



ISSN: 2395-1958
IJOS 2017; 3(4): 556-561
© 2017 IJOS
www.orthopaper.com
Received: 17-08-2017
Accepted: 18-09-2017

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Analysis of outcome of unstable intertrochanteric fractures treated by proximal femoral nail- A prospective and retrospective study

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DOI: <https://doi.org/10.22271/ortho.2017.v3.i4h.77>

Abstract

Background: An analytical study was conducted on the outcome of unstable Intertrochanteric fractures treated by conventional proximal femoral nailing in a prospective and retrospective method.

Materials and methods: During our study period, 130 patients, both males and females, aged between 50 years and 100 years who were suffering from unstable intertrochanteric fracture and who were treated with Proximal femoral Nailing were included in the study. Both prospective and retrospective studies were conducted to evaluate clinical and functional outcome of 130 patients. Modified Harris Hip score was used to evaluate clinical and functional outcome. Radiological assessment with hip anteroposterior and lateral views were taken. quality of reduction, malalignments, screw cut outs, bony union and implant related complications were noted.

Results: In our study majority of the cases about 60% were in the age group of 61 to 80 years among the study group of 50 to 100 years. Females were slightly more affected (52.35%) as compared to males (47.65%). Average time for radiological union was about 16 weeks. Among 130 of our patients 1 case died on 3rd postoperative day for reason unrelated to the surgery. So Harris Hip Score was calculated for 129 patients. We had 53.9% of excellent and 36.1% of good results which together accounted to about 90% of the cases

Conclusion: Based on our experience and results we conclude that proximal femoral nailing is an excellent judicious and rational method of fixation for unstable intertrochanteric fractures in elderly patients.

Keywords: Unstable Intertrochanteric fractures, proximal femoral nailing, Harris hip score

1. Introduction

Intertrochanteric fractures are debilitating injuries that commonly affect elderly. The frequency of these fractures has increased because of significant increase in the life expectancy of population and sedentary lifestyle. Trochanteric fractures occur in the younger population due to high velocity trauma, whereas in the elderly population it is most often due to trivial trauma [1-3]. The aim of treatment thus should be early mobilization and prevention of malunion. Many devices have evolved in the evolution of the fixation methods recommended for use in trochanteric fractures, of them the most commonly used device is the Dynamic Hip Screw with Side Plate assemblies. Each one has got its own advantages and disadvantages. However none of the implants had given satisfactory results in unstable Intertrochanteric fractures till the arrival of proximal femoral nail in the nineties. Proximal femoral nail is a cephalomedullary collapsible device with rotational stability with other advantages also [4-7]. Hence an analytical study on functional outcome of unstable Intertrochanteric fractures was done in a prospective and retrospective manner.

2. Materials and methods

The study consists of 130 cases of intertrochanteric femur fracture in 128 patients satisfying the inclusion criteria, who were treated with Proximal Femoral nail in a tertiary care centre. This is a retrospective and prospective study from January 2012 till April 2017. Cases satisfying the inclusion criteria were admitted in our institute and were analyzed clinically and radiologically. All the patients selected for the study were examined clinically, associated

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injuries and co-morbidities were noted and clinical and laboratory investigations carried out in order to get fitness for surgery. Patients were operated between 1 to 10 days after admission once the patient was optimized for the surgery. Regular conventional proximal femoral nail design was used for all the patients. Patients were selected as per the inclusion and exclusion criteria.

2.1 Inclusion criteria

1. Unstable intertrochanteric fractures (Reverse oblique fractures and Inter trochanteric fractures with loss of posteromedial cortex)
2. Individuals more than 50 years of age.

2.2 Exclusion criteria

1. Compound hip fractures
2. Stable Intertrochanteric fractures
3. Individuals less than 50 years of age
4. Pediatric fractures
5. Pathological fractures

2.3 Data collection

After the patients were admitted to hospital all the necessary clinical details were recorded in a proforma. After the completion of the hospital treatment patients were discharged. All patients were followed up prospectively at 6 weeks, 3 months, 6 months and one year or retrospectively data were collected from case files and registries.

All surgeries done with patient tied to fracture table, reduction was confirmed under c arm. We used standard proximal femoral length of 250mm. Diameter of the nail was chosed depending upon the medullary canal size of patient. The proximal derotation screw was of 6.2mm and lag screw of size 8mm. Distal locking was jig aided and both static and dynamic holes were locked. Patients were encouraged to sit in the bed after 24 hours. Patients were taught quadriceps exercises and knee mobilization in the immediate post-operative period. Patients are taught gait training before discharge from the hospital. Only in very unstable fracture patterns weight bearing was not advised. Others were encouraged to weight bear partially with axillary crutches or walker depending on the pain tolerability. Patients were followed up at every 6th week till the radiological union was seen and patient was pain free. After that patients were followed up once in 3 months. Patients were assessed for pain, hip and knee function, fracture union and shortening. Modified Harris hip scoring system was used for functional evaluation.



Fig 1: Conventional proximal femoral nail used for all cases

3. Results and analysis

The study included 130 intertrochanteric fractures from 128 patients from our institute between January 2012 to April 2017. Following observations were made from our study.

3.1 Age and sex distribution

In our series, majority of the cases i.e.79 (60%) were in the age group of 61-80 years, followed by 35 (27%) cases in the age group 81-100 years. The youngest patient was 50 years old and eldest patient was 100 years old. The mean age was 78.33 years.

Majority of the patients were females – 67 cases (52.35%) and 61(47.65%) were males.

Table 1: Age Distribution

Age group	Number of cases	Percentage
50 – 60	16	13%
61 – 80	79	60%
81-100	35	27%

Table 2: Sex Distribution

Sex	Number of cases	Percentage
Male	61	47.65%
Female	67	52.35%

3.2 Nature of violence

59 cases (45.3%) affected were due to domestic slip and fall, 52 cases (40%) due to RTA, and 19 cases (14.7%) due to fall from height. Slip and fall was the most common mode of injury.

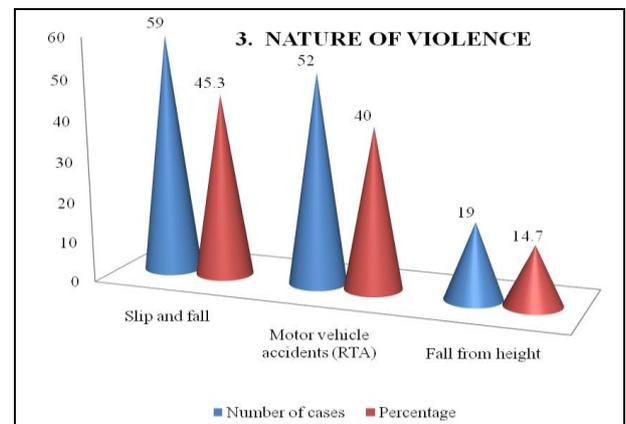


Fig 2: nature of injury

3.3 Side affected

Right side was involved in 64 (49.23%) cases and left in 66 (50.77%), left side was more commonly involved than right side.

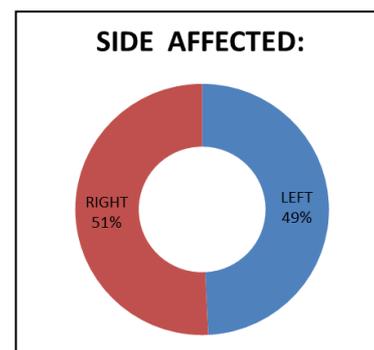


Fig 3

3.4 Boyd and griffin classification

In the present study, majority of the cases i.e. 62 (47.7%) had type 2, followed by 42(32.30%) cases had type 3 Boyd and Griffin type.

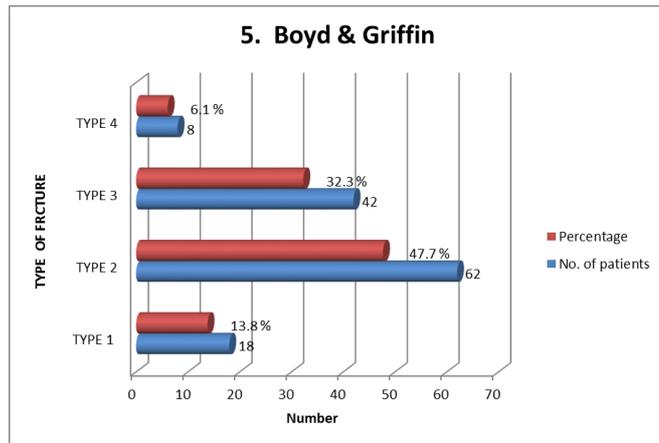


Fig 4

Thirteen patients had closed head injury, CT brain study was reported as normal report and were thus managed conservatively. 8 patients had distal radius fracture. Six of them were treated closed reduction and below elbow cast application & other 2 were treated with Open reduction & internal fixation with locking plates. 4 cases had ipsilateral fracture clavicle & were treated with bracing.

All the cases included in our study group were fresh fractures that underwent surgery at the earliest possible in our set up. The delay was due to associated injuries, as well as assessment of medical condition of the patients. All the patients were operated ranging from 2 to ten days from the date of admission.

3.5 Intraoperative details

In our study, we considered various intraoperative parameters such as duration of radiographic screening - more exposure was noted in case of comminuted fractures with difficult reduction. We took less exposure time in cases of intertrochanteric fracture where reduction was not a problem. Duration of surgery was more for the intertrochanteric fractures where we had to do open reduction because of difficult anatomical reduction by closed means. Anatomical reduction included less than 10° of varus or valgus angulation as compared to normal or unaffected side. Blood loss-measured by mop count more blood loss was seen in patients who required open reduction.

Table 3: Intraoperative details

Mean duration of screening(in seconds)	55
Mean duration of operation(in minutes)	65
Mean blood loss(in milli litres)	90

3.6 Intraoperative complications

In one of our case near cortex got splintered while passing the hip screw and in the same patient we missed the hole while putting the distal locking screw, which was due to problem with jig and after two days we redid it and placed the distal screws correctly. In one of our case we could pass only hip screw proximally because of the narrow neck. In 4 we had difficulty in doing distal locking due to jig problem which stopped happening after we started using a fresh jig. In four of our patients we did open reduction.

Table 4: Intraoperative complications

Complication	Number of cases	Percentage
Open reduction	4	3.07%
Failure to put derotation screw	1	0.76%
Varus angulation	3	2.3%
Breakage of cortex during proximal locking and distal locking hole was missed	1	0.76%

3.7 Post-operative complications

One case expired third postoperative day due to reason unrelated to surgery (myocardial infarction). We had two cases of superficial wound infection post operatively, which were managed with regular dressing, culture and sensitivity and appropriate i.v antibiotics. We had 2 cases of deep infection managed with wound debridement, VAC dressing and antibiotics followed by secondary suturing.

We had 2 cases of trochanteric non unions which incidentally were associated with open reduction and were diabetics. They were treated with implant removal and cemented hemireplacement hemiarthroplasties. We encountered 3 cases of delayed union and three case of mal union (varus <10 degree). 10 cases had shortening more than 1 cms (average of 1.3 cms) who were treated with sole raise. 6 cases had knee stiffness which improved after physiotherapy. 1 patient had a superior cut out of derotation screw after about 7 months of surgery which was explanted as fracture had united. We did 2 nail explants after complete union of the fracture as they had pain due to backed out screw heads.

Table 5: Delayed complications

Complication	Number of cases	Percentage
Delayed union	3	2.3%
Varus malunion <10°	3	2.3%
Nonunion	2	1.5%
Shortening of >1cms	10	7.7%
Knee joint stiffness	6	4.6%
superior cutout of screws	1	0.76%

In our study the average duration of hospital stay was 13 days. Mean time for full weight bearing was 16 weeks with aids. Average time for radiological union was 16.5 weeks. We had 2 cases of knee stiffness, which improved with physiotherapy and 2 cases of stiff hip secondary to poor motivation and inadequate physiotherapy. Post-operative mobility was aided in immediate post-operative period but later all patients except two were ambulatory independently with or without walking aid after 6 weeks. Two exception cases later on succumbed due to problems not related to surgery at around 4 months post operatively.

3.8 Follow up

All patients were followed at 6 weeks, 12 weeks, 6 months and some patients upto one year and further if necessary. Two of our patients expired at around 4 months postoperatively due to causes unrelated to surgery, but had poor Harris Hip Scores. They were confined to bed and had stiffness of hip as well. At each follow up radiograph of operated hip with upper half femur was taken and assessed for fracture union and implant failure and screw cut out.

3.9 Anatomical results

Anatomical results were assessed by presence or absence of deformities, shortening, hip and knee range of motions. Less

than 10° of varus or valgus malunion was considered anatomically as good result. In our study 3 cases had delayed union, ten patients had shortening $>1\text{cm}$, three patients had varus malunion <10 degrees, two went in for nonunion later revised to bipolar arthroplasties.

3.10 Functional results

In our series of 130 operated cases one case expired third postoperative day due to myocardial infarction. Functional & anatomical results are assessed taking the remaining 129 cases into consideration using Harris Hip Scoring System (Modified) [8]. In our study, According to Harris Hip Scoring System (Modified), Good to excellent results are seen in 89.2% cases of trochanteric fractures. We had 7% of cases with fair results and 3% had poor results. (figure 5 and 6)

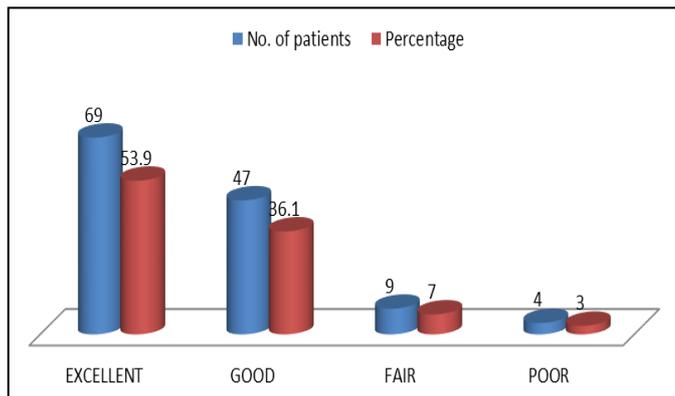


Fig 5: functional outcome

4. Discussion

The treatment of intertrochanteric fracture is believed that it should be internally fixed to reduce the morbidity and mortality of the patient.

The treatment of intertrochanteric fractures of the proximal femur is still associated with some failures. The reasons are disregard for biomechanics, overestimation of the potentials of new surgical techniques or new implants or poor adherence to established procedures. High stress concentration that is subject to multiple deforming forces, slow healing time because of predominantly osteoporotic bone, high incidence of complications reported after surgical treatment compels the surgeon to give a second thought regarding selection of the proper implant.

The most common current modes of fixation are Blade plate systems, Sliding screw systems and intramedullary devices. From the mechanical point of view, an intramedullary device inserted by means of minimally invasive procedure seems to be better in elderly patients. Closed reduction preserves the fracture haematoma, an essential element in the consolidation process. Intramedullary fixation allows the surgeon to minimize soft tissue dissection there by reducing surgical trauma, blood loss, infection, and wound complications.

PFN is a novel, modern intramedullary implant based on experience with the gamma nail. The currently used gamma nail as an intramedullary device also has a high learning curve with technical and mechanical failure rates of about 10%. The Arbeitsgemeinschaft für Osteosynthesefragen (AO ASIF) in

1996 therefore developed the proximal femoral nail with an antirotational hip pin together with a smaller distal shaft diameter which reduces stress concentration to avoid these failures.

In our study the average age of the patients was 78.33 years, which is slightly higher but was comparable to Indian and western authors with similar studies [9-11]. This is due to prevalence of osteoporosis in an increasing geriatric population. Though there is variability of sex composition our study showed almost equal sex incidences.

Majority of the cases in our study i.e., 62 (47.7%) had type 2 of Boyd and Griffin classification, followed by 42(32.30%) cases had type 3. The average operating time of about 65 minutes & Carn screening time of 55 seconds were comparable to other studies. Average intraoperative blood loss was very minimal amounting to an average of about 90ml. Only about 12 of them were given intra or post-operative blood transfusion with most of them having a very low pre-operative hemoglobin levels. Average hospital stay averaged to about 13 days, it was more in patients who had co morbid conditions, wound infections and patients with associated fractures with highest being 22 days. Average duration of radiological union was 16 weeks.

Simmermacher *et al* [12] (1999), in a clinical multicentric study reported technical failures of PFN after poor reduction, malrotation or wrong choice of screws in 5% of the cases. In our study poor reduction occurred in three cases with varus malreduction. A cut out of the neck screw occurred in 0.6% cases in the study conducted by Simmermacher.

We had a similar cut out of derotation screw which was explanted 7 months after surgery by which time fracture had united. Anatomical fracture reduction was found in 90% of the patients and full weight bearing stability was achieved in 98%. In our study acceptable anatomical reduction was obtained in 90% cases but we had to openly reduce three fractures. In our study we had no case of intraoperative fracture displacement after nail insertion but we had comminution of trochanteric region while trying to pass the hip screw and we missed one hole while putting the distal locking screw because of problem with the jig. This was however rectified after 2 days when distal locking was redone perfectly.

We had non-union in two cases which were later revised to cemented bipolar arthroplasties. These cases were diabetics and incidentally openly reduced intraoperatively which might have been the cause for non-union. In our Study we had 90% near normal anatomical fracture reduction (less than 10° of varus or valgus malalignment) and fracture consolidated in 16 weeks. In ten cases we had shortening of more than 1 cm (average of 1.3cms). 88.57% had full range of hip motion. 1.5% had superficial infections which were controlled with antibiotics, and 1.5% had deep infections that were managed by wound debridement and antibiotics. Migration of the screws due to severe osteoporosis was detected during the follow up in 2 patients. In one of our patients though the fracture had united, we could see the 'Z effect' with the migration of hip pins into the joint in which case the nail was explanted. The complication rates in our study were comparable with the other studies [13-15]. (figure 7)

Table 6: Comparison of Post Op Complications with Other Studies

Complications	Pavelka	Dousa	Banan H	Al yazzari	A.S. Sidhu	Morihara	Mutin uzun	Our Study
Incomplete reduction	4	-	-	-	-	-	-	-
# at distal lock	2	-	-	-	-	-	-	-
Fixed in distraction	2	1	-	-	-	-	-	1
Incorrect neck screw	2	1	-	-	-	-	-	1
Implant cutout	-	-	4	4	-	-	-	1
Delayed union	-	-	1	-	2	-	-	3
AVN / NU	-	-	-	1	-	2	-	2
Difficult distal lock	-	-	-	4	4	-	-	4
Fixed in varus	-	-	-	-	3	-	2	3
Screw backout	-	-	-	-	1	5	2	2

Metin Uzun *et al* [16], in 2009, In a study of 35 patients reported Long-term radiographic complications following treatment of unstable intertrochanteric femoral fractures with the proximal femoral nail and effects on functional results. In Metin Uzun’s study, Haris Hip scores were as shown in the table with a mean Haris Hip Score of 82.1. Reduction was

assessed as good or acceptable in all the patients. Radiographic complications mainly included secondary varus displacement in nine patients (25.7%). Secondary varus displacement was due to cut-out of the proximal screws (n=2), screw loosening due to collapse of the fracture site (n=2), and reverse Z-effect (n=5).

Table 7: Haris Hip Score Comparison

Modified HHS	Metin Uzun [16]	Our Study
Mean	82.1	86.41
Excellent	11 (31.4%)	69 (53.9)
Good	15 (42.9%)	47 (36.1)
Fair	7 (20%)	9 (7%)
Poor	2 (5.7%)	4 (3%)

In our study mean Harris hip score was 86.41. Radiological complication chiefly included 3 cases of varus malunion in 3 patients. The mean duration of hospital stay was 13 days; mean time for full radiological union was 16 weeks. Post operatively all patients were ambulatory of which three of them required walking aids. Ten patients had more than 1cms shortening after fracture union which was treated

conservatively by sole rise. All patients enjoyed good range of hip and knee motion except in four, two of whom had hip stiffness which persisted and two had stiffness of knee which improved by physiotherapy. In our study 1 case expired within 3 days of surgery due to reason not related to surgery.



Fig 6a: pre op xray

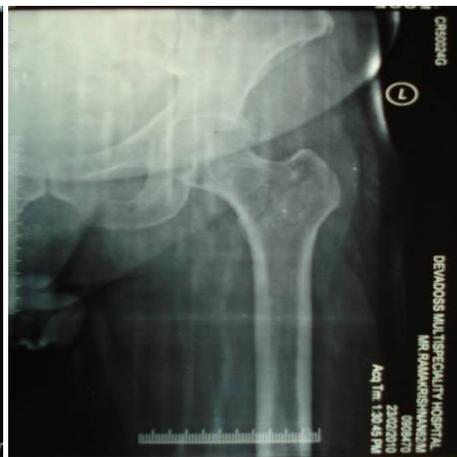


Fig 6b: Immediate post op



Fig 6c: 3 months post op



Fig 6 d to f: standing, sitting and leg raising.

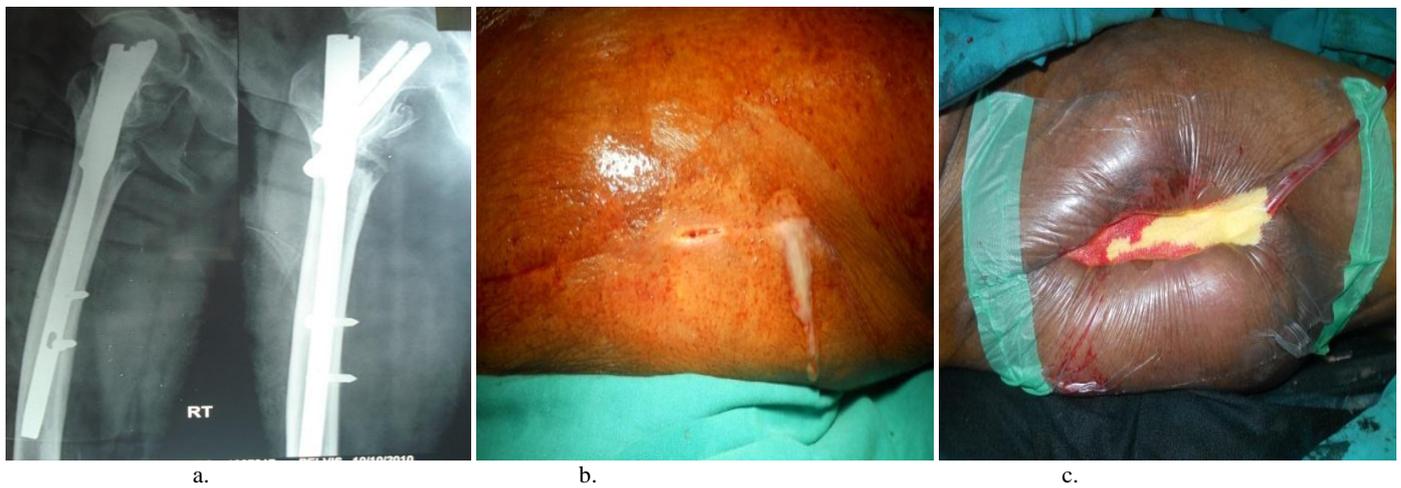


Fig 7: complications: 7a. distal locking missed. 7b. deep infection 7c. infection treated by vac dressing.

5. Conclusion

Based on our experience and results we conclude that proximal femoral nailing is an excellent judicious and rational method of fixation for unstable intertrochanteric fractures in elderly patients. Comparative studies with other intramedullary devices and newer variations like PFN-A are necessary for a better idea regarding more efficient implants which also have lesser complication rates.

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