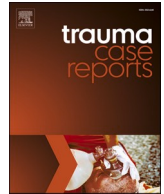




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Case Report

A case of total hip arthroplasty for nonunion after femoral trochanteric fracture surgery with complete breakage of only the compression screw of the InterTAN nail[☆]

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ABSTRACT

Intramedullary nails are an effective treatment for common femoral trochanteric fractures. However, one of their complications is implant breakage due to poor reduction and nonunion after surgery. We herein report a case of a 54-year-old man who underwent total hip arthroplasty for nonunion after internal fixation of a femoral trochanteric fracture. The femoral trochanteric fracture was treated by internal fixation using the Trigen InterTAN nail. The patient developed symptoms of hip pain 6 months after internal fixation. Nine months after internal fixation, hip radiographs and computed tomography scans showed breakage of only the compression screw. During total hip arthroplasty, we were unable to remove the lag screw and compression screw before the femoral head dislocation because no gap was present between the two screws. Thus, we removed these screws with the femoral head after dislocation of the femoral head. The removed nail was partially damaged at the lag screw hole. This change was retrospectively observed on the preoperative computed tomography scan. Three months after total hip arthroplasty, the patient was able to walk unaided and the hip pain had resolved. If only the compression screw is completely broken after internal fixation with the Trigen InterTAN nail, both the lag screw and compression screw will be difficult to remove with preservation of the femoral head. We effectively managed such a case by not only revision internal fixation but also total hip arthroplasty.

Introduction

Intramedullary nails are an effective treatment for common femoral trochanteric fractures. However, one of their complications is postoperative implant breakage due to poor reduction and nonunion. Common breakage sites are reportedly the lag screw hole and the distal transverse screw hole [1,2].

The Trigen InterTAN nail (Smith & Nephew, Watford, Hertfordshire, UK) (hereinafter referred to as the InterTAN nail) comprises a compression screw coupled to a lag screw (Fig. 1) [3,4]. A biomechanical study with cadavers showed that the InterTAN nail has advantages in varus and rotational braking of the femoral head compared with the Gamma 3 nail (Stryker, Kalamazoo, MI, USA), a type

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of intramedullary nail with one lag screw inserted into the femoral head [5]. Previous reports of InterTAN nail breakage described breakage of both the lag screw hole and the compression screw after femoral trochanteric fracture surgery [4,6,7]. In revision surgery in these cases, the implants were removed while preserving the femoral head. However, no reports have described complete breakage of only the compression screw of the InterTAN nail after femoral trochanteric fracture surgery.

We herein report a case involving complete breakage of the compression screw of the InterTAN nail with partial breakage of the nail at the lag screw hole after femoral trochanteric fracture surgery. The patient underwent revision total hip arthroplasty (THA) for nonunion. We were unable to remove the implants while preserving the femoral head before the hip joint was dislocated because no gap was present between the two screws.

Case presentation

A 54-year-old man initially presented at another hospital with an unstable trochanteric fracture of the left femur after falling from a standing height (Fig. 2A). The patient had a history of diabetes, chronic kidney disease, alcoholic liver disease, and bone loss. He had undergone surgical treatment with the InterTAN nail, and postoperative radiographs showed poor fracture reduction (Fig. 2B). Full weight bearing with a walker was allowed immediately after internal fixation. Six months after internal fixation, pain commenced in the left hip joint, and radiographs revealed nonunion and a telescoping lag screw (Fig. 2C). Nine months after internal fixation, the patient walked with a single cane because of left hip pain. Hip radiographs and computed tomography scans showed breakage of only the compression screw. The patient was referred to our hospital for revision surgery. Preoperative hip radiographs showed compression screw breakage but no nail fracture (Fig. 2D). We planned revision THA because the patient wished to return to work as soon as possible.

THA was performed via a posterolateral approach. A part of the compression screw that was present in the subcutaneous tissue was removed. The fascia femoris was incised, the vastus lateralis was divided, and the lateral end of the lag screw was deployed. We attempted to insert an osteotome between the lag screw and the remaining compression screw through the lag screw hole to disengage the two screws and remove the two screws in the femoral head as previously reported [4,7], but this method was difficult because no gap was present between the two screws (Fig. 2E). Therefore, we decided to remove the two screws together with the femoral head. A tip of the greater trochanter that was displaced posteriorly by the traction of the short external rotator muscles was resected because it was embedded in scar tissue and difficult to realign. An L-shaped incision was made in the posterior articular capsule, exposing the intra-articular area. The hip joint was dislocated, the lateral end of the lag screw was hammered with an elevatorium, and the femoral head, lag screw, and compression screw were removed as a single mass (Fig. 3A, B). The nail, which was partially damaged at the lag screw hole, was removed; however, its continuity was preserved (Fig. 3C). Following acetabular reaming, a cementless cup (Continuum Acetabular Shell; Zimmer Biomet, Warsaw, IN, US) was placed on the acetabulum, and following femoral rasping, a cementless stem (Alloclassic SLL; Zimmer Biomet) was inserted into the femur. A highly cross-linked polyethylene liner and ceramic ball were used for the sliding surface of the hip joint. Three months after surgery, the patient was able to walk without a cane and was asymptomatic with no complications. Hip radiographs showed no evidence of implant loosening (Fig. 2F). Retrospectively, the preoperative computed tomography scans showed partial damage to the lag screw hole (Fig. 4A, B).

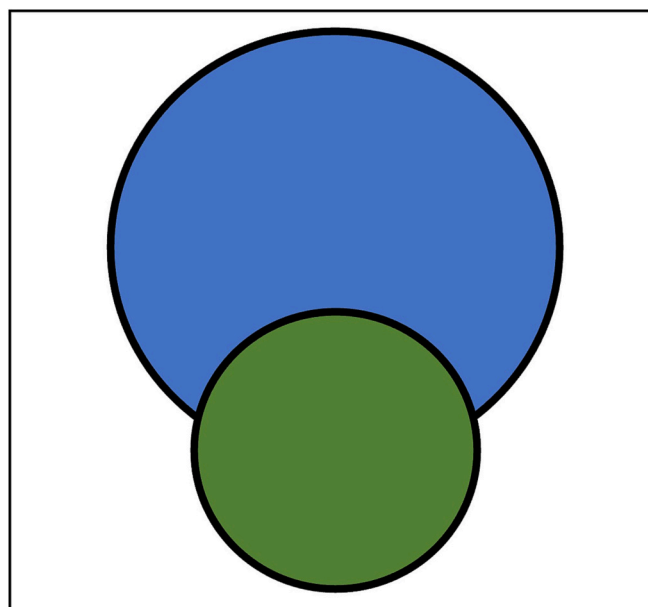


Fig. 1. Cross-sectional view of the combined 11-mm lag screw (blue) and 7-mm compression screw (green). The inferior compression screw was inserted along a cutout on the inferior surface of the superior lag screw.

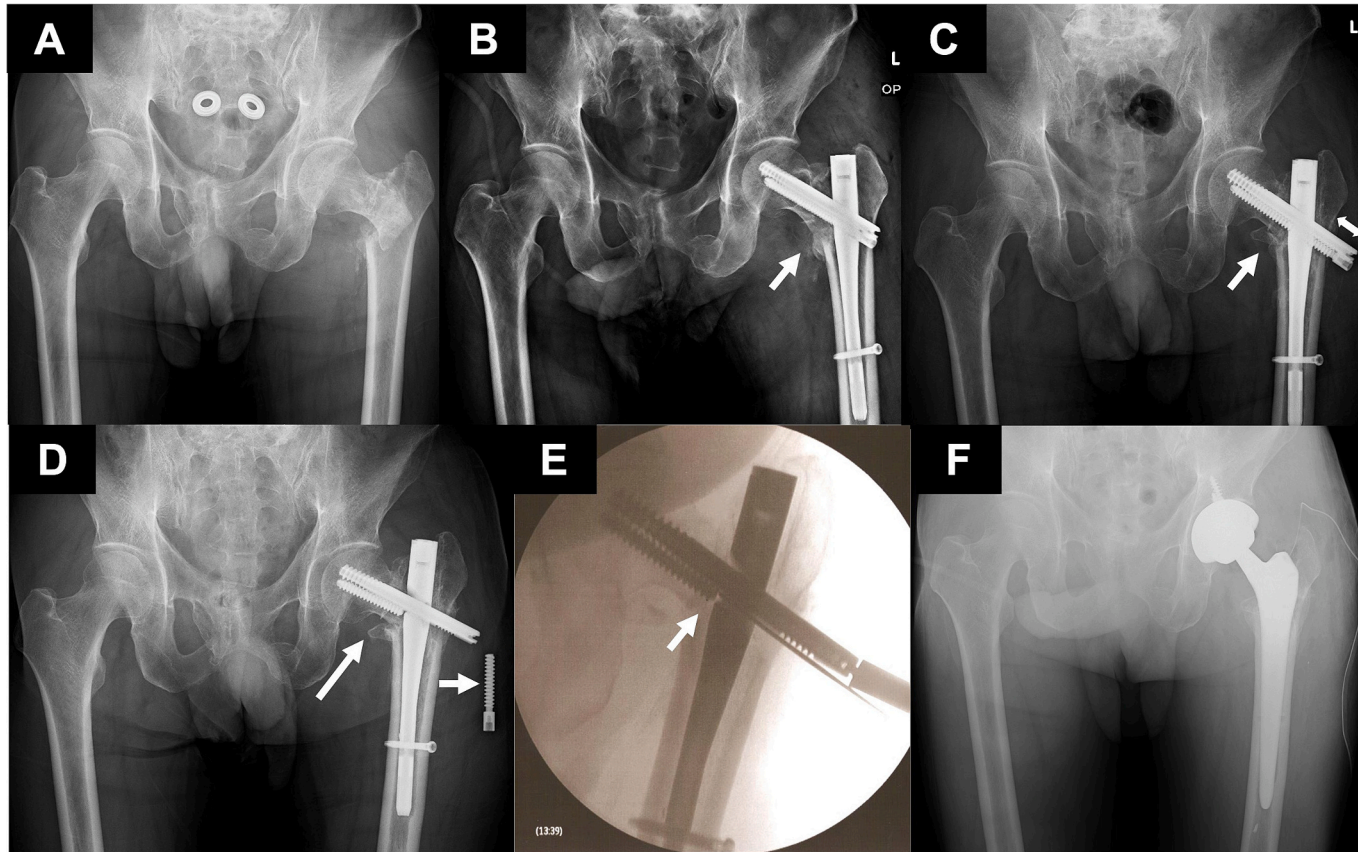


Fig. 2. (A) Hip radiograph with a left femoral trochanteric fracture. (B) Immediate postoperative hip radiograph; the tip apex distance was 20.7 mm, and the medial cortical bone of the proximal femur was poorly repositioned with defects (white arrow). (C) Six-month postoperative hip radiograph showed lag screw telescoping by 21.5 mm (white double arrow) with nonunion (white arrow). (D) Nine-month postoperative hip radiograph showed breakage of the compression screw (short white arrow) with varus deformity of the fracture site (long white arrow). (E) Intraoperative fluoroscopic frontal view of the hip joint at the time of revision surgery. We could not insert an osteotome between the lag screw and the compression screw because no gap was present between the screws (white arrow). (F) Hip radiograph immediately after revision THA. Good positioning of the implant was achieved.

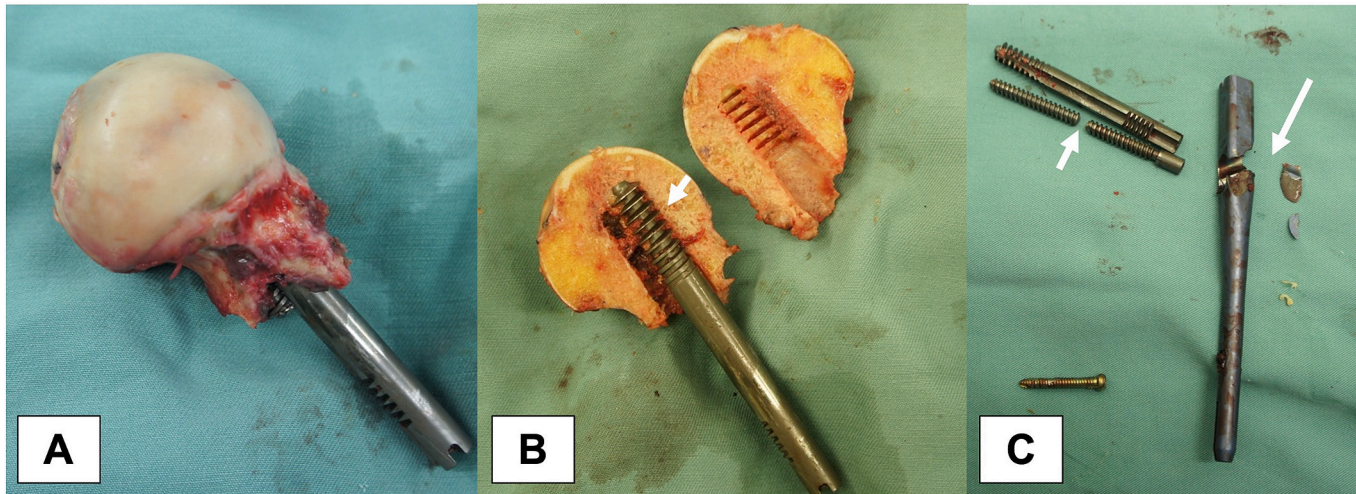


Fig. 3. (A) The femoral head, lag screw, and part of the compression screw were removed as a single mass. (B) The femoral head was cut in the coronal plane. No loosening or cutout of the lag screw or compression screw was observed, and no areas of poor coloration of the cancellous bone were present (white arrow). (C) Image of the removed implant. The compression screw was broken (short white arrow). The lag screw hole of the nail was partially damaged, but its continuity was preserved (long white arrow).

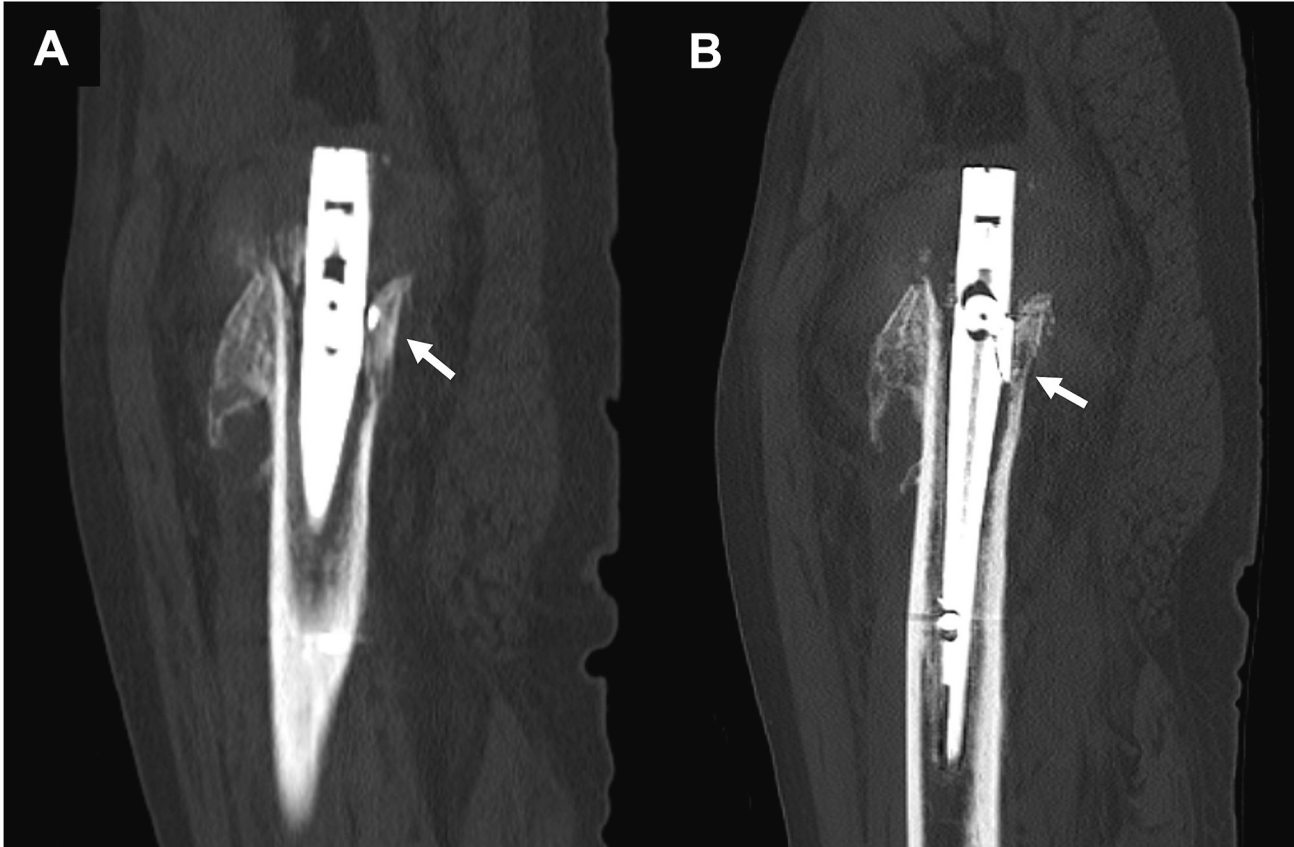


Fig. 4. (A) Eight-month postoperative sagittal computed tomography scan showed partial damage at the lag screw hole (white arrow). (B) Nine-month postoperative sagittal computed tomography scan showed that the partial damage to the lag screw hole had worsened (white arrow).

Discussion

In this study, we experienced a case in which only the compression screw of the InterTAN nail was completely broken after femoral trochanteric fracture surgery, and a good outcome of revision surgery was achieved with THA.

Three cases of breakage of the compression screw of the InterTAN nail have been previously reported, and in each case, both the lag screw hole of the nail and the compression screw were completely broken [4,6,7]. Several methods of removing the integrated compression screw and preserving the femoral head have been reported. Zheng et al. [7] reported that after removing the proximal site of the broken nail, inserting and removing an osteotome at the upper edge of the lag screw, and creating a space, an osteotome was inserted between the lag screw and the compression screw, which caused the lag screw to be displaced toward the upper site. Burgesson and Coles [4] reported that by removing the proximal part of the broken nail and inserting an osteotome between the two screws, the compression screw could be displaced downward. Therefore, breakage of the lag screw hole will affect the method of revision surgery. In the present case, it was difficult to insert an osteotome between the two screws because of the incomplete breakage of the InterTAN nail. As a result, removing both screws while preserving the femoral head was difficult. If a compression screw fracture is observed after surgery using the InterTAN nail, a thorough examination should be performed to determine whether the nail has broken completely or incompletely. If incomplete breakage of the InterTAN nail has occurred, a surgical procedure such as THA must be planned.

Previous studies have shown that the lag screw hole is a weak point at which the cross-sectional area is reduced by approximately 73 % and forces of the device are transmitted from one part to the other in the Gamma nail (Howmedica Inc., Indianapolis, IN, USA) [8,9]. In the present case, poor restoration caused nonunion and a telescoping lag screw. This process may have caused the stress and partial breakage of the lag screw hole. In a biomechanical study with cadavers in which the compression screw of the InterTAN nail provided high rotation braking force of the femoral head, only the compression screw was broken in one case [10]. The rotation stress of the femoral head causes a concentration of stress on the compression screw, and this may have resulted in the breakage of the compression screw in the present case.

Conclusion

If breakage of the compression screw is observed after femoral trochanteric fracture surgery with an InterTAN nail, nail breakage-related complications must be fully examined. If only the compression screw is completely broken after femoral trochanteric fracture surgery, removing both screws while preserving the femoral head will be difficult. In this case, we achieved a successful outcome by performing removal of the broken metal work and subsequent THA.

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Statement of informed consent

The patient was informed that data from his case would be submitted for publication, and he provided written consent.

CRedit authorship contribution statement

Fumihiko Yoshimura: Writing – original draft. **Koichi Kinoshita:** Writing – review & editing. **Hajime Seo:** Writing – review & editing. **Taiki Matsunaga:** Writing – review & editing. **Kenichiro Doi:** Writing – review & editing. **Takuaki Yamamoto:** Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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