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The role of a trochanteric buttress plate in intertrochanteric fractures with lateral wall fractures: A longitudinal cohort

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Abstract

Objectives: To study the outcome of lateral wall buttressing along with Proximal Femoral Nail fixation in lateral wall Intertrochanteric fractures and comparing with Proximal femoral Nail fixation only.

Method: This study is a longitudinal cohort analysis comprised of 30 consecutive patients of all ages and either gender, with intertrochanteric fracture with fracture lateral wall, Orthopaedic trauma classification (OTA) classification type 31-A3, admitted at Government medical college Ratlam, MP, India, from the period of January 2019 to April 2020. The minimum follow-up considered was 12 weeks. Functional outcome was measured by Harris Hip score, intraoperative parameters for comparison include blood loss, duration of surgery and radiological exposures. Possible complications of operative fixation of such intertrochanteric fractures were also analyzed in both the groups. All the comparative parameters were compared with student's T-test.

Material: Operative fixation of the subject fracture by Proximal femoral nailing only, odd number of patients (Group A) and Proximal femoral nailing with a Trochanteric buttress plate, even number of patients (Group B).

Results: Functional outcome by Harris hip score (HHS) came out to be significantly improved in subjects with augmentation with the trochanteric buttress plate (group B), 80% (12 of 15) with HHS 90 to 100 as compared to 60% (09 of 15) with HHS 90 to 100 in proximal femoral nailing only patients(group A). Also, there was statistically significant increased blood

loss, duration of surgery, and the number of radiological exposures in the group B, skewed by the probable deterrent factor as the learning curve of the intervention.

Conclusions: The study yields the lateral wall reconstruction as an important factor for the stability of intertrochanteric fractures. Combining a trochanteric stabilization plate with proximal femoral nailing appears to be a useful method to achieve stabilization, which needs to be further assessed by biomechanical stress studies.

Keywords: Trochanteric instability, lateral wall fixation.

Introduction

Trochanteric fractures despite being extremely common continue to be a challenge for most of the orthopaedics surgeon, especially the unstable variety. An unstable trochanteric fracture varies in its definition; a reverse fracture line with or without intertrochanteric comminution or associated with a large posteromedial component, a fractured greater trochanter, and a fractured lesser trochanter or lateral cortex breach [1]. Despite having a range of modern implants the treatment failure continues to ranges from 0% to 20% [1].

Medial calcar was conventionally deemed as the most important factor determining the stability of an unstable intertrochanteric fracture. However, recent studies suggest that the integrity of the lateral wall in intertrochanteric fractures is also an important predictor for failure and reoperation in such cases[2]. The deficient lateral wall leads to excessive collapse and varus malpositioning [2]. Various varieties of Intramedullary nailing have proved their superiority in unstable fractures with lateral wall fractured intertrochanteric fractures as the nail gives support to the posteromedialwall, resisting excessive fracture collapse[3]. However, Implant failure does occur in intramedullary cephalomedullary nailing due to unbalanced biomechanical forces acting on implant around hip joint due to no support tothe lateral wall. Resulting in Z effect screw migration and cutout as the common complications. We hypothesize that an anatomical fixation and supporting the lateral wall with a lateral buttress plate added to the conventional PFN is crucial to prevent complications [4]. Our aim is to study the outcome of lateral wall buttressing along with Proximal Femoral Nail fixation in lateral wall Intertrochanteric fractures and comparing the outcome with proximal femoral Nail fixation only.

Materials And Methods

Setting, Duration and type of study The study design is a longitudinal cohort study from January 2019 to April 2020, which includes cases operated at the Government medical college, Ratlam (Madhya Pradesh).

Sampling methods Sample size calculation The study includes a total of 30 adult patients of unstable intertrochanteric fractures of femur satisfying the inclusion criteria (Orthopaedic trauma classification type 31-A3)[5], as apparent on the pre-operative xray sciagram, and treated with a Proximal Femoral Nail only (15 cases) or proximal femoral nail with lateral wall buttress plate (15 cases).

Inclusion criteria: Patients with fracture in the trochantric area with fracture lateral wall or anterolateral fragment, Aged 20 to 60 years were included in the study

Exclusion criteria: Open fractures, Pathological fractures, Fractures more than 2 weeks old, previous deformity of the femur, ipsilateral fractures of the lower limb were excluded from the study.

Ethical consideration & permission: Institutional Ethical committee approval was taken before the study.All cases were operated after a proper informed patient consent about the procedure.

Consent: Written consent was obtained from the relatives of patients after explaining them the nature and purpose of the study. They were assured that confidentiality would be strictly maintained. The option to withdraw from the study was always open.

Data collection procedure & Statistical Analysis: The groups were divided as **Group A,** which were the odd number of the presented cases, treated with proximal femoral nailing (PFN) only. **Group B** – which were the even number of cases, treated with PFN along with trochanteric lateral wall buttress plate. The statistical analysis was done by IBM SPSS version 24.0.0 using T-test. . In our study maximum and minimum age of patients were 70 years and 42years respectively. In our study out of 30 patients, maximum patients (16 patient, 53 %) belong to 61-70 years age group. Mean age 60.03 years, Range (42-70 years). PFN- Mean age 60.13yr(6.82 +/- SD). Mean age 60yr (7.78+/- SD).

Implant design: Trochanteric Buttress Plate (TBP) is designed by Shashikant Ganjale[6]. It is an anatomically contoured, 3 mm thick, malleable, oblong plate with two Oblique cephalad holes angulated at 130 or 135 degrees (2 variations of the plate) for passing 6.4 mm derotation screw and 8 mm of the proximal femoral nail system; 5 proximal and 2 distal screw non locking holes of 4.5 mm (non angulated) for possible fixation of extra screws, proximal screws may hold comminuted fragments of the greater trochanter (figure 1). The heads of neck screws of the nailing system can be compressed snuggly to the plate, forming a rigid construct, compressing the lateral wall fracture fragment between the proximal femoral body and the buttress plate.

Operative procedure: PFN with lateral wall reconstruction. The proximal holes can be used to engage the hip abductors in case of a comminuted greater trochanter by tying or tension band wiring in the holes. The distal two 4.5 mm holes can be purposed for possible unicortical fixation of plate to the proximal femur.

Figure 1: A- Trochanteric buttress plate (TBP) and B- schematic setup of the plate with a proximal femoral nail. Image: Gadegone WM, Shivashankar B, Lokhande V, Salphale Y. Augmentation of proximal femoral nail in unstable trochanteric fractures. SICOT J. 2017;3:12.

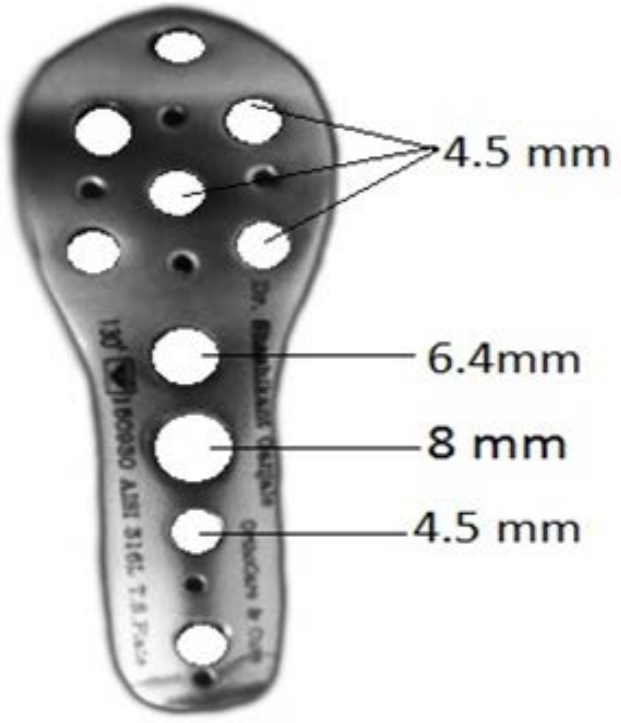


Figure A

Figure B

After anesthesia closed reduction was achieved on the fracture table and fluoroscopic verification was done in Anteroposterior and Lateral images. Reduction can be temporarily fixed with kwires. The entry to the trochanter was made with an awl or Steinmann pin and then enhanced with a cannulated reamer. Guide wire was passed under C-Arm guidance. Reaming of the canal was done as deemed appropriate to fit the largest possible diameter nail in the canal. Only long PFN were used in the study cases. Proximal screw holes were aligned in the direction of the neck just above the calcar. The sliding of the plate presented a challenge to fit in the assembly as efficiently as possible, so the jig's outer arm was removed after the guide wire for neck screws were inserted and the plate was slid through them, aligned with the appropriate hole ie, 6.4mm derotation screw and 8mm neck screw (figure 2). The incision was enlarged adequately for the plate to pass through. Extension of incision was required for the possible fixation of large fragments of Greater trochanter with cortical screws. The jig arm can be now reattached to assembly. The size of the neck screws were taken considering the appropriate TAD (tip to apex distance). The proper contouring and fixation of the TBP was complicated in some cases due to the plate interaction with the screws as they tend to get stuck with screwing movements, this can be easily tackled by alternatingly screwing the two neck screws, as with each rotation it makes space for the movement the other screw. The final tightening of the screws was done after the release of traction. The distal holes in the plate were fixed unicortically or bicortically depending on the thickness of the shaft and size of the nail at that level. In cases with large fragments of the greater trochanter, care was taken to hold the fragment with k wire or SS wire cerclage/ tension band wiring and then buttressing them with the plate. Distal interlocking was done by free hand technique under c-arm control. Figure 3 shows the progressive C-arm images of the process of fixation of the trochanteric buttress plate with the PFN assembly.

Intraoperative details : Operative time, blood loss, and number of radiological shots (exposure) were recorded. The visual gauze analog was used to measure blood loss[7]. Patients were advised to carry on with knee bending exercises from 2nd post operative day. An X-ray examination was performed on the second postoperative day. At around 14th day postoperatively, the sutures were removed. Weight-bearing with the help of a walker began 4 weeks after the surgery. Progressive weight-bearing and full weight-bearing a month after the surgery was continued. Follow up with functional outcome assessment by Harris hip score[8] was measured at 2 weeks, 8 weeks and 12 weeks postopertively.

Observation Chart

Table 1: Age Distribution

Age group	No. of Patients
20-30	-
31-40	-
41-50	2
51-60	12
61-70	16

Table 2: Sex Distribution

Group	Male	Female	total
A (PFN)	13	02	15
B(PFNWITH RECONSTRUCTION)	11	04	15
Total	24(80%)	06	30

Table: 3 Harris Hip Score

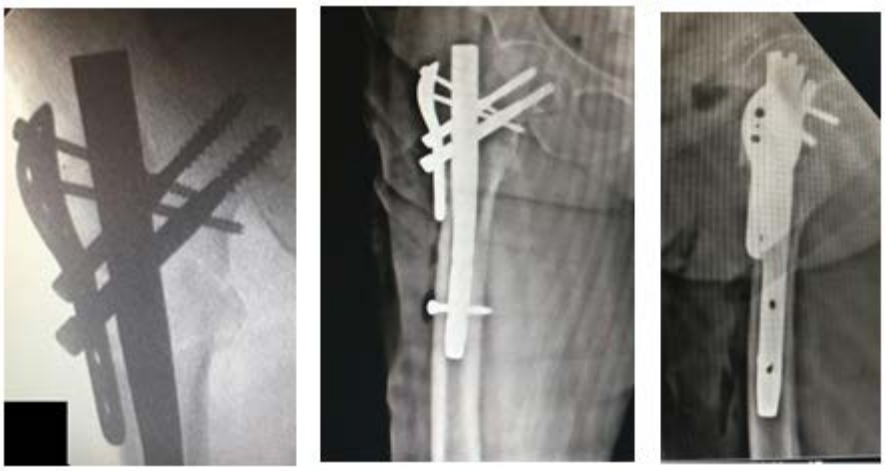
Harris hip score	2 weeks		8 weeks		12 weeks	
	PFN	PFN with reconstruction	PFN	PFN with reconstruction	PFN	PFN with reconstruction
<70	13	9	4	1	2	-
71-80	2	4	9	8	1	-
81-90	-	2	2	6	4	2
91-100	-	-	-	-	8	13

Table 4: Intraoperative Parameters

Parameter	PFN	PFN With Reconstruction	P - Value
Duration of surgery	64.88 (47-90mins) (+/-12.24SD)	91.86min (70-125mins) (+/-12.78SD)	0.0001
No. of exposures	24-46 (32.13) (+/-5.27SD)	38-112 (56.6) (+/-16.26SD)	0.0001
Blood loss(in ml.)	60-120 (93) (+/-18.11SD)	110-220 (144.8) (+/-36.27SD)	0.0001

Table 5: Complications

Complications	2 weeks		8 weeks		12 weeks	
	PFN	PFN With LW reconstruction	PFN	PFN With LW reconstruction	PFN	PFN With LW reconstruction(0%)
Anterior hip pain	3	2	3	2	1	-
Impingement	1	-	-	-	1	-
Infection	-	-	-	-	-	-
Implant failure	-	-	-	-	-	-
Screw migration	-	-	1	-	2	-
Z/Reverse Z effect	-	-	-	-	2	-
Avascular necrosis	-	-	-	-	-	-



Followup week 4 Followup week 12 (AP) Followup week12 (lat)

Figure 2: Consecutive followup xrays at week 4 and 12 respectively.

Intraoperative image Postoperative X-ray week 4 (AP and Lateral) week 12

Figure 3: Consecutive Followup Xrays At Week 4 And 12

Results

Total patients who participated in the study were 30. 15 in each group. Mean age 60.03 years, Range (42-70 years), PFN- Mean age 60.13 years (6.82 +/- SD), PFN with lateral wall reconstruction - Mean age 60 years (7.78+/- SD) (T-value = 0.0487, P-value = 0.96). Table/figure 4 shows the age distribution. Table/figure 5 shows sex distribution of cases.Harris Hip score range and mean for PFN only group as found out to be 66-100 (87.86) (+/-11.17SD), for a group with Trochanteric buttress plate with PFN 81-100 (95.13) (+/-7.50SD) **P-Value- 0.0512**

Functional outcome by Harris hip score (HHS) came out to be significantly improved in subjects with augmentation with the trochanteric buttress plate (group B), 80% (12 of 15) with HHS 90 to 100 as compared to 60% (09 of 15) with HHS 90 to 100 in proximal femoral nailing only patients(group A). Also, there was statistically significant increased blood loss, duration of surgery, and the number of radiological exposures in the group B, skewed by the probable deterrent factor as the learning curve of the intervention.

Statistical Analysis

Data was compiled using MS excel 2007 and analysis was done with the help of Epi-Info 7 software. Frequency and percentage were calculated & statistical test (Chi Square) was applied wherever applicable; $p<0.05$ was taken as statistically significant.

Discussion

Many previous observations in studies indicate that lateral wall reconstruction significantly lessened cases of lateralization of the greater trochanter, gross medialization of the femoral shaft,and controlled telescoping of comminuted fragments following weight-bearing in case of DHS. These factors resulted in better functional mobility hip abductor function [2,3,6]. This study, therefore, does indicate that the addition of a Trochantric buttress plate over PFN is likely to improve the stability of fracture fixation. In DHS there is a modification, the trochanteric stabilizing plate (TSP), it is an add-on plate that extends proximally from the side plate and provides a lateral buttress to the trochanteric segment.[9] So this new implant desperately needed to be tested for its efficacy. Improved bony contact between proximal and distal fragments by stabilization of the comminuted lateral wall is likely to

improve the chances of union and maintenance of adequate lever arm. Reconstructing the integrity of the lateral trochanteric wall could aid in the provision of stability and increase the likelihood of earlier out-of-bed mobilization [10].

Lateral wall reconstruction significantly lessened the incidence of lateralization of the greater trochanter, with limited telescoping of comminuted fragments following weight-bearing. These factors resulted in better functional outcomes. Complications related to the implant were not observed in any of the patients, which is less than the incidence rate of 7% observed in a recent study by Gadegone WM et al [11]. The addition of the buttress plate to the proximal femur nail assembly needs to be practiced as it presents the challenge for a steep learning curve. However, there is a slight increase in the operative time, longer exposure to radiological imaging, and increased blood loss, all of them statistically significant.

Babhulkar et al. reported recently Augmentation of intramedullary nailing in unstable intertrochanteric fractures using cerclage wire and lag screws in unstable trochanteric fracture for lateral wall reconstruction was used to reduce the complications associated with lateral wall fracture[12] . The procedure has provided good radiological and functional outcome in there series. However the procedure requires little additional operating time to reconstruct lateral wall with cerclage wire. To augment trochanter with cerclage wire is difficult procedure and may require additional dissection of soft tissues and loosening of wire is possible complication.

The biomechanical effect of the TBP needs to be evaluated. However, it appears to act as a buttress plate with root for adherence similar to the cephalic screw of the proximal femoral nailing system. Observation in our study suggests that in cases where TBP is not used if the guidewire of the lag screw passes through, a fractured lateral wall, upon tightening the compression screw, the screw head is engaged into the lateral wall and no subsequent compression can be achieved. Early mobilization in such cases is dubious, and fracture healing may be delayed. The TBP in such cases acts as a buttress over which the lag screw head can rest upon, adding primary compression between fracture fragments and fracture reduction.

Conclusion

Our study suggests that the addition of a Trochanteric buttress plate over the Proximal femoral nail is plausible to provide better fixation construct and stability, improved bony contact, and likely better chances of union and maintenance of an adequate lever arm.

What This Study Add To Existing Knowledge

Lateral wall reconstruction significantly lessened the incidence of lateralization of the greater trochanter, with limited telescoping of comminuted fragments following weight-bearing. These factors resulted in better functional outcomes. Complications related to the implant were not observed in any of the patients. The addition of the buttress plate to the proximal femur nail assembly needs to be practiced as it presents the challenge for a steep learning curve. However, there is a slight increase in the operative time, longer exposure to radiological imaging, and increased blood loss, all of them statistically significant.

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