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Embedding the lateral end of the lag screw within the lateral wall in the repair of reverse obliquity intertrochanteric femur fracture

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Abstract

Objective: The management of reverse oblique intertrochanteric femoral fractures is difficult because such fractures have unique biomechanical characteristics. This study was performed to review the results of treating reverse oblique intertrochanteric femoral fractures with a long cephalomedullary nail by embedding the lateral end of the lag screw to secure axial compression.
Methods: We herein report the surgical outcomes in seven patients with reverse oblique intertrochanteric fractures treated with our procedure. Patients whose hip screws obviously had no contact with the distal fragment and whose follow-up time was too short were excluded. The lateral end of the lag screw was embedded within the lateral cortex, and the screws were locked to the nail. All nails were long, and a distal locking screw was inserted in the dynamized position.
Results:
No reoperation, definite leg length discrepancy, or malunion occurred in this study.
Conclusions: These data suggest that early complications do not seem to increase when the lateral end of the lag screw is embedded and the screw is locked to the nail in the treatment of reverse oblique intertrochanteric fracture at this stage.

Keywords

Intertrochanteric fracture, intramedullary nailing, fracture fixation, reverse oblique intertrochanteric femoral fracture, lag screw, cephalomedullary nail

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Introduction

The management of reverse oblique intertrochanteric femoral fractures (ROF) is difficult because such fractures have unique biomechanical characteristics. Excessive medialization of the distal fragment is a common problem when such fractures are treated using a sliding hip screw.[1–3] The lag screw sliding mechanism of the cephalomedullary nail provides limited motion between the main fragments, similar to the sliding hip screw. Therefore, the development of an alternate method is required to achieve interfragmental compression. Axial compression of the distal fragment along the nail is believed to be a feasible alternate method. However, the lateral end of the lag screw can obstruct this compression in some patients with ROF.[4,5] Therefore, avoidance of obstruction by the lag screw end might ensure axial compression when the lateral end of the lag screw contacts the distal fragment. The purpose of this study was to retrospectively review the clinical results obtained with a long cephalomedullary nail by embedding the lateral end of the lag screw into the lateral wall and locking the screw to the nail in seven patients with ROF. To the best of our knowledge, no previous study has investigated the lag screw end as a factor for obstruction of axial compression in the primary treatment of proximal femur fractures.

Patients and methods

This retrospective review included consecutive patients with AO/OTA 31-A3 fractures treated using our novel procedure from October 2011 to December 2015 at our institute. One experienced surgeon performed the surgical procedure. In all patients, closed reduction and internal fixation were performed with a long cephalomedullary nail on a fracture table under image intensifier guidance. Six of the long nails were 10 mm in diameter with a neck–shaft angle of 125°, and one long nail was 9 mm in diameter with a neck–shaft angle of 125°. The lag screw was embedded within the lateral cortex and locked to a nail to minimize lateral overhang from the nail (Figure 1). Longitudinal compression was then manually applied on the fracture table to reduce the fracture gap in all cases. Finally, a distal locking screw was inserted in the dynamized position in all patients. All patients received perioperative antibiotic prophylaxis. Within 3 weeks after surgery, the patients were allowed to stand and walk. Partial weight bearing was not performed because of the high age of the patients. All patients were clinically and radiographically followed up until a plateau in mobility function was attained.

The study protocol was approved by the institutional review board of the hospital. Written informed consent was obtained from each patient.

Results

In total, 141 patients were treated for proximal femoral fractures during the study period; of these, 9 consecutive patients with AO/OTA 31-A3 fractures were treated using our novel procedure. One patient whose follow-up time was too short due to a social problem and one patient whose hip screws obviously had no contact with the distal fragment were excluded. Thus, seven patients in whom the hip screw contacted the distal fragment were enrolled in this study (Table 1).

The patients comprised five women and two men, with an average age of 79 years (range, 64–86 years) at the time of surgery. The average follow-up time was 13.6 months (range, 9–22 months), and all fractures were caused by a fall. One patient had diabetes mellitus and four had hypertension. The average perioperative time was 4 days (range, 2–8 days). Spinal anesthesia was used, and acceptable reduction was

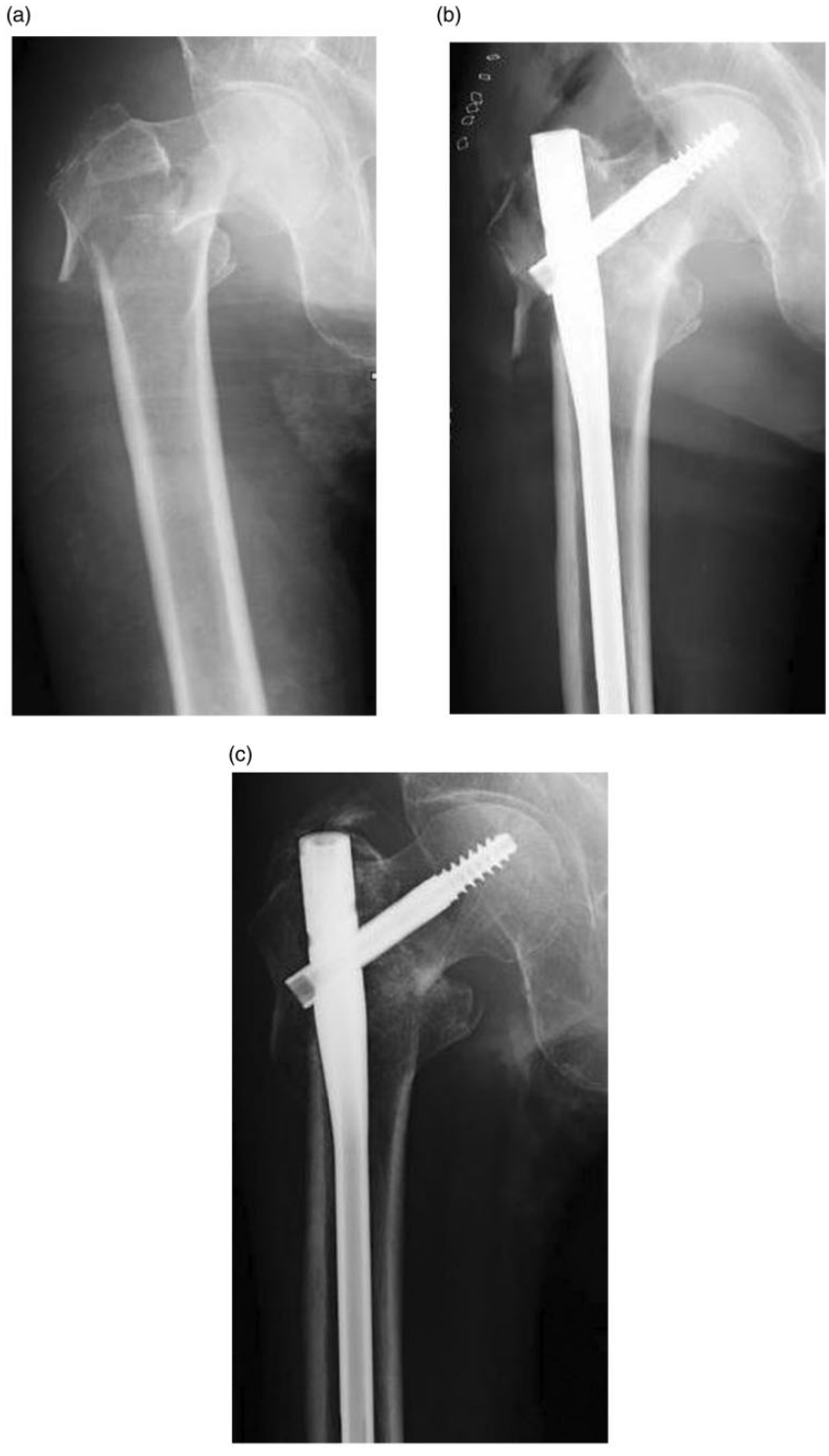

Figure 1. Patient 3 (AO/OTA 31-A3 fracture). This patient's fracture was treated by embedding the hip screw within the lateral cortex and locking the screw to a nail. Fracture union was confirmed 4 months postoperatively. (a) Initial radiograph. (b) Immediately postoperatively. (c) 12 months postoperatively.

Table 1. Patients' characteristics

Patient	Sex	Age (years)	Perioperative time (days)	Preoperative patient mobility	Patient mobility at last follow-up	Operative time (min)	Follow-up period (months)
1	F	64	8	Cane gait	Walker	58	12
2	F	77	4	Independent	Cane gait	60	15
3	M	80	5	Wheelchair	Wheelchair	40	10
4	F	86	2	Cane gait	Walker	45	9
5	F	84	2	Cane gait	Cane gait	50	14
6	F	77	4	Cane gait	Cane gait	52	22
7	M	83	3	Walker	Wheelchair	43	13

F, female; M, male

achieved in all cases. The lag screws were positioned as middle–middle in five patients and slightly middle–superior in two. The mean operative time was 49 min (range, 43–60 min). In three patients, transfusion of packed red blood cells was necessary after surgery. Neither definite leg length discrepancy nor malunion was observed. In six patients, painless weight bearing was achieved within 6 months postoperatively. In the other patient, slight thigh pain during walking continued until the last follow-up. However, union was confirmed radiographically. Two patients who required wheelchairs at the last follow-up were able to put weight on the affected limb at the time of transfer. Reoperation was not performed in any patients.

One patient died of pneumonia 10 months postoperatively. However, her pain had disappeared 3 months postoperatively.

Discussion

In the treatment of ROF, the sliding hip screw has shown a higher reoperation rate than intramedullary devices.[2,6,7] However, Haidukewych et al.[1] reported that the union rate in patients managed with cephalomedullary nails was 67%. Therefore, some investigators have sought better results with intramedullary devices.[8–12] In general, the sliding mechanism of the lag screw provides interfragmental compression in intertrochanteric femoral fractures. This is why the fracture line courses medially as it extends from the proximal to distal end in some fractures. However, compression insufficiency between the main fragments is expected because of the approximate direction of sliding of the lag screw and the major fracture line in ROF. Therefore, it would appear that axial compression of the distal fragment is more effective for interfragmental compression than is lag screw sliding in the treatment of ROF. On the other hand, some authors have reported cases of fixation failure in which the lag screw was inserted through the lateral cortex between the main fragments.[4,5] In such cases, the lateral end of these screws have the potential for obstruction of axial compression (Figure 2). Therefore, obstruction by the lateral end of the lag screw must be avoided in this situation. In the present study, the lag screw was embedded within the lateral cortex and locked to a nail to avoid obstruction of axial compression of the distal fragment. Biber et al.[13] described a similar technique in specific cases of delayed union or nonunion. With respect to nail length, a short nail was not used because stress concentration at the broad medullary canal was a particular concern in the older patients of this study.

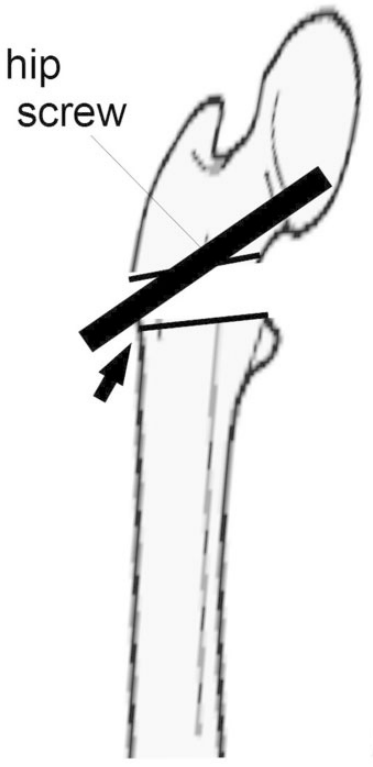

Figure 2. Obstruction of axial compression by the lateral end of the lag screw

No early complications were found when the lateral end of the hip screw was embedded and the screw was locked to the nail. This procedure seems to be a feasible alternative to lag screw sliding in specific cases of ROF. We hope to observe a decrease in the rates of nail breakage during the long-term follow-up.

Declaration of conflicting interest

The authors declare that there are no conflicts of interest.

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