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Original Research Article

OUTCOME FOLLOWING MANAGEMENT OF UNSTABLE INTERTROCHANTERIC FRACTURE WITH PROXIMAL FEMORAL NAILING ANTIROTATION II

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ABSTRACT

Background: Intertrochanteric fractures are the most common osteoporotic fracture occurring in the elderly patients. Due to increase in life expectancy, there is an increase in incidence of intertrochanteric fractures. Early surgery helps in mobilize the patient which allows early weight bearing thus reducing the complications due to recumbency. The use of minimally invasive implants decreases the complications such as Blood loss, wound healing problems, infections and help in faster rehabilitations. PFNA II is newer intramedullary implant which has a one helical blade inserted to proximal femur and has yielded better fixation and results in osteoporotic bones. The chance of implant failure is less as it provides better tolerability towards rotation and varus collapse, and also the blade provides higher cut out resistance. This study aims to assess the functional outcome among patients with unstable intertrochanteric fracture surgically treated with proximal femoral nail antirotation II. **Materials and Methods:** A prospective study was done at department of orthopaedics, Government Medical College, Thrissur to assess the functional outcome among patients with unstable intertrochanteric fracture surgically treated with proximal femoral nail antirotation II between March 2022 to March 2023. 81 patients were evaluated to 1 year to assess the functional outcome using Harris hip score All patients were followed up at 6week,3months,6month,9months and 1 year. During every visits, patients were assessed clinically regarding hip and knee function, ability to bear weight and walk, fracture union, deformity and other complications. Radiological evaluation for union, screw cut out, breakage of nail, malunion, nonunion, abutment of nail and bolt breakage was done. Functional outcome assessment using Harris hip score was assessed at 1 year. **Results:** In our study there were 15 cases (18.5%) with excellent outcome, 27 cases (33.3%) with good results, 32cases (39.5%) with fair results, 6 cases (7.4 %) with poor outcome and 1 failed case (1.2 %). Most of the patients with excellent and good results were younger individuals with minimal post operative and radiological complications. A lot many of the patients with fair and poor results were of older age group, with co- morbidities and had radiological complications. There were no association seen in the functional outcome with the respect to gender, wound infection and type of the fracture. **Conclusion:** Intertrochanteric fractures of femur treated with Proximal Femoral Nail Antirotation 2 helps in achieving biological reduction, imparts stability and enables early mobilization. It also prevents excessive collapse and decreases blood loss during the surgery. This results in faster union, lesser incidence of complications. Thus it helps in achieving overall good functional outcome.

Keywords: intertrochanteric fracture; unstable; proximal femoral nailing antirotation 2

INTRODUCTION

Intertrochanteric fractures are the most common osteoporotic fracture occurring in the elderly patients. Due to increase in life expectancy, there is an increase in incidence of intertrochanteric fractures. These fractures are basically extracapsular fractures of neck femur with external rotated and shortened lower limb. Conservatively managing the patients with intertrochanteric fractures are prone for various recumbent problems such as deep vein thrombosis, bed sores, urinary tract infections and orthostatic pneumonia significantly contributing in mortality. It can also lead to malunion of fractures which result in permanent disability. So most of the patients are managed surgically unless the fracture is undisplaced and medical unfit. Early surgery helps in mobilize the patient which allows early weight bearing thus reducing the complications due to recumbency. The use of minimally invasive implants decreases the complications such as Blood loss, wound healing problems, infections and help in faster rehabilitations.[1-4]

EVANS has classified the intertrochanteric fractures as stable and unstable types, with fractures with posteromedial cortical disruptions, comminutions or with reverse obliquity are considered unstable as it has high risk for displacement, nonunion, malunion or varus collapse. The implant used is divided into extramedullary implants and intramedullary nails. The implant choice is determined by the fracture pattern (stable or unstable).

Several implants such as dynamic hip screw (DHS), the Gamma nail (GN) and the proximal femoral nail (PFN have encountered a variety of complications like cut-out, screw back out, implant breakage, femoral shaft fractures and subsequent loss of reduction.[5-8]

PFN which has two proximal screws and was biomechanically better implant compared to DHS, but have higher rate of complications such as implant failure, screw cut out and screw migration (z effect). In this Z effect proximal screw (de-rotation screw) of PFN migrate medially and distal screws (lag screw) migrate backward, while in reverse Z effect proximal screw (de-rotation screw) migrate laterally and distal (lag screw) migrate medially. Intramedullary nailing has advantage of short incision, less operative time, rapid rehabilitation and thus decreased medical complications.[9,10]

PFNA II is newer intramedullary implant which has a one helical blade inserted to proximal femur and has yielded better fixation and results in osteoporotic bones. The chance of implant failure is less as it provides better tolerability towards rotation and varus collapse, and also the blade provides higher cut out resistance.[11,12]

PFNA11 provides biomechanically stable fixation and enables early mobilization which results in faster healing with less incidence of complications. Intertrochanteric fractures of femur treated with Proximal Femoral Nail Antirotation 2 helps in achieving biological reduction, imparts stability and enables early mobilization. It also prevents excessive collapse and decreases blood loss during the surgery. This results in faster union, lesser incidence of complications. Thus, it helps in achieving overall good functional outcome.[13,14]

MATERIALS AND METHODS

A prospective study was done at department of orthopaedics, Government medical College, Thrissur to assess the functional outcome among patients with unstable intertrochanteric fracture surgically treated with proximal femoral nail antirotation II between March 2022 to March 2023. 81 patients were evaluated to 1 year to assess the functional outcome using Harris hip score.

Inclusion Criteria

Adult patients between age group 45-95 years presenting within 72 hrs of injury and walks independently (assisted waking allowed) prior to injury and having closed unstable intertrochanteric fracture (AO TYPE 31 A2 & 31A3) were included in the study.

Exclusion Criteria

Adult patients unfit for surgery, with compound fractures, admitted for re-operation, skeletally immature patients, and those who have associated injuries (head injury, spinal cord injury) were excluded.

All admitted patients with intertrochanteric fractures were clinically examined and splintage was done using above knee traction. The fracture pattern was classified according to AO classification, all patients were thoroughly evaluated for medical conditions with help of respective departments, consent for surgery was explained and counter signed by the bystanders. Tetanus toxoid and one dose of parenteral antibiotics were given prior to the surgery. The nail diameter to be used was chosen with the help of an AP X Ray of the proximal femur at the level of isthmus.

Choice of Nail: Hollow and tubular PFNA2 was chosen, which was made up of AISI 316 L stainless steel. All nails used were of uniform length of 170,200,240 mm. 16.5 mm is the proximal diameter of the nail, while the distal diameter ranges from 9 to 11 mm. The diameter of the PFNA2 to be used was determined from an Antero posterior X ray, by measuring the diameter of the femur at the level of isthmus. PFNA2 of 130° with 10° of anteversion and 5° of mediolateral curvature was used. proximal Blade 8mm in size and its length ranges from 55mm to 115 mm. Distally PFNA2 has two parallel holes for distal interlocking bolts. The upper one of the distal holes is for static locking and the lower one is for dynamic locking

Patient was positioned supine on the fracture table, under image intensifier stable or near anatomic reduction is obtained after correcting the rotation,

abduction, lateral and anteroposterior angulation and maintained under taction. Open reduction was done when acceptable reduction could not be attained. After Deeping the longitudinal incision proximal to tip of the greater trochanter, passage of guidewire and nail done followed by insertion of proximal blade and the distal static and dynamic holes were locked.

During the postoperative period, the general conditions and vitals were monitored, IV antibiotics and iv fluids were given for 2days, analgesics were given according to patient compliance and blood transfused as per requirement. All patients were mobilized 24hrs after surgery in the bed along with quadriceps exercises and knee mobilization, protected weightbearing started at 4 th post op day, but complete weightbearing without support was allowed only after radiological and clinical union. All patients were followed up at 6 week, 3 months, 6 month, 9 months and 1 year. During every visit, patients were assessed clinically regarding hip and knee function, ability to bear weight and walk, fracture union, deformity and other complications. Radiological evaluation for union, screw cut out, breakage of nail, malunion, nonunion, abutment of nail and bolt breakage was done. Functional outcome assessment using Harris hip score was assessed at 9 months.

RESULTS

The age distribution of the study population ranged from 48 years to 94 years, with mean age being 75.25 years, majority of patients were females (54cases 66.7% and 27cases were males ie.33.4%). The most common mode of injury was slip and fall contributing about 90.1% (73 cases), right side of the patient was involved in 60.5% (49 cases) compared to left side of 39.5%(32cases). 85.2% (69 cases) osteoporosis was present, only 12 case (ie 14.8%) did not had osteoporosis. 85.2% of cases (69 cases) was operated within 1 week, 14.8%of caseswere operated after 7days. 6 patients had postoperative infections out of which 2 cases were having deep infection which needed repeated wound debridement 5.1% of patient had Delayed complication which included helical blade cut out(1 case) and 4 patients (1.2%) had malunion.

Table 1: Age Distribution Descriptive analysis of age in study population (N=81)

Parameter	Mean ± SD	Median	Min	Max	95% C.I	
					Lower	Upper
Age(years)	75.25±10.16	78.00	48.00	94.00	73.00	77.49

Table 2: Gender Distribution Descriptive analysis of gender in study population (N=81)

Gender	Frequency (n=81)	Percentages (%)
Male	27	33.3%
Female	54	66.7%

Table 3: Descriptive analysis of parameters in study population

Parameters		Frequency (n=81)	Percentages (%)
Laterality	Right	49	60.5
	Left	32	39.5
Mode of injury	Fall	73	90.1
	RTA	8	9.9
Osteoporosis	Present	69	85.2
	Absent	12	14.8
Delay in surgery (week)	1	69	85.2
	2	6	7.4
	3	6	7.4

Table 4: complications in study population

Complications		Frequency (n=81)	Percentages (%)
Post OP Complications	Superficial wound Infection	4	4.9
	Deep wound Infection	2	2.5
	Nil	75	92.6
Radiological Complications	Malunion	4	4.9
	Helical blade cut through	1	1.2
	Nil	76	93.8

Table 5: Harris Hip Score (HHS) In Study Population

Harris Hip Score	Frequency (n=81)	Percentages (%)
Excellent	15	18.5
Good	27	33.3
Fair	32	39.5
Poor	6	7.4
Failed	1	1.2

Harris Hip function score 42 patients (51.8%) had excellent-good functional score, while 38 patients (46.9%) had fair-poor results, one case had a failed result.

The Harris hip functional score compared with age were found to be statistically significant, (P < 0.001) with participants with mean age (62.87 +- 10.15) had excellent score and poor results were seen in participants with mean age group (88.50+- 5'95), while good and fair results were seen in participants with mean age group (74.37+-6.80 and 79.22+-7.08) respectively.

Association between gender, post-op complications, radiological complications and various co-morbidities and functional outcome (HHS) was assessed. It was found out that there were statistically significant differences between radiological and post operative complication with functional outcome measured by HHS. There were no statistically significant differences between gender and functional outcome as well as with various co-morbidities and functional outcome.

DISCUSSION

Trochanteric fracture of femur has always been a challenge to orthopedic surgeons as the aim of the treatment is not only to achieve fracture union but also focuses on early mobilization of the patient and helping them return to their pre morbid state at the earliest. With the advances in health services and improvements in living standards, life expectancy has markedly been increased. This in turn has a hidden burden on the society and health care systems as the quality of bone decreases with age and higher is the chance of fractures.[15,16]

Next in line is the controversy in choosing an ideal implant to treat the trochanteric fractures of femur. There are various studies, each claiming advantages over the other. Extramedullary as well as intramedullary implants have been used. The dynamic hip screw (DHS) have remained the choice of implant for a while considering its favorable results, low rate of non-union and implant failure. DHS works on the principle of controlled compression at the fracture site. Disadvantages of DHS include larger exposure, greater soft tissue damage, varus collapse, increased surgical time, high rates of complications and implant failure. For all these reasons, DHS is being less popular among orthopedic surgeons.[17]

Studies show that an intramedullary implant inserted in a minimally invasive manner is better tolerated by the patients especially the elderly as they are biomechanically stronger and helps in early mobilization. Gamma nail though once commonly used, has been discarded due its high rate of complications.[18]

Amongst the various implants available, PFNA2 is beginning to gain popularity among orthopedic surgeons. Advantages of PFNA2 include early mobilization, better outcome, lesser chances of fractures of the femoral shaft as it has a smaller distal shaft diameter, reduced lever arm, lesser implant breakage, easily available and affordable, prevents the medialization of the femoral shaft, limits the surgical insult to the tendinous hip abductors, shorter surgical time, minimal invasive technique, minimal soft tissue damage and blood loss and lesser complications like infections, DVT, respiratory distress, etc.

The present study was undertaken to assess the functional outcome of trochanteric fractures of femur treated with PFNA2. We have evaluated our results and compared the same with those obtained by various other studies which used similar fixation technique.

1. Age distribution

In our study, trochanteric fractures were common among the age group 66-82 with a Mean age of 75.25 years. The youngest person in this study was 48 years and the eldest was 94 years of age.

In 1980 Gallaghar et al reported an 8 fold increase in trochanteric fractures in men who were over 80 years and women over 50 years of age64.

Average age reported by other workers is as follows

Table 6: Age distribution comparison in various studies

Name of the worker	Age in years
Cleaveland and Thompson65	76.0
Murray and Frew66	62.5
Boyd and Griffin31	69.7
Scott33	73.3
Evans30 -	
Male	62.6
Female	74.3
Sarmiento67	71.9

Trochanteric fractures are more common in the elderly due to senile osteoporosis and special care should be taken to prevent or treat osteoporosis. Along with this make sure to avoid the potential danger of poor lighting, wet slippers, slippery floor etc. In our study we had a significant outcome (p <0.001) relating to age and younger patients had better clinical and functional score.

Table 7: Mean age of various studies and significance with functional outcome

Study	Mean Age	Significance
Korkmaz et al68	77.6	P<.05
Rehan Ul Haq69 et al	55.5	P 0.400
Present study	74.46	P < 0.001

2. Sex distribution

Most of the patients in this study were female (66.7%) and male accounted to 33.3%

Ratio of Male: Female in other series is given below

Table 8: Sex distribution comparison in previous studies

Series	Male	Female
Boyd and Griffith31	74	226
Murray and Frew66	56	46
Scott33	35	65
Robey70	46	53
Clawson71	75	102

In 1982 Melton J.L., Ilistrup DM, Riggs BL et al in their study titled 'fifty years trend in Hip fracture incidence' reported female to male ratio of 1.8:1. And this is consistent in our present study of trochanteric fractures.

In our study we had no significance relating gender to functional outcome (p=0.304).

Both men and women had comparable clinical and functional score.

3. Mode of Injury

Most of the patients in our study sustained trochanteric fractures following domestic fall (self fall at home) and trivial trauma. Road traffic accident (RTA) were common in the younger patients group.

In this study 90% of patients had injury by self fall and 10% were due to RTA which is comparable with other studies.

Table 9: Mode of Injury comparison

Study	Self-fall	RTA
Xu Yaozeng72	41	9
Mehmet Fatih70	87	3
Ranjeetesh Kumar73	26	4

4. Laterality

Out of the 81 different types of trochanteric fractures studied, 49 cases (60.5%) had proximal femoral fractures on the right and 32 cases (39.5%) had the fracture on the left.

5. Co morbid condition of the patient

Out of the 81 cases, Most were found to have pre existing co-morbidities which were optimized before the surgical procedure. Most frequent co-morbidity encountered was Systemic hypertension (81.5%) closely followed by Diabetes mellitus (71.6%). Other preexisting co morbid conditions included coronary artery disease (25.9%), Dyslipidemia (11.1%) Chronic Obstructive Pulmonary Disease (6.2%), Benign Prostatic Hyperplasia (3.7%), Cerebrovascular Accident (12.3%), Hypothyroidism (2.5%) and chronic kidney disease (6.2%).

Functional outcome as per Harries Hip Score is found to be less in persons with Chronic Obstructive Pulmonary disease (P value 0.010).

6. Time duration between hospital admission and surgery

All patients in the present study series were operated within 1week following hospital admission and among these, the majority (85.2%) were operated within the 4 to 7 days. Operative procedure was delayed in a few cases due to delay in optimizing their medical problems.

Immediate surgical intervention is required to avoid complications like respiratory infections, catheter sepsis, cardiac failure and occurrence of bed sores. It also helps in early mobilization and rehabilitation of the patient. Evans noted 30% mortality rate in patients on conservative line of treatment compared to a 15% mortality rate in the surgically treated group.

Blood loss during surgery

Table 10: Amount of blood loss during surgery

Blood Loss	Number of patients
100-250 ml	76 patients
250-400 ml	5 patients

In our study there were only 5 patients with blood loss more than 250ml and most of them were associated with cases in which closed reduction was difficult and later went for open reduction. Blood loss was measured by mop count (each fully soaked mop was considered to have 50ml blood in it)

Table 11: Amount of blood loss during surgery in previous studies

Study	Blood loss
Pajarinen74	50 -200 ml
Ranjeetesh Kumar73	-200 ml

7. Post operative Complications

In the present study we had 6 cases wound infection (Superficial wound infection 4(4.9%) and Deep wound infection 2(2.5%)) in the post operative period. Intra venous antibiotics were prolonged in all these patients. Our protocol in this study was to give IV antibiotics for 5 days but in the presence of would infection, we had prolonged the use of IV antibiotics according to pus culture and sensitivity reports. Wounds were dressed as per requirement.

There were no cases found to have chest infection, pulmonary embolism, DVT, respiratory distress or urinary retention during the post operative period.

Other studies

Table 12: comparison of wound infection with other studies

Ranjeetesh Kumar et al73	P<0.05
J. Pajarinen74	p>0.05
Present study	P<0.001

8. Radiological complications

Functional outcome was poor in cases with radiological complications

In our study there were 4 cases (4.9%) that developed malunion and Helical blade cut through was seen in 1 cases (1.2%). Radiological complications had significance with outcome (p< 0.001). If there are no radiological complications there is fair functional outcome.

9. Functional assessment of the results

Functional assessment was done using Harris hip score at the end of 3 months.

In our study there were 15 cases (18.5%) with excellent outcome, 27 cases (33.3%) with good results, 32cases (39.5%) with fair results, 6 cases (7.4 %) with poor outcome and 1 failed case (1.2 %). Most of the patients with excellent and good results were younger individuals with minimal post operative and radiological complications.

A lot many of the patients with fair and poor results were of older age group, with co- morbidities and had radiological complications.

There were no association seen in the functional outcome with the respect to gender, wound infection and type of the fracture.

The Mean Harris hip score in the present study is 82.68

Other studies

Table 13: Comparison of HHS with other studies

Study	Mean HHS
Ranjeetesh Kumar73	93
Cyril Jonnes75	90.3
Chaitanya.m76	94.6
Madu Sridhar77	88.2
Present study	82.68

CONCLUSION

In this present study, carried at Govt Medical College Hospital, Thrissur between the time period between March 24th 2022 and December 24th 2022, 81 patients with intertrochanteric fractures were identified and treated with Proximal femoral nail Antirotation 2. Here are the conclusions:

- Majority of the patients were female with a mean age of 75.
- Mode of injury mostly being slip and fall at home
- In this study both sides were almost involved, but with slight predominance over the right side
- Most of the patients were operated within the initial 5 days itself and only minimal blood loss was observed.
- There were 4 patients with superficial wound infection, 2 patient with deep wound infection. Of these, 5 patients had diabetes mellitus.
- There were 4(4.9%) patients with mal union and 1(1.2) patient with Helical blade cut through, No abutment or breakage of nail and bolt breakage were seen.
- There were 15 excellent, 27 good, 32 fair and 6 poor outcome patients along with 1 failed cases, according to our functional outcome assessment based on Harris hip score.
- Mean HHS in the current study is 82.68
- Functional outcome was better in the young individuals and if they had no radiological complications.
- There is statistically significant difference between Age, Post op complication, and functional outcome.
- There is no statistically significant difference between Gender and functional outcome.

We conclude that Intertrochanteric fractures of femur treated with Proximal Femoral Nail Antirotation 2 helps in achieving biological reduction, imparts stability and enables early mobilization. It also prevents excessive collapse and decreases blood loss during the surgery. This results in faster union, lesser incidence of complications. Thus it helps in achieving overall good functional outcome.

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