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Unstable Trochanteric Fractures: The Role of Lateral Wall Reconstruction Using a Trochanteric Stabilization Plate with Cephalomedullary Nail

Ravi Ranjan Rai[1]*, RachitSheth[2], Piyush N Parikh[3]

[1]Assistant Professor, Department of Orthopaedics, Ahmedabad Municipal Corporation Medical Education Trust Medical College, L. G. Hospital, Ahmedabad, India
[2]DNB Orthopaedics, Senior Resident, Department of Orthopaedics, Ahmedabad Municipal Corporation Medical Education Trust Medical College, L. G. Hospital, Ahmedabad, India
[3]MS Orthopaedics, Professor and Head, Department of Orthopaedics, Ahmedabad Municipal Corporation Medical Education Trust Medical College, L. G. Hospital, Ahmedabad, India

***Corresponding author:** Ravi Ranjan Rai, Assistant Professor, Department of Orthopaedics, Ahmedabad Municipal Corporation Medical Education Trust Medical College, L. G. Hospital, Ahmedabad, India, **E-mail:** drravirai84@gmail.com

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Abstract

Objectives: The present study aims at identifying the merits of adding a trochanteric stabilization plate in addition to a proximal femoral nail for treatment of unstable trochanteric fractures with a broken lateral wall.

Design: Retrospective case series.

Setting: The orthopedic unit of a public teaching hospital, India.

Patients: This study comprised 44 consecutive patients of all ages and either sex, presenting with unstable trochanteric fracture with broken lateral wall, OTA classification 31 A3. Minimum follow up was 12 months.

Intervention: Stabilization of fractures using proximal femoral nailing and a trochanteric stabilization plate.

Main outcome measurements: Salvati and Wilson scoring system and radiological union.

Results: Fracture consolidation was observed in all cases at an average of 15.5 weeks. Overall functional hip score, as per the Salvati and Wilson scoring system, was excellent in 26 patients and good in 17 patients. Time required for the procedure and the amount of blood loss was observed to be close to routine intramedullary nailing in trochanteric fractures.

Conclusions: Although reconstruction of the medial calcar remains the most important predictor for a successful outcome in trochanteric fractures, lateral wall reconstruction is an important component for stabilization of unstable trochanteric fractures. Combining atrochanteric stabilization plate with intramedullary nailing appears to be a useful methodology to achieve the required stabilization.

Introduction

Trochanteric fractures are one of the most common fractures. The definition of an unstable trochanteric fracture varies, but includes those with a fractured lesser trochanter, reverse fracture line or intertrochanteric comminution associated with a large posteromedial component, a broken greater trochanter, or lateral cortex breach [1]. Despite the use of modern techniques and implants, treatment failure ranges from 0% to 20% [1].

Conventionally, in fixation, importance has been given to reconstruction of the medial calcar. However, recent studies have pointed out that the integrity of the lateral wall in these fractures is also an important predictor for failure and reoperation [2], 3A study of proximal femoral nail failures in extra-capsular fractures of the hip showed that common reasons for failure included inadequate reduction, improper screw positioning, and integrity of the lateral wall. Positioning of lag screws too close to the fracture site, or through a broken lateral wall, has been observed as a potential reason for failure. The intact lateral wall plays a key role in stabilization of unstable trochanteric fractures, by providing a lateral buttress for the proximal fragment; deficiency in this case leads to excessive collapse and varus malpositioning [2]. The present study aims at identifying the merits of adding a trochanteric stabilization plate (TSP), in addition to acephalomedullary nail, for the treatment of unstable trochanteric fractures with a broken lateral wall.

Patients and Methods

This is a retrospective review of unstable trochanteric fractures that were treated with trochanteric stabilization plate at a single institution between July 2012 and August 2014. During the study period, 416 trochanteric hip fractures were treated at our institution. 66 patients were considered to have unstable trochanteric fractures (OTA classification 31 A3) and needed a trochanteric stabilization plate in addition to intra-medullary nailing. Among these 66 patients, 9 expired due to causes unrelated to surgery and 13 were lost to follow up. Remaining 44 patients, 24 males and 20 females were included in the study. Average age at presentation was 59.12 years, with patients ranging from a minimum age of 20 years to a maximum of 98 years. The average follow up time was 18.4 months, ranging from a minimum of 12 months to a maximum of 36 months. The cause of trauma was most commonly falling on a level surface, accounting for 65% of the cases, with the remainder sustained in high energy road traffic accidents or falls from height. Patients with open fractures or those with a previous history of surgery on the proximal femur were excluded from the study.

All patients underwent detailed clinical and radiological examination. Their pre-fracture ambulatory status was noted. Informed consent was obtained from all patients. For measurement of functional outcomes, the Salvati and Wilson scoring system was used [3].

Surgical procedure

Under spinal anesthesia, patients were positioned on a fracture table and reduction achieved by traction. The location of skin incision and the entry point for nailing were consistent with standard intramedullary nailing procedures. In all cases, a trochanteric entry nail was used. Guide pins for the proximal screws were inserted through the drill sleeve. At this stage, the decision regarding use of a TSP was considered (Figure 1A). We have observed that if the guide pin passes through a broken lateral wall, or very close to it, on passing the compression screws the screw head gets buried into the lateral wall, and no compression is achieved. This creates a situation where early mobilization is questionable and fracture healing may be delayed. Hence, in such a situation, the decision to use a TSP is made. After the decision regarding use of a TSP is made, the length of screw to be used was measured. The final screw used was10mm longer than the measured length, in order to accommodate for the thickness of the TSP and washer. Subsequently, drilling over both guide pins was performed. The proximal incision was extended distally approximately 3-4 cm. A Cobb's elevator was used to create a sub muscular plane over the trochanter and proximal femur. The TSP was inserted in this sub muscular plane, taking care to accommodate the proximal guide pins in the slit apparent on the TSP (Figure 1B). The final position of the TSP was then checked under an image intensifier. The proximal screws and washer were inserted over the guide wire. Final tightening was performed after the release of traction. Distal locking was completed under the guidance of the image intensifier. This procedure for inclusion of TSP in intramedullary fixation can be completed with only minor extension of the incision, and minimal extra operative time and blood loss, when compared to intramedullary fixation without TSP.

Post-operative protocol

All patients were permitted to perform high sitting and knee bending from the second or third post-operative day, as tolerated. Toe touch weight-bearing ambulation with support was commenced under the guidance of a physiotherapist on the third postoperative day. Patients were followed-up clinically and radiologically in the fracture clinic at regular intervals for possible complications, progress of union, and physiotherapy. All patients were followed-up for a minimum period of 12 months. Overall, clinical outcomes were rated as per the Salvati and Wilson scoring system at the time of final follow-up.

Results

Average delay between the time of operation and the time of injury was 5 days (range 2-12 days), mostly attributable to comorbidity conditions associated with age and the delay in presentation. Six cases had less than anatomical reduction observed in the immediate postoperative period, resulting in 7-9 mm of shortening, however, none of these cases required a shoe raise. Pre-injury ambulatory status was restored in 34 patients; 6 patients required a walking aid for long distances and 4 patients required a walking aid for short distances. A normal range of hip movement and full muscle power was achieved in 26 patients, while 12 patients had a slight decrease in the range of hip movement, and the remaining 6 patients had limited flexion and abduction with fair muscle power. Hip abductor function was observed to be adequate in most cases at the final follow-up.

The Salvati and Wilson score for overall hip function at 12 months was excellent in 26 patients, good in 17 patients, and fair in 1 patient (who was aged 98 years). Clinico-radiological consolidation of the fracture was observed in all cases, at an average of 15.56 weeks. No cases of implant failure, or fixation failure, were observed in our study. Implant related complications were observed in 4 patients. One patient presented with pain around the hip region due to impingement of the TSP, which was removed after fracture healing. Three patients presented with screw back out and impingement while the fracture was healing, with 2 of these patients requiring exchange of screws. Complications are shown in Table 1.

Discussion

Cephalomedullary nail fixation has become the primary treatment for unstable trochanteric fractures. Fracture collapse is a notable postoperative complication associated with unstable trochanteric fractures. In a study by Got fried [2], it was reported that fracture collapse is closely and commonly related with fractures of the lateral wall, and can result in a protracted period of disability until fracture healing. Further, it was suggested that the integrity of the lateral wall is crucial in mitigating postoperative complications in the context of unstable trochanteric fractures. A recent study by Tan et al [4] described a variant of an unstable trochanteric fracture with a broken lateral wall and comminuted greater trochanter (Figures 2A and 2B), and concluded that loss of superolateral support, rather than the medial calcar buttress, is the primary contributing factor for mechanical failure in these types of fractures. 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 [5]. Our study includes similar unstable trochanteric fractures, and has shown that adding a TSP to intramedullary fixation yields better results in terms of early mobilization and union time Figures 2C, 2D and 2E.

The functional results in this study were graded as excellent in 59.09 % of the cases and good in 38.63 %, according to the Salvati and Wilson scoring system. These observations indicate that 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 hip abductor function, and subsequently a better final Salvati-Wilson functional score with restoration of pre-fracture mobility. The average time for union in trochanteric fractures fixed with only proximal femoral nailing is described in various studies to be 18 to 20 weeks (Figures 3A-3D) [5-8].

Table 1: Complications

Complications	Number of patients
Systemic	
Urinary Tract Infection	02
Local	
Plate Impingement	01
Screw Impingement	03
Superficial Wound Infection	02

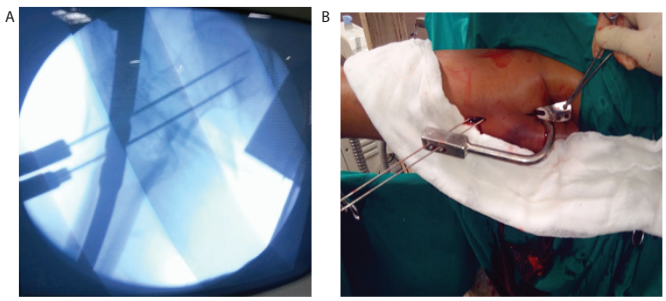

Figure 1: A) Intra operative C-arm image showing the guide pins for hip screws passing through the broken lateral wall. It is at this stage that the decision to add a TSP is made.

B) The TSP is inserted in the sub muscular plane via the proximal incision, such that the slit in the TSP accommodates the guide pins

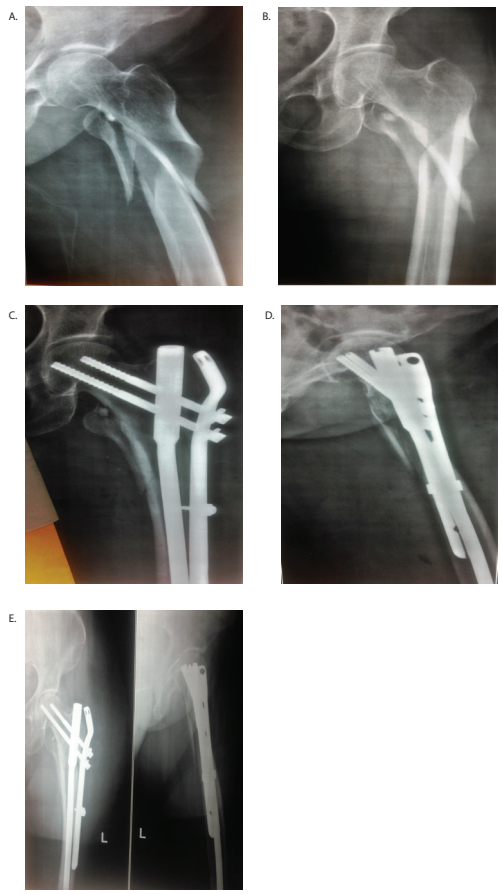

Figure 2: (A and B): A female patient, aged 55 years, presented with an unstable trochanteric fracture with broken lateral wall

(C and D): Immediate post-operative radiograph, showing the fracture reduced and stabilized with an intramedullary nail in combination with a TSP

(E): Radiograph at the 3-month follow-up

Figure 3: (A): Radiographic picture taken from a male patient, aged 30 years, following a high energy trauma

(B): Fracture was reduced and stabilised with intramedullary nail and lateral wall buttress with TSP

(C and D): shows good fracture consolidation after 18 weeks.

However, the average time for union in the present study was 15.5 weeks. Complications related to the implant were observed in 4 patients (9%), which is slightly higher than the incidence rate of 7% observed in a study by W.M. Gadegone [7].

For surgeons familiar with proximal femoral nailing, the additional surgical time associated with adding a TSP over the nail will be marginal. However, theoretically, the slight increase in the operative time, and a wider exposure required for nailing in combination with the TSP, may marginally increase blood loss. The mechanism of action attributable to the TSP has not been properly evaluated in biomechanical studies. However, the TSP appears to act as a buttress plate in cases with a comminuted lateral wall. We observed that if the guide pins of the lag screw pass through, or close to, a broken lateral wall, upon passing the compression screws, the screw head is buried into the lateral wall and no compression is achieved. Subsequently, this creates a situation where early mobilization becomes questionable, and fracture healing may be delayed. In this situation, a TSP acts as a buttress over which the lag screw head with the washer can rest, assisting in fracture reduction as well as providing primary compression between fracture fragments.

Therefore, this study indicates that addition of a TSP over the intramedullary nail is likely to improve the stability of fracture fixation, while simultaneously permitting a controlled sliding collapse. 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 an adequate lever arm.

Limitations of our study

This is a retrospective study with no randomization and no control group. As this is first study of its kind, where a TSP has been used over intramedullary nailing, we are unable to compare our results with similar studies. The mechanism of action of the TSP has not been properly evaluated to determine the way in which it may contribute to biomechanical stability. Finally, we recognize that our results are limited in terms of generalization, as the number of patients could have been more.

Conclusion

The combination of a TSP and intramedullary nailing allows reconstruction of the lateral wall in unstable trochanteric femoral fractures. This creates a biomechanically stable construct allowing early mobilization. Superior overall functional and radiological outcomes in patients with trochanteric fractures with lateral wall comminution indicates that the combination of intramedullary nailing and TSP is likely to be a better option in the management of these fractures, when compared to intramedullary nailing alone.

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