



Case report

Intra-abdominal migration of a k-wire during revision total hip arthroplasty

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ABSTRACT

Revision total hip arthroplasty in the setting of severe acetabular bone loss is a challenging problem that is becoming more common. Kirschner wires are often used during acetabular revision for temporary fixation of trial components. We describe an intraoperative migration of a Kirschner wire through the acetabulum into the peritoneal cavity, requiring acute laparoscopic removal.

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Introduction

The incidence of revision total hip arthroplasty (THA) is expected to nearly double by the year 2026, representing approximately 96,700 annual procedures [1]. Management of acetabular bone loss is a critical technical goal during hip reconstruction, particularly in circumstances where the ability of a hemispherical implant to achieve mechanical fixation is compromised. Management of large acetabular defects has been improved significantly with the advent of trabecular metal augments [2,3]. The macro-architecture of these implants allows for modulation of the acetabular volume, potentially allowing for hemispherical implant fixation with a mechanical press fit. Provisional fixation of acetabular augment trials with Kirschner wires (k-wires) allows for accurate definitive augment positioning and intraoperative assessment of residual bone deficiencies prior to acetabular component selection. Smooth k-wire fixation in severely osteopenic bone may be unreliable however, and reports of mechanical failure or migration have been documented [4].

We present a case report of intra-abdominal migration of a smooth k-wire used for provisional fixation of a trabecular metal

augment during acetabular reconstruction of a multiple-revised total hip replacement. The authors report no conflicts of interest and the patient described in this manuscript has provided informed written consent for its publication.

Case history

A 64-year-old female with a past medical history significant for hypothyroidism, posttraumatic stress disorder, and anxiety was referred to our institution for evaluation of a multiple-revised, persistently infected right THA. Her primary procedure was performed 10 years prior to presentation through a posterior approach utilizing an uncemented THA with a metal-on-metal bearing surface. Three years postoperatively, she began to develop increasing pain and frequent dislocations. She ultimately underwent a revision procedure in 2011 and was found to have a retroverted, vertically oriented acetabular component with concurrent soft-tissue destruction and metallosis consistent with a metal-on-metal reaction. The position of the acetabular component was corrected, and she was converted to a metal-on-polyethylene articulation. Two years after this procedure, she developed drainage from her surgical incision and was ultimately diagnosed with a deep periprosthetic joint infection involving methicillin-resistant *Staphylococcus aureus*. She underwent 3 operative debridement and spacer procedures in an attempt to eradicate the infection. Extensive soft-tissue destruction was noted, with dehiscence and necrosis of the abductor musculature. The greater trochanter was also found to

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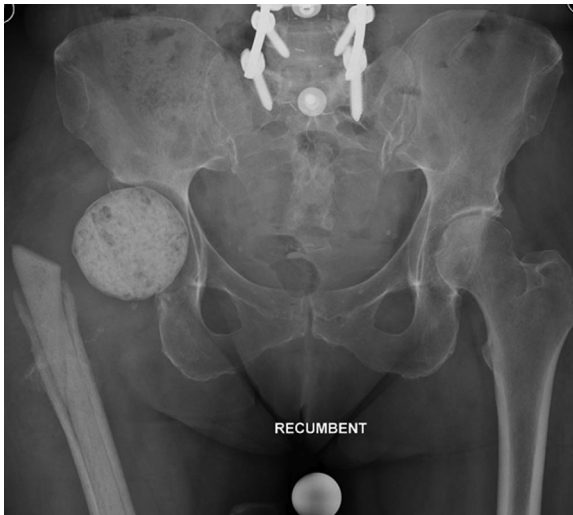


Figure 1. Preoperative anteroposterior radiograph with antibiotic-impregnated cement spacer in place demonstrating severe acetabular and femoral-sided bone loss.

be devitalized and was completely debrided to the level of the proximal diaphysis. A tensor fascia muscle flap was utilized in an attempt to provide soft-tissue coverage over the hip joint. She underwent an extended course of antibiotics consisting of daptomycin and rifampin and ultimately presented to our institution with a static antibiotic spacer in place (Fig. 1). Despite her complicated course, her strong desire was for an attempt at reconstruction of her hip.

We initially performed a repeat operative debridement with revision to a mobile antibiotic-impregnated hip spacer to confirm resolution of infection, after which another 6-week course of antibiotics was prescribed. Serum inflammatory markers (erythrocyte sedimentation rate and C-reactive protein) were monitored serially. These values were normal at a 6-week postoperative check and remained normal throughout the remainder of her treatment at our institution. Additionally, a hip aspiration performed after her antibiotic course was complete, demonstrated no evidence of persistent infection. She was scheduled for reimplantation of her acetabular component, with the plan to revise her femoral component in a staged fashion after achieving acetabular ingrowth, in order to facilitate use of a constrained liner.

Acetabular bone loss at the time of revision was found to be consistent with a Paprosky IIIA defect, with acetabular deficiencies from approximately the 9-o'clock to 2-o'clock position. Reconstruction of the acetabular defect with a posterior and anterior wall dual-augment construct was felt to be a reasonable option. The implant system used (Stryker Restoration Acetabular Wedge Augment System) allows for temporary fixation of trial augments with parallel k-wire holes. Definitive augments may be placed over the k-wires after trial removal in order to confirm appropriate position and alignment. During assessment of the anterior augment trial, fluoroscopic images demonstrated significant superomedial migration of a single k-wire, with the proximal aspect of the wire protruding through the inner table of the acetabulum (Fig. 2). This was unable to be retrieved through the acetabular tract or through manual palpation of the inner pelvic table, and biplanar fluoroscopic imaging suggested that it was located within the peritoneal cavity. The most likely hypothesis for this complication is that one of the parallel k-wires used for augment trialing was not threaded through its hole on repeat trialing and instead was pushed through the severely deficient acetabular bone as the trial was seated.

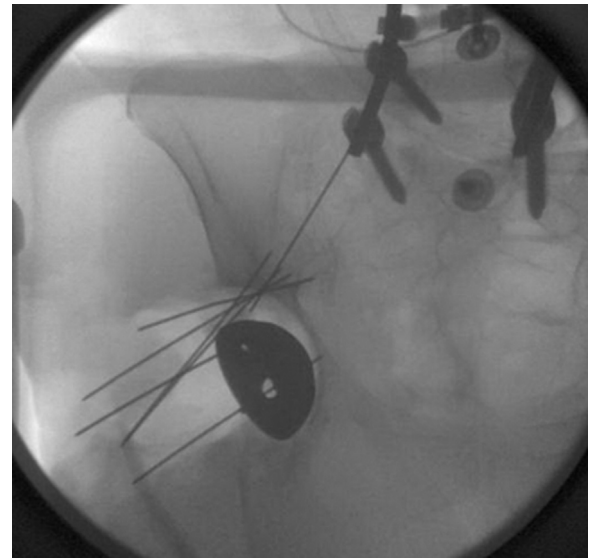


Figure 2. Intraoperative anteroposterior fluoroscopic image of right hip with radiolucent trial augment held in place with k-wires superior to trial acetabular component. A single k-wire has migrated superomedially through the inner table of the pelvis.

General surgery was consulted intraoperatively and confirmed that the k-wire was located within the peritoneal cavity using ultrasonography. Given the patient's stable medical status, the decision was made to proceed with final acetabular instrumentation, wound closure, and dressing placement, with the plan to subsequently prep and drape the abdomen during the same anesthetic episode for a diagnostic laparoscopy. Upon visualization of the peritoneal cavity with the laparoscope, the k-wire was immediately identified resting on a loop of small bowel in the right lower quadrant. There was a rent within the peritoneal membrane with a small hematoma at the site of k-wire penetration. The k-wire was easily removed laparoscopically through an accessory portal, and the small bowel was examined and found to be intact without evidence of penetrating injury (Fig. 3).

Postoperatively the patient was extubated uneventfully and transferred to the surgical intensive care unit overnight for close monitoring for signs of bowel perforation. She subsequently had an uncomplicated postoperative recovery and underwent staged femoral reconstruction 4 months later with a cemented proximal femoral replacement and constrained liner (Fig. 4). She is currently over 1-year postoperative from her staged reconstruction. Functionally, she is able to ambulate with a cane, has significantly reduced pain, has no clinical signs of recurrent infection, and is very satisfied with her overall outcome.

Discussion

K-wire migration is a reported, albeit rare, complication during orthopaedic surgery. Only a handful of case reports demonstrating this phenomenon exist in the literature, and to our knowledge, none have involved total hip arthroplasty. K-wires have been shown to travel across tissue planes to unintended locations through direct mechanical force (as in our case report) but have also spontaneously migrated to intracardiac and intrathoracic locations through the circulatory system [5]. These events can occur even years after surgical intervention, presenting as culprits for new onset arrhythmias and hemoptysis [6,7]. Direct intrapelvic pin migration has been previously documented in a 2-year old pediatric patient undergoing Salter innominate osteotomy, as well as in geriatric patients undergoing operative fixation of a

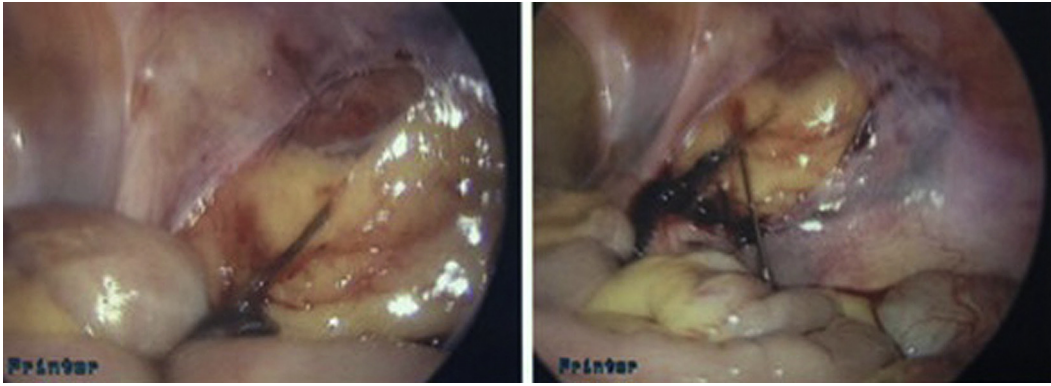


Figure 3. Laparoscopic images demonstrating a k-wire causing a tear in the peritoneal membrane with accompanying hematoma, resting on a segment of small bowel.

peritrochanteric hip fractures [8,9]. It should be further noted that a k-wire does not need to remain within the abdominal cavity in order to cause serious harm. Durao et al. reported on a case of an elderly patient who died after being discharged from the hospital status post dynamic hip screw placement for an intertrochanteric hip fracture. An autopsy revealed a single puncture injury in the cecum with signs of bacterial peritonitis. It was hypothesized that a temporary guide pin traversed the acetabulum, penetrating the peritoneal cavity at some point during the surgical procedure [10].

Various acetabular augment systems allow for provisional fixation of trial components with the use of a k-wire, which can then also be used to place the definitive augment to ensure consistent positioning. Provisional fixation offers several advantages, particularly the ability to accurately determine the size of the acetabular component with trial augments in place. However, acetabular

osteopenia (typically a consequence of stress shielding, osteolysis, or disuse) is an extremely common finding during total hip revision. Poor bone quality is known to be a substantial risk factor for k-wire migration [11]. Although the use of provisional k-wires may still be of significant value in complex acetabular reconstructions requiring multiple augments, we recommend caution with their use in patients with severely osteopenic bone. Additionally, threaded k-wires may achieve better purchase and be less likely to migrate compared to smooth k-wires in situations where deficient bone stock is encountered.

Summary

We describe an intraoperative migration of a k-wire through the acetabulum into the peritoneal cavity, requiring acute laparoscopic removal. This is the first reported case of k-wire migration during THA in the literature. Surgeons utilizing k-wires during hip surgery should be aware of the clinical and radiographic features of this complication. Delayed or missed diagnosis of a peritoneal perforation can have serious or potentially deadly consequences. Threaded k-wires may be more resistant to inadvertent migration in revision scenarios with poor acetabular bone quality.

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Figure 4. One-year postoperative anteroposterior radiograph with definitive revision component placement demonstrating severe acetabular and femoral-sided bone loss.