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TO EVALUATE THE CLINICAL AND FUNCTIONAL OUTCOME OF AUGENTATION PLATING IN UNSTABLE INTERTROCHANTERIC FRACTURE

Orthopaedics

Dr Rahul Verma Final Year Post Graduate Resident, Dept Of Orthopaedics, Krishna Mohan Medical College, Mathura, UP

Dr Harshit Jain Professor, Dept Of Orthopaedics, Krishna Mohan Medical College, Mathura, UP

Dr Rakesh Kumar Gupta Professor, Dept Of Orthopaedics, Krishna Mohan Medical College, Mathura, UP

Dr Arun Bansal Professor, HOD, Dept Of Orthopaedics, Krishna Mohan Medical College, Mathura, UP

ABSTRACT

Introduction: Treating unstable intertrochanteric fractures presents challenges due to factors like poor fragment alignment, loss of posteromedial support, reverse oblique fracture type, and severe comminution. While PFN implants are commonly used for these fractures, complications such as screw migration, cut-out due to greater trochanteric comminution and coronal split, and insufficient lateral wall support may arise, often requiring lateral augmentation. **Objectives:** This study evaluates the clinical and functional outcomes of augmentation plating (PFN combined with TBP) in managing unstable intertrochanteric fractures. **Methods:** This prospective study included 40 patients (aged >18) with unstable intertrochanteric (IT) fractures involving the lateral wall (primarily AO types A2 and A3), treated at Krishna Mohan Medical College, Mathura, UP, from May 2022 to October 2023. PFN combined with TBP was used for fixation. **Results:** Patients were followed for two years. Functional outcomes, measured using the Harris Hip Score (HHS), showed significant improvement (p=0.001), rising from an average of 80.70 at 3 months to 89.90 at 6 months. Average blood loss was 164.20 ml, union occurred at an average of 14.88 weeks, and surgeries lasted about 97.80 minutes. No cases of non-union, implant failure, screw migration, or "Z effect" were observed. However, complications included impingement in 3 patients, infection in 1, and hip pain in 3, all managed effectively. **Conclusion:** Repairing the lateral trochanteric wall is crucial for stabilizing unstable intertrochanteric fractures. Combining PFN with TBP provides effective fixation, promoting early healing and alignment while minimizing complications such as screw migration and cut-out.

KEYWORDS

unstable IT, TBP; PFN; cut out; screw migration

INTRODCTION :

Unstable intertrochanteric fractures feature inadequate fragment contact, particularly with medial and posterior displacement, comminution, or a fracture pattern prone to further displacement under weight-bearing, like the reverse oblique type.[1] Recent studies highlight the lateral wall's condition as crucial for predicting failure and reoperation needs. An intact lateral wall enhances stability with proximal femoral nails.[2,3]

Intramedullary (IM) nails effectively treat these fractures, especially those involving the lateral wall, by supporting the posteromedial area to prevent collapse.[4] However, they can fail due to unbalanced forces if the lateral wall isn't well-supported, leading to complications like screw migration, Z-effect, screw cut-out, and implant breakage. While IM nails stabilize unstable intertrochanteric fractures by supporting the medial calcar, they fall short in addressing the fractured lateral wall's reduction and buttressing needs.[5] Additional lateral wall reconstruction is necessary to achieve satisfactory reduction and stability in these complex fractures.[6]

We suggest that adding a lateral buttress plate to the standard PFN is essential for reinforcing the lateral wall, this additional support mechanism aims to enhance stability and mitigate potential issues commonly encountered in such interventions, ultimately improving patient outcomes and reducing the risk of post-operative complications.

MATERIALS AND METHODS:

This is a prospective study conducted from May 2022 to October 2023 which includes cases of unstable Intertrochanteric fracture operated at Krishna Mohan Medical College , Mathura, UP.

Inclusion Criteria:

1. They suffered from unstable intertrochanteric fractures
2. Adult patients aged 18 years or older, comprising both gender.

Exclusion Criteria:

1. Patients with open fracture, pathological fracture, infected hip pathology
2. Patients under eighteen years of age.
3. Patients with pre-existing femoral deformities.
4. Patient who didn't complete the follow up.
5. Patients with ipsilateral fractures of lower limb
6. Very elderly patients who were morbid and deemed to have high medical and anaesthetic risks.

Patients diagnosed with unstable intertrochanteric fractures underwent surgical management using augmentation plating. AO classification was used for evaluation. Postoperatively, patients were regularly monitored at intervals of 1 week, 1 month and after that at three months interval for upto one year , until clinical and radiological union was achieved. During the final follow-up assessments, the HSS was used to assess healing based on parameters including pain levels, range of motion, ability to walk independently, presence of residual deformity, and bone healing. Radiological (X ray) criteria were also used to analyse the union of bones.

Implant Design: Shashikant Ganjale[7] designed the Trochanteric Buttress Plate (TBP), which is a 3 mm thick, malleable plate featuring two oblique cephalad holes. These holes are angled at either 130 or 135 degrees, designed specifically for 6.4 mm derotation screws or 8 mm proximal femoral nail screws. It also includes five proximal and two distal non-locking screw holes (4.5 mm) for added fixation, especially for comminuted greater trochanter fragments. TBP compresses neck screws against it, securing lateral wall fracture fragments between the proximal femur and the plate involved stabilizing them together. It secures abductors for smaller greater trochanter fragments and features two distal 4.5 mm holes for unicortical fixation, enhancing overall stability and buttressing the lateral wall.

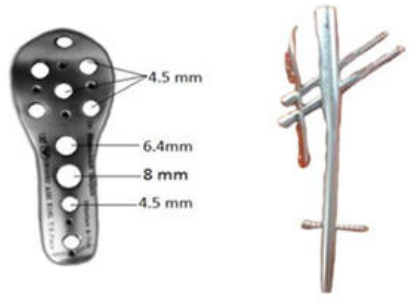

Fig 1: A) TBP B) set up of PFN with TBP

Operative Procedure:[7] After anesthesia, closed reduction was performed, and C-arm imaging verified reduction in both views. Temporary fixation was achieved with K-wires. The trochanter was accessed using an awl or thick pin, followed by cannulated reaming.A guide wire was inserted under C-arm guidance. Narrow canals were reamed for the largest possible nail diameter, selecting either an 18 cm or 24 cm PFN for A2 fractures and longer nails for A3 fractures. The PFN was placed over the guide wire, ensuring alignment of the holes with the femoral neck.

Fig 2. Trochanteric entry point

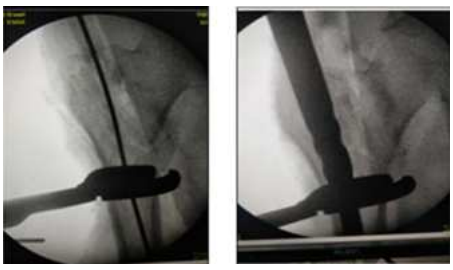

Fig 3. Guide wire insertion and PFN

TBP was inserted through the hip incision along with derotation screws, involving subperiosteal dissection up to the trochanteric flare. If larger greater trochanter fragments needed fixation, the incision was extended. A guide wire sleeve was directed into the TBP holes, confirmed via C-arm imaging. Drilling and screw fixation followed, tightening head-neck screws for added rigidity. The lower plate holes were secured with unicortical or bicortical screws based on femoral shaft thickness.

Fig 4. Lateral wall reduction with TBP

The greater trochanter was secured with cortical screws through the TBP, while smaller fragments were sutured to stabilize the abductor muscles, sometimes reinforced with cerclage wire. Plate fitting challenges were resolved, and distal interlocking for long PFNs was performed using C-arm guidance. A vacuum drain was inserted, and the wound closure was performed layer by layer. Intraoperative details, including surgical time, blood letting (measured from soaked sponges and vacuum drainage), and units of transfusion administered, were documented. Patients started static limb exercises the day after surgery. X-rays were taken on the second day, and stitches were removed by the 12th day. Touchdown weight-bearing commenced at two weeks post operatively, advancing to full load-bearing by three months, contingent upon healing. Performance status were measured using the modified Harris Hip Score at three and six months following the surgery. Patients were scheduled for follow-up appointments every six weeks until fracture union was confirmed, after which they were assessed every three months for up to one year. The evaluations covered hip and knee function, walking ability, fracture status, deformity, and limb shortening. Functional outcomes and mobility were evaluated using the Harris Hip Score at three and six months.

RESULTS:

42.5% cases were between 20-30 years of age , 27.5% of participants were in the 30-40 age group, while the remaining patients fell into the elderly age group. Majority of the patients (60%) were males and (40%) were females.45% of cases in our study were attributed to Road Traffic Accidents (RTA). 30% of cases presented with a history of slip and fall, while 24.5% were attributed to falls from height. 32 patients came under A3 classification and 8 were under A2 classification. 62.5% of patients had right-sided fracture. Harris Hip Score showed significant improvement (p=0.001) from a mean of 80.70 at 3 months to 89.90 at 6 months. Average blood loss was 164.20 ml. Union of fracture occurred at a mean of 14.88 weeks. Average duration of surgery was 97.80 minutes.Patients were monitored for average period of 11.13 months, varied from 8 to 16 months. The study reported no instances of non-union, implant failure, screw migration, or the "Z effect". However, complications included superficial infection in 1 patient, and anterior hip pain in 3 patients, all effectively treated with appropriate measures.

Table 1: Summary Statics

	Minimum	Maximum	Mean	Std. Deviation
Age	22	66	39.53	14.929
Interval between injury and surgery (days)	1	14	4.85	3.786
Duration of surgery [in minutes]	82	120	97.80	10.246
Blood loss [in ml]	110	250	164.20	37.659
Time for union [in weeks]	11	22	14.88	3.12

Table 2: AO classification of IT fracture among patients

AO CLASSIFICATION	Frequency	Percent
A2	8	20.0
A3	32	80.0
Total	40	100.0

Table3 : HHS at 3- and 6-month intervals.

	Mean	Std. Deviation	P value
3 months	80.70	8.695	0.001 (S)
6 months	89.90	6.578	

Table 4: Grading of HHS among patients of our study at intervals of 3 and 6 months.

	3 months		6 months	
	Frequency	Percent	Frequency	Percent
<70	6	15.0	0	0
71-79	9	22.5	5	12.5
80-89	20	50.0	10	25.0
90-100	5	12.5	25	62.5
Total	40	100.0	40	100.0

Table 5: Dispersion of complications

Complications	Frequency	Percent
Non-union	0	0
Shortening	0	0
Impingement	3	7.5
Infection	1	2.5
Anterior hip pain	3	7.5
Implant failure	0	0
z effect	0	0
Avascular necrosis	0	0
Screw migration	0	0

DISCUSSION:

Effective treatment of intertrochanteric fractures requires understanding the fracture type, selecting the right implant, and ensuring precise reduction and placement. Stable fractures, which feature an intact posterior-medial buttress, are typically treated with sliding hip screws (SHS) or intramedullary nails. Unstable fractures, characterized by posteriomedial comminution, benefit more from intramedullary nailing due to its superior biomechanical support, which helps prevent displacement and complications.[8-12] Complications “associated with implantation for” trochanteric fracture stabilization includelateral screw protrusion, cut outs ,the Z or

reverse Z effect ,lateral trochanteric wall fracture.[13] Recent studies highlight the critical function of the lateral trochanteric wall in managing IT fractures. Its preservation ensures crucial lateral support, promoting stability for the proximal fractured fragment. Loss of this support can lead to complications like exaggerated reduction, varus malreduction, medialization, limb length discripenncy, and rise in need for revision surgery.[14,15,16,17] Our study suggests that combining a TBP with a PFN may improve stability in fracture fixation.

Kiradiya et al.[18] studied the effects of lateral wall buttressing using PFN fixation in intertrochanteric fractures. In a cohort of 30 patients treated from January 2019 to April 2020, those receiving PFN plus a TBP showed significantly better Harris Hip Scores, with 80% achieving scores of 90 to 100, compared to 60% for PFN alone. However, the TBP group had increased blood loss, longer surgery duration, and higher radiological exposures. The study underscored the benefits of lateral wall reconstruction, though further biomechanical research is needed. These findings were comparable with results of our study. Ganjale et al.[7] studied outcomes using a TBP combined with a PFN in 32 patients with unstable IT fractures and lateral wall comminution, from April 2015 to December 2017. Bone healing occurred in a mean of 12.6 weeks, with complications in four patients (two neck screw migrations and two superficial infections). Follow-up averaged 10.6 months, revealing that 87.5% achieved a Salvati and Wilson hip function score of 36 out of 40. The study concluded that TBP augments stability, restores anatomy, and helps prevent complications like screw migration and cut out. Jain et al.[19] studied the use of a PFN augmented with TBP in 30 patients with IT fractures, including those with lateral wall damage, all achieving satisfactory reduction through closed methods. Key metrics included a mean surgical duration of 91.86 minutes, intra-operative blood loss of 144.8 mL, and average time for union of fracture was 11.6 weeks. The mean HHS was 94.1, indicating excellent outcomes. The study concluded that effective reconstruction of the lateral trochanteric wall significantly enhances fixation and promotes early union in these fractures. Thakur et al.[20] compared treatment outcomes for ST femur fractures using intramedullary PFN alone versus PFN augmented with a TSP in 50 patients. After 6 months, all TSP patients achieved unassisted mobilization, while only two PFN-only patients did. The study, using the Harris Hip Score, concluded that adding TSP to PFN enhances treatment effectiveness, emphasizing the importance of surgical precision for favorable clinical outcomes. Raja et al.[21] conducted a prospective study on 20 patients with unstable IT fractures and fractured lateral walls, treated using TBP alongside PFN. The found that 60% achieved an excellent Modified Harris Hip Score with a mean score of 87.25. Surgical duration averaged 99.25 minutes, with average blood loss of 330 mL and fracture union occurring at a mean time of 15.15 weeks. The study found that using a buttress plate to augment the lateral wall significantly improves outcomes in unstable IT fractures, highlighting the importance of calcar reconstruction for successful fixation. Our study findings were comparable to above study findings. Observations in our study suggests that incorporating a TBPTalongside a PFN facilitates the reconstruction of the lateral wall in unstable intertrochanteric fractures. This approach establishes a biomechanically robust trochanteric construct, supporting early mobilization and significantly decreasing excessive collapse, thus mitigating potential limb length differences. The favorable functional and radiological results observed in patients with unstable intertrochanteric fractures suggest that combining a PFN with a TBP represents an advantageous "treatment strategy.

CONCLUSION:

Our study "indicates that adding a TBP to a PFN offer a better fixation construct and increased stability. This combination appears to improve bony contact, enhance the likelihood of bone union, and help maintain an adequate lever arm. Excellent radiological and functional outcomes were reported in our" study.

Despite these advantages, "our study identified a slight increase in operating time, prolonged exposure to radiological imaging, and higher blood loss compared to PFN fixation alone, primarily due to the additional lateral wall reconstruction procedure. Very few minor complications were noted in our study like anterior hip pain and infection, which were taken care of by taking appropriate measures. Complications like non-union, implant failure, shortening, z effect, and screw migration were not seen in our study. As time passed, a normal range of motion and normal gait with walking without" support were observed in all patients.

Although our "study yielded promising results, further evaluation is necessary given the small sample size and the non-comparative nature of the study.

Case 1:

Case 2:

Financial Support And Sponsorship: Nil
Conflicts Of Interest: Nil

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