

Comparative study of functional and radiological outcome in unstable intertrochanteric fracture treated by augmentation of proximal femoral nail versus non-augmentation

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Abstract

Unstable intertrochanteric fracture continues to be a challenge for orthopaedic surgeons. Despite high union rate, the functional outcome still tends to be disappointing. Intact lateral wall plays a key role in stabilization of unstable trochanteric fracture by providing a lateral buttress for proximal fragment and its deficiency leads to excessive collapse and varus malpositioning. Patients admitted in with unstable intertrochanteric fractures satisfying the inclusion criteria will be included in the study and will be alternatively allocated into two groups i.e. Group A (will contain patients treated with proximal femoral nail without any augmentation,) Group B (will contain patient treated with proximal femoral nail augmented with additional screw or encercage wire). In our study, in augmentation group According to Harris Hip scoring system (Modified), excellent results are seen in 10(66.7%), we had good results in 1(7.7%), Fair in 4(26.7%) and no case with poor results. Our results are comparable with other studies.

In our study in Control group According to Modified Harris Hip Score excellent result are seen in 6(40%), we had good result in 7(46.7%), Fair in 2(13.3%) and no case with poor results.

Keywords: Unstable intertrochanteric fracture, proximal femoral nail, modified harris hip score

Introduction

Intertrochanteric fracture are common in elderly peoples because of osteoporosis and in younger peoples because of high energy trauma. The incidence of the hip fracture world-wide is estimated at 1.6 million ^[1].

Unstable intertrochanteric fracture are best treated with an intramedullary implant. The theoretical benefits of intramedullary nails over side plate devices include improved biomechanics (short lever arm), decreased blood loss, smaller incision, and decreased femoral neck shortening Integrity of lateral wall of the trochanteric another consideration when

treating intertrochanteric fracture [2].

Unstable intertrochanteric fracture continues to be a challenge for orthopaedic surgeons. Despite high union rate, the functional outcome still tends to be disappointing. Intact lateral wall plays a key role in stabilization of unstable trochanteric fracture by providing a lateral buttress for proximal fragment and its deficiency leads to excessive collapse and varus malpositioning.

Cephalomedullary nailing biomechanically is a better choice of implant for fixation of unstable fracture as nail itself gives support to posteromedial cortex and resist excessive collapse. Hence anatomical reduction and supporting the lateral wall is important to prevent complication [3].

Augmentation of fixation of intramedullary nail in unstable trochanteric fracture using cerclage wire for lateral wall reconstruction is useful and reduces the reoperation rates by reducing the failure rates [4].

The use of cerclage wire and Lag screw in the greater trochanter in addition to the intramedullary nail provides better stability to the lateral wall and posteromedial wall. This reduces complication like screw cut out and fracture collapse. The functional outcome is better due to increased stability and union time is not affected [4].

This study is intended to analyse the radiological and functional outcome of unstable intertrochanteric fracture by augmentation of proximal femoral nail by means of screw or encirclage wire in comparison with those without augmentation.

Methodology

Source of data

Patients admitted with unstable intertrochanteric fracture as in-patient at a Medical College & Research Institution.

Study design: A Prospective Randomized Comparative study.

Sample size: It is a hospital-based study of 30 patients who satisfy inclusion criteria 15 patient treated with proximal femoral nail only and 15 patients treated with proximal femoral nail augmented with additional screw or encirclage wires.

Inclusion criteria

- 1) Age above 18 years.
- 2) Willingness and written informed consent of the patient to participate in the study.
- 3) All type 2 & 3 unstable intertrochanteric fractures as per AO/OTA classification.

Exclusion criteria

- 1) Patient is not willing for proposed procedure.
- 2) All patient with stable intertrochanteric fracture.
- 3) Pathological fracture.
- 4) Stroke and hemiplegic patient.
- 5) Patient not willing to give informed consent.

Patients admitted in with unstable intertrochanteric fractures satisfying the inclusion criteria will be included in the study and will be alternatively allocated into two groups i.e. Group A (will contain patients treated with proximal femoral nail without any augmentation) Group B (will contain patient treated with proximal femoral nail augmented with additional screw or encirclage wire). Patients will be treated with regular antibiotics, early mobilisation and

physio therapy in post op period. Patient will be followed up after 6week, 3month and 6month. Outcome will be assessed for radiological signs of union by RUSH score in standard AP and lateral views of X-ray in the follow up period. Patients will also be assessed for functional outcome by using modified Harris Hip Score during the follow up period. Datas will be analysed using suitable statistical methods.

Results

Table 1: RUSH score

Fixation method	RUSH score
Intertrochanteric fracture with augmentation	26
Intertrochanteric fracture without augmentation	22

Table 2: Rush score Distribution

Rush score	Case	Control	P value
22	0	8 (53.3)	<0.001
24	4 (26.7)	7 (46.7)	
26	7 (46.7)	0	
28	4 (26.7)	0	
Total	15 (100)	15 (100)	

*Chi-squared test was used.

Table 3: Mean rush score Distribution

Groups	No. of patients	Mean	SD	P-value
Case	15	25.5	1.6	<0.001
Control	15	22.9	1.6	

*Independent t-test was used.

Table 4: Shortening Distribution

Shortening	Case	Control	P value
Yes	0	2 (13.3)	0.24*
No	15 (100)	13 (86.7)	
Total	15 (100)	15 (100)	

*Fishers exact test was used.

Table 5: Mean TOU Distribution

Groups	No. of patients	Mean	SD	P-value
Case	15	14.1	1.4	0.39*
Control	15	14.8	1.8	

*Independent t-test was used

In our study, we considered various intraoperative parameters such as duration of radiographic screening-more exposure in case of comminuted fractures with difficult reduction. We took less exposure time in case of unstable IT fractures where augmentation was not done.

Duration of surgery was more in case where augmentation was done.

Blood loss was more in open reductions (counted by soaked mops).

In our study, we encountered certain complications intraoperatively. Most of these complications occurred in first few cases.

- In two of our Non-augmentation (Control) case and one augmentation we failed to

achieve anatomical reduction (malreduction).

- One Non-augmentation (Control) cases fixed in varus angulation.

Table 6: Intraoperative complications

Complications	Case	Control	P value
Mal reduction	1 (6.7)	2 (13.4)	0.47
Varus angulation	0	1 (6.7)	
No complications	14 (93.3)	12 (80)	
Total	15 (100)	15 (100)	

Postoperative complications

Immediate complications

We had one cases of superficial wound infection which was managed by regular dressing, culture and sensitivity and appropriate IV antibiotics. No deep infections seen.

Delayed complications

- We encounter 1 cases of varus malunion (varus <10 degree) in augmentation group and 1 case of delayed union in control group.
- Two cases had shortening more than 1cms in control group who were treated with sole rise.
- One cases had knee stiffness seen in augmentation group which was improved by rigorous physiotherapy.
- 2 case of varus malunion and knee stiffness seen in control group
- We had no cases of non-union or cutting of screws.
- We had no case of Z effect.
- No case of reverse Z effect.
- We did not get any above such complication in augmentation group.

Table 7: Post op complication

Complications	Case	Control	P value
Delayed union	0	1 (6.7)	0.28
Knee stiffness	1 (6.7)	0	
Varus Mal union	1 (6.7)	0	
Varus Mal union and Knee stiffness	0	2 (13.4)	
No complications	13 (86.9)	12 (80)	
Total	15 (100)	15 (100)	

*Chi-squared test was used

In our study average duration of hospital stay was 15 days.

All patients enjoyed good range of hip and knee range of motion except two who improved with physiotherapy.

Post-operative mobility was aided in immediate postoperative period but later all patients were ambulatory independently.

Follow up

All patients were followed at 6 weeks, 12 weeks, 6 months. At each follow up radiograph of the operated hip with upper half of femur was taken and assessed for fracture union and implant failure and screw cut out.

Table 8: Mean post OP walking

Groups	No. of patients	Mean	SD	P-value
Case	15	3	0.8	0.38
Control	15	3.3	0.8	

*Independent t-test was used

Table 9: Mean days taken to return normal activity

Groups	No. of patients	Mean	SD	P-value
Case	15	56.4	6.1	0.19
Control	15	61.1	14.5	

*Independent t-test was used

Anatomical results

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

In our study one patient had shortening >1cm, two patients had varus malunion <10 degrees

Functional Results

In our series of 30 operated cases.

Functional and anatomical results were assessed taking using Modified Harris Hip scoring system (MHHS).

Intertrochanteric fracture with augmentation-15.

Intertrochanteric fracture without augmentation-15.

Table 10: Results Distribution

Results	Case	Control	P value
Excellent	10 (66.7)	6 (40.0)	0.045
Fair	4 (26.7)	2 (13.3)	
Good	1 (7.7)	7 (46.7)	
Total	15 (100)	15 (100)	

*Chi-squared test was used.

Discussion

The most common current modes of fixation are blade plate system, sliding screw systems and intramedullary devices. From the mechanical point of view, a combined 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 gamma nail [5].

The Arbeitsgemeinschaft fur osteosynthesefragen (AO ASIF) in 1996, developed the proximal femoral nail with an antirotational hip pin together with a smaller distal shaft diameter which reduces stress concentration to avoid lag screw implant interface failures. Proximal femoral nail has all advantages of an intramedullary device such as decreasing the moment arm, can be inserted by closed technique which retains the fracture haematoma an important consideration in the fracture healing, decrease blood loss, infection, minimise soft tissue dissection and wound complications.

At present it is generally believed that all intertrochanteric fractures should be internally fixed

to reduce the morbidity and mortality of the patient. But the appropriate method and the ideal implant by which to fix the intertrochanteric fractures is still in debate. Because each method having its own advantages and disadvantages [6].

SG Kulkarni, SS Babhulkar in 2015 reported a study on Augmentation of proximal femoral nail in unstable intertrochanteric fracture using cerclage wire and lag screw an analysis of 180 cases with an average follow up of 1 year. The union time was found to be almost same in augmentation and control group, Harris Hip score was found to be significant in case of augmentation group, in control group there were 6 incidences of PFN screw cut out (7.8%) and screw back out was seen in 5 case, one case in control group has non-union, in 9 control cases they have encountered varus malunion. In 7 control cases required hip arthroplasty due to screw penetration.

Wasudeo M Gadegone *et al.*, in between 2010 to 2015 reported a study Augmentation of proximal femoral nail in unstable trochanteric fractures an analysis of 82 patients with an average follow up 8.4 months. Postoperative X-ray examination showed anatomical reduction in 78 cases, and acceptable reduction in 4 cases. Clinico-radiological consolidation of the fracture was observed in all cases at an average of 14.2 weeks. Mean duration of surgery was 65min.in all the patients. Means intraoperative blood loss was 80ml. Nine patients developed local complication including lateral migration of neck screw, Z effect (n=1), infection(n=2) and breakage of distal interlocking bolt in one case. No case of non-union or implant breakage was observed. No limb length discrepancy was observed in any our cases. At the end of follow up the Salvati and Wilson hip function was 32 (out of 40) in 88% of patients [7].

You-Shui Gao *et al.*, in between 2016 to 2017 reported a study A novel cerclage wiring technique in intertrochanteric femoral fracture treated by intramedullary nails in young adults an analysis of 9 patients with an age range of 28-48 years with an average follow up of 6 month. All patients achieved anatomical reduction and underwent routine follow up until fracture healing. There was no early complication, such as infection or late complication, such as delayed union, non-union, implant breakage or cut off. The fracture had obvious callus formation within 14 weeks. The patient returned to their previous position with a total treatment duration of the 16 weeks on average.

The assessment criteria for the efficacy of surgical technique included duration of surgery, number of operative complications, blood loss and radiographic screening time. Clinical assessment includes post-operative walking ability, hip and knee function, fracture union time and implant bone interaction [8].

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

In our study the average age was 56.4 years which was comparable to Indian as well as western authors with similar study.

In our study majority of them was male of about 73.33%.

The most common mode of injury in our study was trivial fall 16 cases 53.33% which is comparable to most Indian studies. This was also affected by the age as the older the patient more likely he/she getting the fracture by trivial falls.

The average operating time was in augmentation cases 71 min and 58 min in non-augmentation cases from the incision to closure. We had a greater operating time in the beginning where we have done augmentation which reduced greatly in the later part of the study. This signifies the learning curve of the Proximal femoral nail with

The average intra operative blood loss was very minimal. The average blood loss was more in patients who required open reduction and augmentation.

Radiation exposure was calculated in seconds, it was 80 seconds by the C-arm. Stable fractures required less exposure than the unstable fractures. This is far below the toxic levels of the radiation.

The average hospital stay was 15 days. It was more in patients with co-morbid conditions and

complications. We had no Z effect or non-unions in our study [9, 10].

In the intraoperative period,

- In two Control and 1 augmentation patients we got Mal reduction.
- We had 1 control cases of fixation of fractures in varus angulation.

Delayed complications

- We encountered one cases of delayed union in control group and one cases of varus malunion in augmentation group (varus <10 degree).
- Two case of control had shortening more than 1cms who were treated with sole rise.
- We had no cases of non-union or implant failure or cutting of screws.
- Two control patients had knee stiffness and varus malunion. And one augmentation has knee stiffness. Patients improved after rigorous physiotherapy.

In our study, in augmentation group According to Harris Hip scoring system (Modified), excellent results are seen in 10(66.7%), we had good results in 1(7.7%), Fair in 4(26.7%) and no case with poor results. Our results are comparable with other studies.

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Conclusion

In conclusion, the use of cerclage wire and lag screw in the greater trochanter in addition to the intramedullary nail provides better stability to the lateral wall and posteromedial wall. This reduces complications like screw cut out, fracture collapse and subsequently reduced limb length discrepancy. It creates a biomechanically stable construct and overall superior functional and radiological outcomes. The functional outcome is better due to increased stability. Although technically demanding, this technique is useful in very unstable trochanteric fractures.

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