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Medial lag screw migration in an intramedullary nail combination

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SUMMARY

Intramedullary fixation is increasingly used for intertrochanteric fractures in the elderly population. The management of hardware migration and non-union remains a challenge for orthopaedic surgeons, often necessitating complex revision procedures. We report a case of medial lag screw migration with propagation of a reverse oblique neck of femur fracture 8 weeks postoperatively in a patient in their mid-70s with pre-existing paraplegia. A revision procedure was performed. Existing hardware was removed without complication. The lag screw tract was packed with layers of a haemostatic agent to prevent intra-articular cement migration followed by fixation with a long intramedullary nail with cement augmentation via the new lag screw. There were no intraoperative complications, and postoperative progress was satisfactory. This report presents a rare case of medial lag screw migration in an intramedullary nail combination and provides a novel surgical strategy for revision.

BACKGROUND

Proximal femur fractures are common in the elderly, and the incidence is expected to increase at an accelerating rate in the coming years.^{1 2} The use of intramedullary nails (IMN) has garnered considerable support for the treatment of femoral intertrochanteric fractures.^{3–5} Despite improvements in surgical technique, treatment protocols^{6–8} and understanding of the bone-healing unit biomechanics,⁹ the uncommon and severe complication of hardware migration can occur and its use in some high-risk patient groups is contentious.^{10 11} We report a rare complication of medial lag screw migration and fracture propagation in a patient in their mid-70s who was non-weight bearing due to pre-existing paraplegia.

This case report has been reported in line with the SCARE criteria.¹² Using comprehensive search and MeSH terms, a search of Ovid MEDLINE 1946, Embase Classic+Embase 1947 using Wolters Kluwer Ovid (Alphen aan den Rijn, Netherlands), PubMed and Scopus using Elsevier (Amsterdam, Netherlands) was conducted from their dates of inception to July 2024 to identify relevant studies for review.

CASE PRESENTATION

A man in his mid-70s was reviewed in the emergency department following 2 days of increasing right hip pain. He was unable to recall any antecedent trauma. He was 8 weeks postoperative from a right reverse oblique intertrochanteric proximal femur fracture

(figure 1), which was treated with short IMN fixation; Gamma nail 120° 180 mm with 90 mm lag screw (Stryker, Michigan, USA) (figure 2). A 120° nail combination was chosen, as there was intraoperative concern that a 125° or 130° nail may enter through the lateral cortex at the area of greatest comminution. It was thought that this may lead to poor 3-point fixation. Imaging at re-presentation revealed medial migration of the lag screw into the acetabulum (figure 3) and significant propagation of the previous fracture (figure 4). On re-presentation, distal propagation of the fracture line could be seen on plain film X-rays, though it was subtle and only confirmed via CT scan (figure 2). It is possible that this fracture may have been present either since the initial injury or may have propagated during the initial operative reduction. However, it is not visible on either the preoperative plain film X-ray or intraoperative fluoroscopy. Alternatively, it is possible that the fracture propagated during the postoperative period along with the lag screw migration. This was deemed to be the more likely situation given the hardware instability and new pain.

His medical history was significant for paraplegia due to an incomplete spinal cord injury at the L1/2 level, contralateral intertrochanteric fracture managed with internal fixation, osteoporosis and a recent diversion colostomy, debridement and haemorrhoidectomy due to a large sacral pressure injury communicating with the anus. He was non-weight bearing preceding the initial fracture, uses a mobile wheelchair and is independent with horizontal transfers.

TREATMENT

The case was discussed between senior orthopaedic trauma surgeons at the time of re-presentation, and a consensus on management was obtained. After



Figure 1 Anteroposterior radiograph of initial injury.



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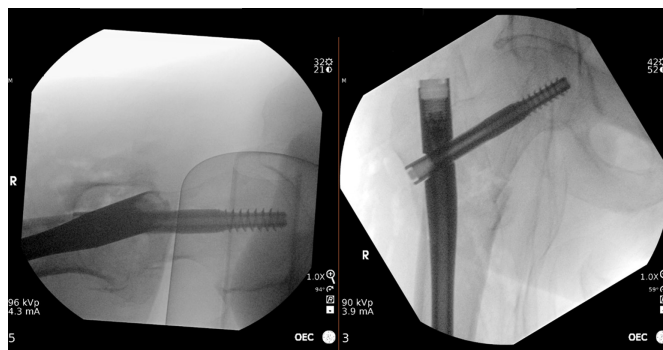


Figure 2 Initial short gamma nail fixation intraoperative images.

medical clearance, the patient was taken to the operating theatre for surgical revision. The existing nail was removed. A long nail (Synthes TFNA femoral nail 14×360mm) was inserted after reaming. A 130° lag screw with cement augmentation was then inserted. A set screw was used to lock the lag screw in static mode. Prior to insertion, the lag screw tract was packed with layered haemostatic agent, Fibrillar (Ethicon, Ohio, USA), to prevent intra-articular migration of cement. The cement lag screw and cement were inserted under image intensification. Difficulty was encountered intraoperatively with visualisation of the cement. The case was subsequently discussed at the quarterly multidisciplinary orthopaedic morbidity and mortality meeting.

OUTCOME AND FOLLOW-UP

The patient was discharged on day 5 of admission. A 6-week postoperative X-ray revealed a small protrusion of intra-articular cement despite the fibrillar packing, which was deemed permissible and not for further intervention (figure 5). A 3-month follow-up was established by phone call, where the patient reported successful resumption of horizontal transfers with physiotherapy aide. A residual dull ache overlying the operative site was also reported, which has diminished with time.

DISCUSSION

This case details a rare medial lag screw migration with significant propagation of a reverse oblique intertrochanteric femoral fracture in a non-ambulatory patient. To our knowledge, medial migration of lag screws after IMN for trochanteric fractures has not been reported in a non-weight-bearing patient at baseline.^{13–30} The growing number of reports for this complication underscores the importance of understanding mechanisms of failure, risk profiles and developing safe revision strategies in comorbid elderly patients.

The initial fixation with a short nail for a reverse oblique fracture pattern was undertaken for the benefits of a shorter



Figure 3 Anteroposterior radiograph of re-presentation with medial migration of lag screw into pelvis.



Figure 4 Sagittal CT demonstrating significant propagation of fracture.

operative time, in a patient with minimal ambulatory needs. However, after discussion in the orthopaedic morbidity and mortality meeting, it is possible that greater fixation with a long nail may have averted migration of the lag screw. During the meeting, it was also noted that the patient was delayed in their routine 6-week follow-up. It is possible that early signs of hardware failure may have been picked up sooner in this scenario.

A literature search was conducted, which identified that most cases involved medial migration of the lag screw from gamma nailing,^{13–15 17 18 20–26 29} with others involving a trochanteric nail,^{16 30} dynamic condylar screw and revision proximal femoral nail²⁷ or intramedullary hip screw.²⁸ Revisions primarily were conversions to arthroplasty.^{13 15 16 18 20 21 23 24 26 30} One patient died during a planned arthroplasty operation, which was presumed to be due to the migrated lag screw communicating with the common iliac artery.²⁵ Other authors report revisions with plate and sliding screw,¹⁴ long proximal femoral nail²⁷ and a shorter lag screw and accessory cannulated screw, which served as a de-rotational device.¹⁷ Implant removal without further intervention was also reported due to medical reasons.^{19 20 28}

The present case report demonstrates a novel revision technique. Given the substantial propagation of the fracture proximal to the distal locking screw, revision to a long nail was necessitated. The use of larger lag screws is supported by Ruecker *et*

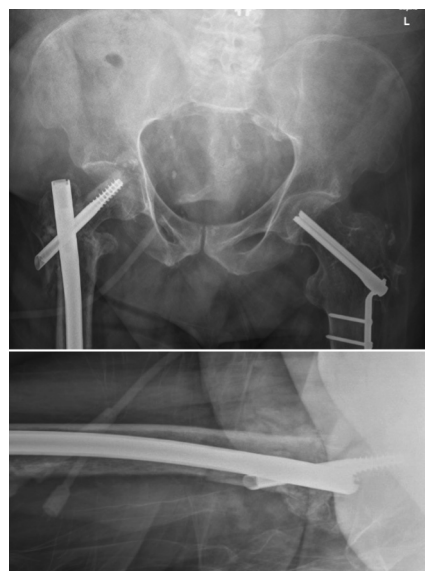


Figure 5 Anteroposterior and lateral radiographs at 6 weeks postoperative.

al in a case series of 48 patients at mean 16 week follow-up, where an intertrochanteric antegrade nail with a large 11 mm lag screw with 7 mm compression screw demonstrated no hardware migration.³¹ The revised lag screw tract was packed with the layered haemostatic agent Fibrillar (Ethicon, Ohio, USA) to prevent intra-articular migration of cement. The cement lag screw and cement were inserted under image intensification with some intraoperative difficulty regarding visualisation of the cement, some of which was demonstrated to have protruded intra-articularly (figure 5).

Other operations were considered for this patient. This included hardware removal and acceptance of non-union, removal with long-stemmed hemiarthroplasty, excision arthroplasty and proximal femur replacement. In considering morbidity, risks and patient goals of pain relief and regaining independence with horizontal transfers, the decision was made to proceed with the aforementioned strategy.

Various mechanisms for IMN failure and screw migration have been hypothesised by Flint *et al*, including femoral head damage, interface dysfunction between the lag screw and the plate or nail, postoperative trauma and surgical errors such as inappropriate screw length or placement.²⁹ Kuroshima *et al* further identify insufficient reduction and toggling caused by the combination of the greater trochanteric fragment and stovepipe canal as possible mechanisms for screw migration.¹⁹ Mechanical failure of the gamma nail where three-point proximal fixation has been used has been reported to be less than 1%.³² Hardware failure in our patient still occurred, even when a three-point proximal fixation technique was employed. Poor bone quality may be a driving factor for lag screw migration in our case, especially in a long-standing non-ambulatory and a comorbid patient.^{9 33}

Prospective studies comparing differing surgical and fixation techniques with more thorough biomechanical analysis may serve to improve treatment protocols and reduce the incidence of lag screw migration. Biomechanical analysis by Weil *et al* has demonstrated that appropriate modelling can reliably

reproduce medial migration of IMN for trochanteric fractures.³⁴ Conditions to achieve migration included deficiency in lateral buttressing, instability of the medial cortex, sustained controlled friction within the femoral head and axial loading in a varus position.³⁴ Implementing such models into the clinical setting may avoid similar hardware failures in the future.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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Patient's perspective

I was in extreme pain before arriving at the hospital for my second surgery, and I needed painkillers. Coming back a second time was a nightmare. I had done all that gym work and preparation with physiotherapy for transfers and then had to restart all over again. Having to stay in bed for 2 weeks was tough. The pain in my hip after the last surgery was diminishing, and at least I am comfortable now. I am just left with a dull ache, but I am aware that these symptoms are expected to last for maybe 6 to 12 months. I am not taking any painkillers anymore. As far as the treatment goes, it was not a problem.

Learning points

- Medial screw migration and fracture propagation following short intramedullary nail fixation in intertrochanteric femoral fractures are rare.
- We present a novel revision technique in a baseline non-ambulatory patient, using a layered haemostatic agent to prevent intra-articular cement migration within the revised lag screw tract.
- Further research is necessary to better understand the incidence and mechanisms to prevent hardware migration.

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