control. Therefore, we can conclude that the Proximal Femoral Nail, after proper training and technique is a safe and easy implant option for treatment of complex intertrochanteric fractures.
- Osteosynthesis with short PFN resulted in excellent stabilization in our series.

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