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# The Paradox of Minimalist Salvage: Biomechanical Destabilization and Failure Following Limited Removal of Exposed Periprosthetic Hardware: A Case Report

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**Case Report**

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# Abstract

**Background:** Exposed periprosthetic hardware typically requires formal operative debridement and often flap coverage. In geriatric patients with significant comorbidities, surgeons may attempt "damage control" strategies—such as the isolated removal of exposed hardware—to minimize physiologic stress. This case reports the catastrophic biomechanical failure of such a limited salvage technique.

**Methods:** An 84-year-old male presented three weeks following retrograde intramedullary nailing for a periprosthetic femur fracture with a distal interlocking screw eroding through the skin. The patient was afebrile and denied constitutional symptoms. Physical examination revealed an exposed screw at the lateral knee without erythema, purulent drainage, or warmth. The superficial exposed screw was removed at the bedside. This was followed by limited operative wound exploration and irrigation performed under monitored anesthesia care (MAC). Intraoperative evaluation was performed to assess for hardware-joint communication.

**Results:** Evaluation revealed a moderate knee effusion that did not communicate with the wound. No gross intraoperative signs of infection were observed, and post-procedure blood cultures remained negative. Six weeks post-discharge, the patient presented with acute delirium, severe pain (10/10), and radiographic nonunion. The loss of the distal interlocking bolt converted a stable construct into an unstable one, necessitating three subsequent surgical revisions to salvage the limb and restore weight-bearing function.

**Conclusion:** We caution against the isolated removal of exposed structural hardware in load-bearing fractures. Unlike non-structural implants (e.g., syndesmotic screws), removing a locking screw from a retrograde nail can lead to immediate destabilization, nonunion, and a paradoxical increase in total surgical morbidity.

**Level of Evidence:** Level V (Case Report)


# Introduction

Exposed hardware after total knee arthroplasty (TKA) is a rare but serious complication, often caused by infection or soft-tissue defects. Standard management typically involves formal operative debridement, hardware removal, and potential flap coverage in an operating room environment. [1] In complex geriatric patients with multiple comorbidities, the morbidity associated with repeat surgical intervention and general anesthesia is significant. Historically, outcomes for exposed total knee prostheses have been poor, with reports indicating that up to 29% of patients in certain series required amputation due to severe complications [2]. Faced with these risks, surgeons often seek "limited" or "palliative" salvage options. The rationale is to minimize the "second hit" of a major revision surgery by performing a bedside or minor procedure to address the local soft tissue problem while retaining the primary fixation. This approach is often compared to the routine removal of symptomatic syndesmotic screws or subcutaneous K-wires, which are removed without compromising limb stability. This case report

challenges that comparison. We present a case where a "minimalist" strategy—removing a single exposed locking screw to cure a soft tissue defect—resulted in the immediate biomechanical destabilization of a retrograde nail. The result was not the intended salvage, but rather a cascade of nonunion, acute delirium, and multiple subsequent surgeries. This report serves as a cautionary tale regarding the critical biomechanical role of "minor" hardware components in retrograde femoral nailing.

# Case Presentation

An 84-year-old male with a past medical history of hypertension and hiatal hernia was admitted for a supracondylar periprosthetic fracture of the left femur. The patient had previously undergone a dynamic hip screw (DHS) fixation and a total knee arthroplasty on the same side. Subsequently, he underwent retrograde intramedullary nailing for stabilization of the periprosthetic fracture. Approximately three weeks after the index surgery, the patient noted

progressive prominence of the distal interlocking screw, with skin erosion and overt hardware exposure occurring approximately 24 hours prior to presentation. He presented to the emergency department, reporting localized pain but no fever, chills, rigors, or other signs of systemic infection.

### *Clinical Examination*

Physical examination revealed vital signs within normal limits, including a temperature of 98.4°F (36.9°C). Local examination of the left knee demonstrated an exposed screw head at the lateral aspect with minimal surrounding erythema. There was no purulent drainage, fluctuance, or appreciable warmth. The wound measured approximately 1.5 cm in diameter. Distal neurovascular examination was intact with palpable dorsalis pedis and posterior tibial pulses.

### *Labs and Imaging Studies*

Initial laboratory studies included a complete blood count (CBC) and comprehensive metabolic panel (CMP), both within normal limits. Blood cultures were drawn and remained negative throughout hospitalization. Anteroposterior and lateral radiographs of the left knee demonstrated the retrograde intramedullary nail with a prominent distal interlocking screw protruding through the soft tissues (Figure 1).

### *Treatment Protocol*

Given the patient's age, medical comorbidities, very recent hardware exposure (approximately 24 hours from patient recognition to presentation), absence of systemic infection, and lack of purulent drainage, a decision was made in consultation with the orthopedic surgery team to pursue bedside hardware removal followed by wound irrigation. The patient was counseled

extensively regarding the approach, risks of infection, and potential need for subsequent operative intervention. In the emergency department, the exposed distal interlocking screw was removed by an

orthopedic surgeon at the bedside under local anesthesia with 1% lidocaine. The orthopedic surgery team subsequently performed a localized wound exploration and irrigation that evening under monitored anesthesia care. The wound was extended proximally and distally to allow adequate visualization and copious irrigation with 3 liters of normal saline. No tissue debridement was performed, as all visualized tissue appeared healthy and viable.

Intraoperative findings included a moderate knee effusion that was noted to be non-communicating with the wound tract. All visualized tissue appeared healthy with no signs of infection, necrosis, or purulence. There were no gross intraoperative signs of infection.

***Postoperative Course***

The patient's post-procedure pain responded well to a regimen of acetaminophen and oxycodone. He remained clinically stable without fever, leukocytosis, or signs of spreading infection. Blood cultures remained negative at 48 and 72 hours. The patient was administered a short course of intravenous cefazolin for 48 hours as prophylaxis. This antibiotic course was intended as short-term prophylaxis against early contamination rather than treatment of established infection. He was discharged home on postoperative day three with instructions for daily dressing changes and non-weight-bearing precautions while ambulating with a walker.

***Follow-Up Outcomes***

However, the clinical picture deteriorated rapidly regarding fracture stability. Approximately three weeks following the screw removal (six weeks from the original discharge), the patient presented to the Emergency Department in acute distress. The patient reported incapacitating left knee pain, rated as 10/10, which had escalated over 2–3 days. The pain was exacerbated by any external rotation of the limb. More concerningly, the family reported severe functional and cognitive decline, including new-onset incontinence and visual hallucinations (e.g., leaving stove burners on), consistent with acute delirium secondary to uncontrolled pain. Vital signs showed a widened pulse pressure (BP 148/63) but no fever. Laboratory evaluation revealed a white blood cell count of 10.3 and stable hemoglobin (10.1). Radiographs of the left femur demonstrated a nonarticular distal femur fracture that remained nonunited (Figure 2). Critically, there was no periosteal reaction indicating healing. The removal of the distal locking screw had eliminated the distal fixation point of the retrograde nail. Without this locking mechanism, the nail could no longer control rotation or axial length in the distal fragment, leading to micromotion and frank nonunion. Following this readmission, the patient required three subsequent surgical revisions over the next six months to restore mechanical stability. These procedures required the removal of the failed construct and conversion to a more robust fixation strategy to address the nonunion.While the patient eventually regained ambulation, he continues to report chronic baseline pain (4/10), requiring ongoing analgesic management.

# Discussion

This case highlights a critical distinction in orthopedic salvage: the difference between a biological cure (soft tissue coverage) and a mechanical failure (destabilizing the fracture). While the limited removal of the screw solved the soft tissue problem, it created a far worse mechanical one. Established literature suggests that hardware preservation with soft-tissue coverage may be possible if the hardware is stable and exposure has occurred for less than two weeks without underlying infection [1]. However, the decision for bedside removal in this case was predicated on the superficial nature of the exposure, the lack of joint communication, and notably, the timing.

A common justification for limited hardware removal is the routine practice of removing symptomatic screws in other contexts, such as syndesmotic screws in ankle fractures. It is vital to distinguish these scenarios biomechanically. Syndesmotic screws are often removed after the ligamentous complex has healed, or they serve as a positioning device that is not the primary weight-bearing column. In a retrograde femoral nail, especially in a periprosthetic fracture with poor bone stock, the distal locking screw is the structural keystone. It

provides the only resistance against rotation and toggle of the distal femoral condyles around the nail. In this case, removing the screw converted a statically locked load-sharing construct into a dynamically unstable one. The radiographic findings of nonunion and no periosteal reaction at six weeks confirm that the fracture environment was too unstable to permit healing.

The decision likely also relied heavily on the timing of the presentation. In vitro studies demonstrate that while bacterial adhesion to orthopedic implants occurs within minutes, [3] mature biofilm formation with a resistant extracellular polymeric substance (EPS) matrix develops within the first few days of exposure. [3,4] Decision-making scales developed for open reduction and internal fixation (ORIF) may guide hardware management by assessing wound status and systemic risk, but their applicability to periprosthetic fractures remains uncertain. [5]

The primary motivation for the limited intervention was to spare a fragile 84-year-old patient from the physiologic stress of major surgery. Paradoxically, this decision led to significantly higher physiologic stress. Mortality rates following surgical treatment for periprosthetic fractures in geriatric populations are substantial, with one-year mortality estimates ranging from 17% to as high as 23% in some series. [6,7]

The patient suffered an episode of acute delirium requiring hospitalization—a known independent predictor of mortality in geriatric patients. Furthermore, instead of one definitive revision surgery, the patient was subjected to three additional procedures. This case suggests that "limited" salvage should be viewed with extreme skepticism in load-bearing fracture nonunions. Assess Stability First: Before removing any exposed hardware, the surgeon must ask: "Is this component providing essential stability?" If the answer is yes, it cannot be removed without immediate substitution (revision fixation). Treat as Infection: Exposed hardware should be presumed to have deep colonization. If the hardware must be retained, the construct must be stable. If stability is compromised by removal of the exposed part, a single-stage revision is safer than a staged "wait and see" approach that risks nonunion. Palliative

wound care for exposed hardware has been described as a viable limb-salvage strategy in patients with severe peripheral arterial disease who are poor candidates for reconstruction. While our patient had viable perfusion, the principle remains parallel: prioritizing soft-tissue stability and patient survival over aggressive hardware retention or complex reconstruction. [8]

***Limitations:***

This case report has several important limitations. As a single case study, it represents Level V evidence and cannot establish definitive guidelines. There is inherent selection bias in reporting an unsuccessful outcome.

# Conclusion

We strongly advise against the isolated removal of exposed structural hardware in periprosthetic fractures. While soft tissue closure may be achieved, the risk of destabilization is unacceptably high. As demonstrated in this case, the removal of a single locking screw led to nonunion, acute delirium, and a protracted course of multiple revisions. In geriatric salvage, the impulse to minimize surgical trauma must not compromise mechanical stability; both must be achieved simultaneously to prevent catastrophic failure.

# Declarations

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**Ethics Approval:** Not applicable.

**Consent to Participate:** Not applicable.

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**Availability of Data and Material:** Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

**Code Availability:** Not applicable.

**Authors' Contributions:** B.C. wrote the main manuscript text and prepared Figures 1 and 2. R.W. and G.K. managed the patient case and supervised the writing process. All authors reviewed and approved the final manuscript.

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# Figures

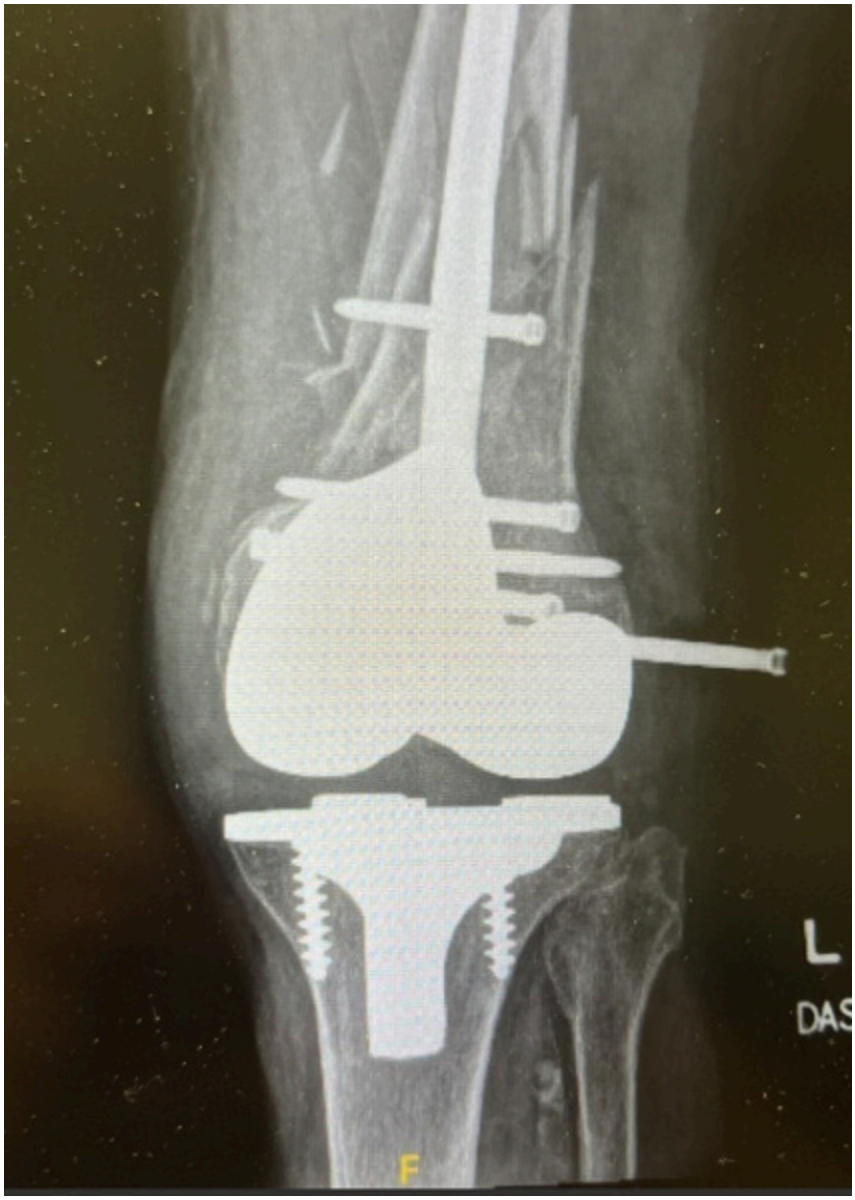



**Figure 1**

Anteroposterior radiograph of the left knee demonstrating the retrograde intramedullary nail and the prominent distal interlocking screw. Note the proximity of the screw tip to the cutaneous boundary.




**Figure 2**

Anteroposterior radiograph of the left knee demonstrating a nonarticular distal femur fracture that remained nonunited.