

Original Research Article

A study on greater trochanter reconstruction in unstable intertrochanteric fracture of femur

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Received: 19 January 2023

Revised: 13 February 2023

Accepted: 15 February 2023

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ABSTRACT

Background: A study on greater trochanter reconstruction in unstable intertrochanteric femur fracture.

Methods: The 2019 to 2022, Patients were randomly divided into two groups with the help of computer-generated coded envelopes; Group A (unstable intertrochanteric femur fracture patients treated by hemi-arthroplasty or PFN with greater trochanter reconstruction) and Group B (unstable intertrochanteric femur fracture Patients Treated by hemi-arthroplasty or PFN with no greater trochanter reconstruction) with 20 patients in each group Outcomes were evaluated based on Harris hip score calculated at 2 weeks 6 weeks 3 months and 6 months.

Results: Most common surgery in study groups performed were PFN, on radiology as non-union and union, most common study participants show union, on follow up at 2,6 weeks,3 months and 6 months Harris hip score was calculated and it was found to be statistically significant suggestive of improved quality of life, on radiological evaluation all cases shows non-displacement of GT position but in follow-ups at 6 weeks, 3 months and 6 months one case each reported displaced implant.

Conclusions: The result of our study shows that there is improved quality of life and significant improvement in Harris hip score after reconstruction of greater trochanter in unstable intertrochanteric femur fracture.

Keywords: Unstable intertrochanteric fracture, Greater trochanter reconstruction, PFN, Hemi-arthroplasty

INTRODUCTION

Intertrochanteric fracture are defined as extracapsular fracture of the proximal femur between the greater and lesser trochanter.¹ Fractures of intertrochanteric region of femur are among the most common injuries in elderly. The frequency of these fractures are increasing due to increasing life expectancy of our elderly population.² The patients are usually osteoporotic, with multiple comorbidities and give a history of trivial fall.³ The fractures are also seen in adult population due to high-energy trauma.⁴

These fractures have a wide variety of geometry and present as stable and unstable types.^{5,6} The factors leading

to instability are: loss of posteromedial support, severe comminution of greater trochanter, sub trochanteric extension of fracture, reverse oblique fracture pattern and extension into femoral neck.⁷⁻¹¹ Unstable trochanteric fracture pose a challenge to the surgeon. Many options to treat these injuries are available, from sliding hip screw, intramedullary nails to arthroplasty. These patients due to comorbidities less tolerate reoperation. Augmentation of fixation aims at reducing the operation rate by reducing failure rates.¹¹ There are many methods of fixation of greater trochanter fragments using cerclage wiring, tension wiring, k-wire, screw, trochanter support plate etc. These fixation methods help in maintaining the abductor lever arm by preventing non-union of greater trochanter and preventing postoperative pain and trendelengburg sign.¹¹

This study is intended to assess the importance of greater trochanter reconstruction in unstable intertrochanteric fracture, compare the results with those patients where greater trochanter was not reconstructed, and compare the results.

METHODS

Study design, duration and location

This was an interventional prospective randomized control trial study carried out over 3 years from 2019 to 2022 at department of orthopaedics, Lokamanya tilak government medical college and PCMC's PGI YCMH Pimpri tertiary care centre and government medical college. SPSS (Statistical package for social sciences) software was used for statistical analysis.

Sample size

Patients were randomly divided into two groups with the help of computer-generated coded envelopes; Group A (Unstable intertrochanteric femur fracture Patients Treated by hemi-arthroplasty or PFN with greater trochanter reconstruction) and Group B (Unstable intertrochanteric femur fracture patients treated by hemi-arthroplasty or PFN with no greater trochanter reconstruction) with 20 patients in each group.

Inclusion criteria

Inclusion criteria for current study were; adult patients of age 55- 90 years, patients who presented with clinical symptoms and radiological features of unstable intertrochanter fracture and patients fit to undergo surgery and follow up for 6 months

Exclusion criteria

Exclusion criteria for current study were; patients with age above 90 years, pathological inter-trochanter fracture and isolated greater trochanter fracture.

Management protocol

Patient prepared on the morning of day of surgery. Single dose preoperative antibiotic given after test dose. Patient is operated under all aseptic precautions with pre-operative consent.

Patient operated with PFN and greater trochanter reconstruction

Under suitable anaesthesia patient was placed on fracture table with unaffected leg in flexion and abduction attitude by using lithotomy post. Affected leg placed in traction boot and fracture reduced by traction & internal / external rotation along with abduction or adduction. C arm checked & placed in optimal position. Using c arm a closed

reduction is performed to as near an anatomical position as possible. A 4 cm incision is made proximal to greater trochanter. An awl is positioned on medial tip of greater trochanter and advanced within the canal to level of lesser trochanter. A guide rod is advanced in medullary canal, so that it is in centre of canal in both AP & lateral views, and canal is reamed. Once the nail is seated, the targeting device is used to make a 2 cm stab incision. Guide pin is advanced in femoral head. Correct length of pin is measured. The screw is placed in both centre of head or slightly inferiorly within 5- 10 mm of subchondral bone. distal locking screws are placed.¹²

Percutaneous cerclage wire

At the level of lesser trochanter, a stab incision is made, and a cerclage wire is passed using AO cerclage instruments. The two ends of wire now project in wound. Through incision of the IMN entry portal, Kocher forceps are introduced and passed submuscularly distally and the anterior end of the cerclage wire is grasped & delivered proximally. Another stab incision is made at the level of GT anterolaterally. Kocher forceps is introduced into wound & abductor muscles. The forceps is now brought into entry point incision & the end of the wire is grasped & brought medial to proximal end of IMN. The same Kocher forceps grasping the wire is now passed distally in a submuscular plane down to the previous stab incision. Now both wires are held & tensioned. Excess wire is cut & the knot bent and tamped inside wound.¹³

Patient operated with hemiarthroplasty and greater trochanter reconstruction

Under suitable anaesthesia, patient is placed in lateral position. Incision is taken by lateral approach under all aseptic precaution. The comminuted trochanteric fragments were fixed with figure of 8 type wiring technique. This technique is conducted by tying two wires over greater trochanter making a figure of 8 anteroposteriorly and then wires placed again inferior to lesser trochanter laterally. Additionally, these wires tied over the trochanteric area can be useful in reconstructing the gluteus minimus, medius & portion of vastus lateralis. This wiring technique is performed after insertion of stem.¹²

RESULTS

A prospective observational study carried out over 6 months in a tertiary care centre & government medical college on 40 patients where they were randomly divided into two groups with the help of computer-generated coded envelopes; Group A (Unstable intertrochanteric femur fracture patients treated by hemi-arthroplasty or PFN with greater trochanter reconstruction) and Group B (Unstable intertrochanteric femur fracture patients treated by hemiarthroplasty or PFN with no greater trochanter reconstruction) with 20 patients in each group.

Table 1: Comparison of age between study groups (n=40).

Age (years)	Trochanter Reconstruction		P value
	Done (N=20) Frequency (%)	Not Done (N=20) Frequency (%)	
≤60	02 (10.0)	00 (00.0)	The Chi-square statistic is 0.1296. The p value is 0.937276. The result is not significant at p<0.05
61-70	05 (25.0)	06 (30.0)	
71-80	09 (45.0)	10 (50.0)	
81-90	04 (20.0)	04 (20.0)	
Mean (SD)	73.55 (8.56)	75.45 (6.25)	
t statistic=0.80, degrees of freedom=38, two-tailed probability=0.428, written as: t (38)=0.802, p=0.428, conclusion at the 0.05 critical alpha level: The difference is not significant			

Based on age distribution most common age group was 71-80 years i.e., 09 (45%) and 10 (50%) for group A and group B respectively. Based on gender distribution males were more than females i.e., 12 (60%) both for group A and group B respectively.

Table 2: Comparison of gender between study groups (n=40).

Gender	Trochanter reconstruction	
	Done (N=20) Frequency (%)	Not done (N=20) Frequency (%)
Female	8 (40.0)	8 (40.0)
Male	12 (60.0)	12 (60.0)

The Chi-square statistic is 0, p value is 1, the result is not significant at p<0.05.

Table 3: Comparison of type of surgery between study groups (n=40).

Type of surgery	Trochanter Reconstruction	
	Done (N=20) Frequency (%)	Not done (N=20) Frequency (%)
Fixed with PFN	13 (65.0)	16 (80.0)
Hemiarthroplasty	7 (35.0)	4 (20.0)

The Chi-square statistic is 1.1285, p value is 0.28809, result is not significant at p<0.05.

Table 4: Comparison Harris hip score at 2 weeks between study groups (n=40).

Harris hip score at 2 weeks	Trochanter reconstruction	
	Done (N=20) Frequency (%)	Not done (N=20) Frequency (%)
Fair	12 (60.0)	12 (60.0)
Good	8 (40.0)	8 (40.0)

The Chi-square statistic is 0, p value is 1, result is not significant at p<0.05.

Most common surgery in study groups were PFN i.e., 13 (65%) and 16 (80%) followed by hemiarthroplasty i.e., 07 (35%) and 04 (20%) for group A & B respectively.

Table 5: Comparison Harris hip score at 6 weeks between study groups (n=40).

Harris hip score at 6 weeks	Trochanter reconstruction	
	Done (N=20) Frequency (%)	Not done (N=20) Frequency (%)
Fair	8 (40.0)	7 (35.0)
Good	11 (55.0)	7 (35.0)
Poor	1 (5.0)	6 (30.0)

The Chi-square statistic is 4.527, The p value is 0.103987, result is not significant at p<0.05.

Table 6: Comparison Harris hip score at 3 months between study groups (n=40).

Harris hip score at 3 months	Trochanter reconstruction	
	Done (N=20) Frequency (%)	Not done (N=20) Frequency (%)
Fair	4 (20.0)	6 (30.0)
Good	15 (75.0)	6 (30.0)
Poor	1 (5.0)	8 (40.0)

The Chi-square statistic is 9.7016, p value is 0.007822, result is significant at p<0.05.

Table 7: Comparison Harris hip score at 6 months between study groups (n=40).

Hip score at 6 months	Trochanter Reconstruction	
	Done (N=20) Frequency (%)	Not done (N=20) Frequency (%)
Fair	3 (15.0)	6 (30.0)
Good	15 (75.0)	6 (30.0)
Poor	2 (10.0)	8 (40.0)

The Chi-square statistic is 8.4571, p value is 0.014573, result is significant at p<0.05.

On follow up at 2 weeks, Harris hip score was calculated and it was found that most were reported fair score i.e., 12 (60%) each for group A and group B respectively. On follow up at 6 weeks, Harris hip score was calculated and it was found that most were reported good score i.e., 11 (55%) & 07 (35%) followed by fair score i.e., 08 (40%) &

07 (35%) for group A and group B respectively. On follow up at 3 months, Harris hip score was calculated and it was found that most were reported good score i.e., 15 (75%) & 06 (30%) followed by fair score i.e., 04 (20%) & 06 (30%) for group A and group B respectively.



Figure 1: A 62-year-old male with h/o trivial fall & sustained left intertrochanteric femur fracture, according to OA classification, it's type 3A2.2 managed with PFN & GT wiring.



Figure 2: A 72 years old female patient with history trivial fall and sustained left intertrochanteric femur fracture, according to OA, type 3A3.1.pt managed with bipolar hemiarthroplasty with GT wiring.

On follow up at 6 months, Harris hip score was calculated and it was found that most were reported good score i.e., 15 (75%) & 06 (30%) followed by poor score i.e., 02 (10%) & 08 (40%) for group A and group B respectively. Based on radiological evaluation all cases shows non-displacement of GT position but in follow-ups at 6 weeks, 3 months and 6 months one case each reported displaced implant.

DISCUSSION

A prospective observational study carried out over 3 years in a tertiary care centre & government medical college on 40 patients where they were randomly divided into two groups with the help of computer-generated coded envelopes; Group A (unstable intertrochanteric femur fracture patients treated by hemiarthroplasty or PFN with

greater trochanter reconstruction) and Group B (unstable intertrochanteric femur fracture patients treated by hemiarthroplasty or PFN with greater trochanter reconstruction) with 20 patients in each group.

Age distribution between study groups

Based on age distribution, present study reported, most common age group was 71-80 years i.e. 09 (45%) and 10 (50%) for group A and group B respectively. Yogi et al study conducted on 30 elderly patients with intertrochanteric fractures.¹⁴ In PFN group average mean age was 69.6 (range 60-77 years). In Bipolar prosthesis group of 15 patients 7 were males and 8 were females. Average mean age was 70.6 (range 62-79 years). Gormeli et al study shown average age in PFN group was 76.20 years and for Bipolar hemiarthroplasty group was 77.40 years respectively.¹⁵

Comparison of gender distribution between study groups

Based on gender distribution in present study, males were more than females i.e., 12 (60%) both for group A and group B respectively. Yogi et al study found that out of 30 elderly patients with intertrochanteric fractures.¹⁴ In PFN group of 15 patients having 8 were male and 7 were female and that for Bipolar prosthesis group it was 15 patients having 7 were males and 8 were females. Similarly, Sonar et al study shown there were eighteen.¹⁰

patients in TFN group and seventeen in hemiarthroplasty group, rest were females out of 30 patients in each group. Prasad et al study included 27 patients in each group consisting 16 females and 11 males in BPA group whereas in PFN group there were 8 females and 19 males.¹⁶

Comparison of type of surgery between study groups

Most common surgery in present study, in study groups were PFN i.e., 13 (65%) and 16 (80%) followed by Hemiarthroplasty i.e., 07 (35%) and 04 (20%) for group A & B respectively. Mahale et al study included 92 unstable intertrochanteric fractures, 50 were having either comminution (31A2.3) or vertical split fracture (31A2.2) of greater trochanter in coronal plane, managed by DHS with Modified Trochanteric Stabilizing Plate (Modified TSP) fixation.¹⁷ Addition of standard TSP to DHS supports only lateral wall of greater trochanter and prevents excessive collapse and varus malunion. It does not support posterior or medial wall of greater trochanter and complications like proximal migration of greater trochanter may occur resulting in limb length discrepancy, subsequent shortening of limb and medialization of femoral shaft especially in AO type 31A2.3 or 31A2.2.

In these fractures, there is difficulty in fixation of comminuted fracture by using standard TSP. Therefore, we modified the standard TSP.

Table 8: Radiological evaluation at different follow-ups.

Radiological evaluation		Follow-ups			
		2 weeks	6 weeks	3 months	6 months
GT position	Not displaced	20	20	20	20
	Displaced	00	00	00	00
Position of implants	In situ	40	39	39	39
	Displaced	00	01	01	01

Comparison of radiology between study groups

Based on radiology as non-union and union, most common study participants show union i.e., 18 (90%) for group A and 14 (70%) for group B respectively. Mahale et al study reported non-union in 6 weeks and 3 months, were 45 cases i.e., 90% then 9 cases i.e. 18% and no cases of non-union after 6 months and 1 year.¹⁷

Radiological evaluation at different follow-ups

Based on radiological evaluation all cases shows non-displacement of GT position but in follow-ups at 6 weeks, 3 months and 6 months one case each reported displaced implant. Similar results also found Mahale et al study comparable results with the present study.¹⁷ Prasad et al study had 4 superficial surgical site infections in BPA group and 2 patients had superficial surgical site infection in PFN group which were treated with appropriate antibiotics.¹⁶ In BPA group additionally 1 patient had deep infection, 2 patients had bed sores and 1 patient had DVT. Not all these complications were seen in PFN group. One patient had Prosthetic related complications in BPA group where patient had dislocation of the prosthesis, which was reduced closed.

Limitations

There are a few limitations in our study. Firstly, it is not randomized and not double blinded. Secondly, power of the study is inadequate. Thirdly, short-term follow up. Forth, implant used were the same in all patients.

CONCLUSION

Age distribution most common age group was 71-80 years, males were more than females, most common mode of injury was trivial trauma, most common surgery in study groups were PFN, On radiology as non-union and union, most common study participants show union, On follow up at 2, 6 weeks, 3 months and 6 months Harris hip score was calculated and it was found to be statistically significant suggestive of improved quality of life, On radiological evaluation all cases shows non-displacement of GT position but in follow-ups at 6 weeks, 3 months and 6 months one case each reported displaced implant.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Sharan S, Kartik PN, Jadhav S. A study on greater trochanter reconstruction in unstable inter trochanteric fracture of femur. *Int J Res Orthop* 2023;9:334-9.