

# Intrapelvic Neck Screw Migration after Trochanteric Fixation Nail Advanced Fixation of a Trochanteric Femoral Fracture: A Case Report and Proposed Treatment Algorithm

Nabil Slaoui Berezak<sup>1</sup>, Jesús Llorens Fernández<sup>1</sup>, Jorge Crespo Cánovas<sup>1</sup>, Carles Marián Carrasco<sup>1</sup>, Francisco Ferrero-Manzanal<sup>1</sup>

## Learning Point of the Article:

Vigilant radiographical follow-up enables early identification of cephalic screw migration, prompting urgent surgical management with multidisciplinary support to prevent catastrophic intrapelvic injuries.

## Abstract

**Introduction:** Although rare, mechanical failure of fixation in trochanteric fractures can lead to significant morbidity, particularly when medial migration of the cephalic screw occurs, posing a serious risk of life-threatening injury to intrapelvic vascular and visceral structures.

**Case Report:** We report a case of severe intrapelvic migration of a cephalic screw in a 79-year-old patient following short trochanteric fixation nail advanced fixation for an unstable trochanteric fracture (Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association 31-A2). The patient presented with acute mechanical failure, pain, and severe agitation. Urgent surgical intervention was performed, consisting of hardware removal and single-stage conversion to total hip arthroplasty (THA) using a dual-mobility construct. This multidisciplinary strategy successfully resolved the intrapelvic risk, provided stable joint reconstruction, and allowed for immediate full weight-bearing and early mobilization.

**Conclusion:** Intrapelvic screw migration requires prompt recognition and urgent surgical intervention with multidisciplinary preparation. Single-stage conversion to dual-mobility THA may provide a salvage procedure that mitigates visceral/vascular risks and enables early functional recovery in frail elderly patients.

**Keywords:** Trochanteric fractures, post-operative complications, total hip arthroplasty.

## Introduction

Although the incidence of hip fractures has plateaued or slightly decreased in some developed nations in recent years, they remain a major global public health concern due to progressive population aging. It is projected that the overall incidence of hip fractures worldwide will nearly double over the next two to three decades [1].

Hip fractures profoundly impair functional independence, quality of life, and long-term survival in elderly individuals [2]. Furthermore, they impose a substantial socioeconomic burden on healthcare systems globally.

Trochanteric fractures are associated with a broad spectrum of complications that may occur during the perioperative or long-term post-operative course. Local mechanical complications include fixation failure through varus collapse and lateral cut-out,

## Author's Photo Gallery



Dr. Nabil Slaoui Berezak



Dr. Jesús Llorens Fernández



Dr. Jorge Crespo Cánovas



Dr. Carles Marián Carrasco



Dr. Francisco Ferrero-Manzanal

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<sup>1</sup>Department of Orthopedic Surgery and Traumatology, Cartagena University Hospital Complex, Murcia, Spain.

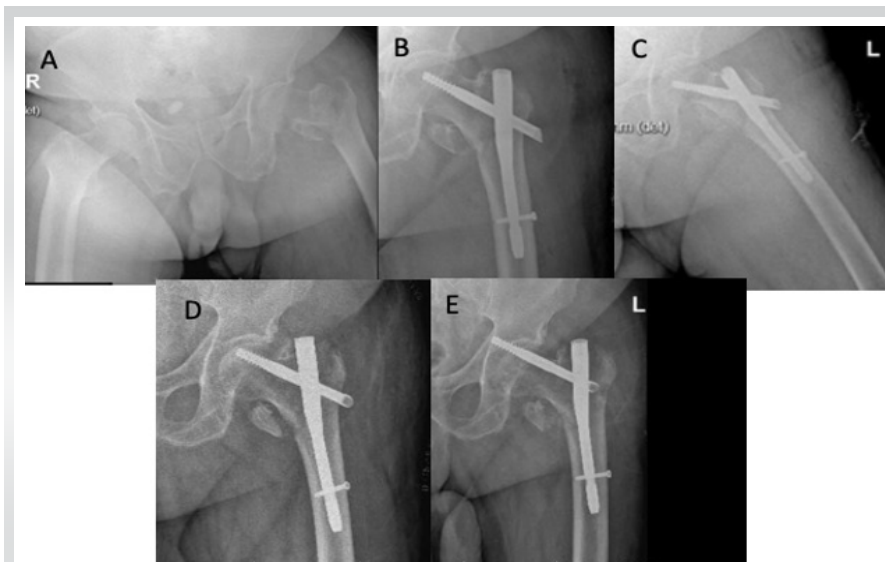
### Address of Correspondence:

Dr. Francisco Ferrero-Manzanal,  
Department of Orthopedic Surgery and Traumatology, Cartagena University Hospital Complex, Murcia - 30202, Spain.  
E-mail: [frankferrero@gmail.com](mailto:frankferrero@gmail.com)

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**Figure 1:** Radiological images of the hip. (a) Trochanteric fracture. (b) Post-operative anteroposterior (AP) view. (c) Post-operative axial view. (d) AP view 10 days after the surgery. (e) AP view 5 weeks after the surgery.

medial cut-in with intrapelvic screw migration, non-union, and implant-related peri-implant fracture. Systemic complications are equally relevant in this frail population and include venous thromboembolism, surgical site infection, post-operative delirium, and cardiopulmonary decompensation related to underlying comorbidities. Beyond the acute period, hip fractures are also linked to loss of ambulatory independence, increased institutionalization rates, and elevated 1-year mortality [1,2,3,4,5]. Among these, intrapelvic migration of the cephalic screw represents one of the rarest yet most catastrophic mechanical complications, given its potential to cause life-threatening vascular or visceral injury.

Despite significant technological advancements in modern intramedullary implants, fixation failure in fragility-related peritrochanteric fractures occurs in approximately 5% of cases and is associated with poor functional outcomes. Fixation failure doubles both the average length of hospital stay and associated healthcare costs [3].

In this report, we describe a rare and potentially life-threatening complication of trochanteric fracture fixation: massive intrapelvic migration of the cephalic lag screw following short trochanteric fixation nail advanced (TFNA) nailing. We detail the clinical presentation, radiological findings, and the multidisciplinary surgical strategy – emergency hardware removal with single-stage conversion to dual-mobility total hip arthroplasty (THA) – used to avert catastrophic visceral and vascular injury. Through this case, we highlight the technical risk factors underlying screw migration and discuss the

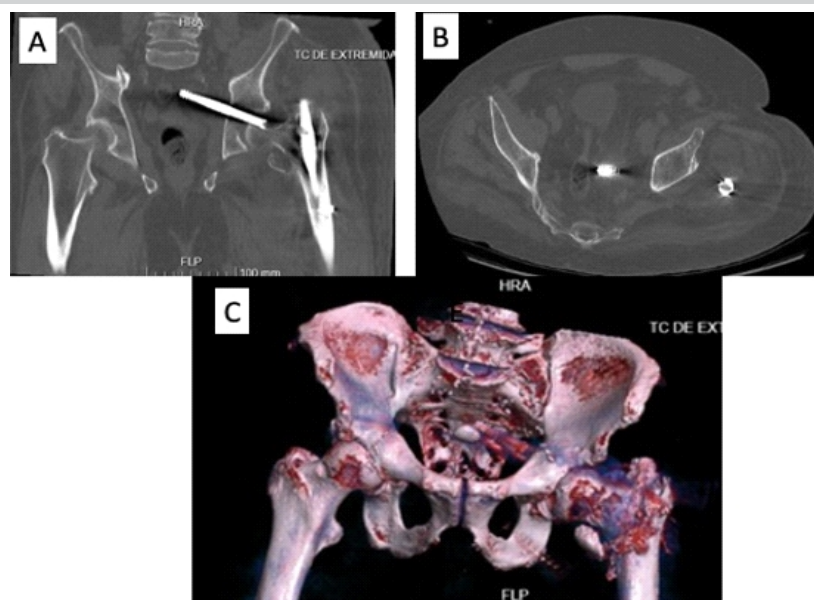
rationale for early recognition and definitive salvage reconstruction in frail elderly patients.

### Case Report

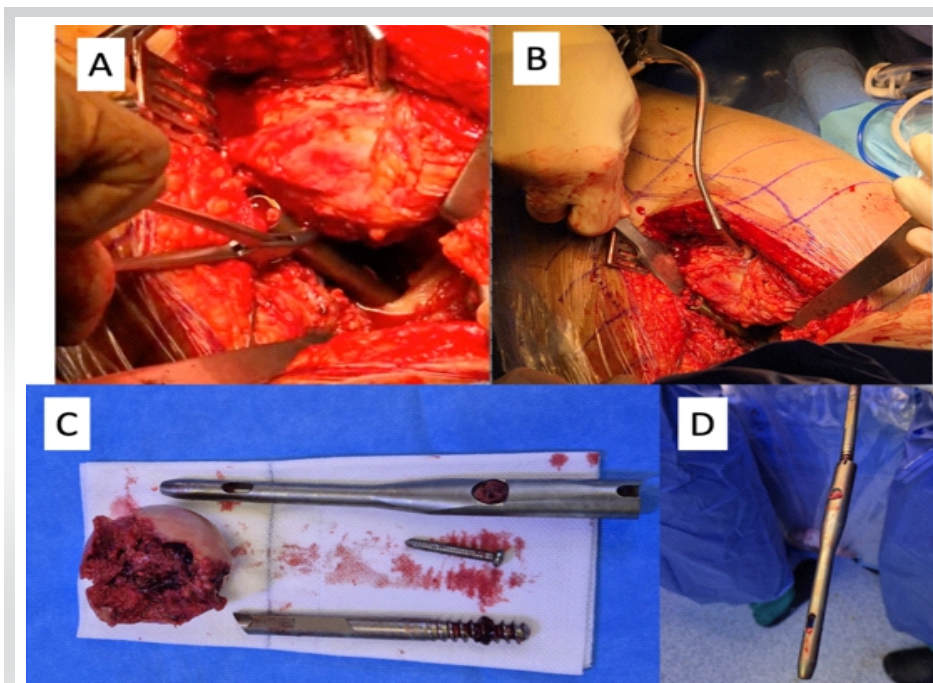
A 79-year-old male patient (American Society of Anesthesiologists physical status III) with a past medical history of atrial fibrillation (anticoagulated with apixaban 5 mg twice daily), arterial hypertension, Grade II obesity (Body mass index 38 kg/m<sup>2</sup>), dyslipidemia, and severe obstructive sleep apnea presented to the emergency department after sustaining an *Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association* (AO/OTA) 31-A2.2 trochanteric fracture of the left femur following a low-energy fall from standing height (Fig. 1a). The fracture was classified as Boyd-Griffin Type 2 (unstable). Evident signs

of osteoporosis were observed on the radiographs.

Following multidisciplinary evaluation by the orthogeriatric and anesthesiology teams, the patient underwent surgical intervention 48 h post-admission. Under spinal anesthesia, closed reduction and percutaneous cephalomedullary nailing were performed using a TFN-ADVANCED™ Proximal Femoral Nailing System (TFNA, Synthes; 125° neck-shaft angle, 170 mm length, 10 mm distal diameter, with a 105 mm non-augmented lag screw). A short intramedullary nail was considered to provide adequate biomechanical stability by bridging the metaphyseal defect while preserving the intact



**Figure 2:** Computed tomography scan images. (a) Coronal view. (b) Axial view. (c) 3D reconstruction.



**Figure 3:** Intraoperative images. (a and b) Removal of the lag screw. (c) Femoral head and implants after removal. (d) Image of the nail after extraction with the aid of the lag screw.

extension. The CT scan revealed massive intrapelvic migration of the lag screw, with its tip positioned within 8 mm of the sigmoid colon (Fig. 2).

Given the patient's severe agitation, involuntary leg movements, and high risk of secondary visceral or vascular perforation, emergency surgical intervention was scheduled. The vascular surgery team was notified and placed on standby.

With the patient in the right lateral decubitus position, a posterolateral approach (Southern-Moore) to the left hip was performed. Operative findings showed lack of fracture union. A femoral neck osteotomy was performed to facilitate head mobilization and visualization of the screw. The proximal femoral diaphysis was retracted anteriorly using a curved Hohmann retractor. The proximal end of the screw

was identified protruding anteriorly from the femoral head. The lag screw was carefully disengaged and extracted by manual traction using Faure forceps under direct visualization (Fig. 3a and b). Subsequently, after extracting the distal locking screw with dedicated instruments, the intramedullary nail was removed using the lag screw as an extraction aid (Fig. 3d). The femoral head and retrieved hardware are shown in Fig. 3c. Then femoral head removal was performed.

The acetabular medial wall defect was directly visualized to rule out femoral shaft. The procedure was performed by an orthopedic resident. The fracture reduction was judged adequate fluoroscopically at the time of fixation. Post-operative radiographs demonstrated an eccentric placement of the lag screw with a tip-apex distance (TAD) of 35.2 mm (Fig. 1b and c).

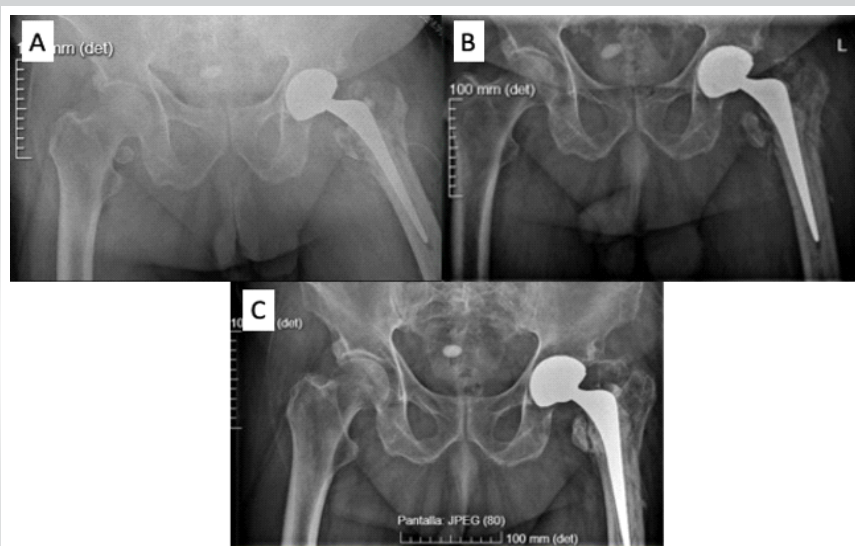
The immediate post-operative period was uneventful. Mobilization with full weight-bearing was initiated on post-operative day 1 using a walker frame under physical therapy supervision. The patient was discharged home on post-operative day 6.

The follow-up radiograph at 10 days postoperatively demonstrated a varus collapse associated with an apparent rotational displacement of the proximal femoral head-neck fragment, causing the lag screw to be superiorly positioned relative to the femoral head (Fig. 1d)

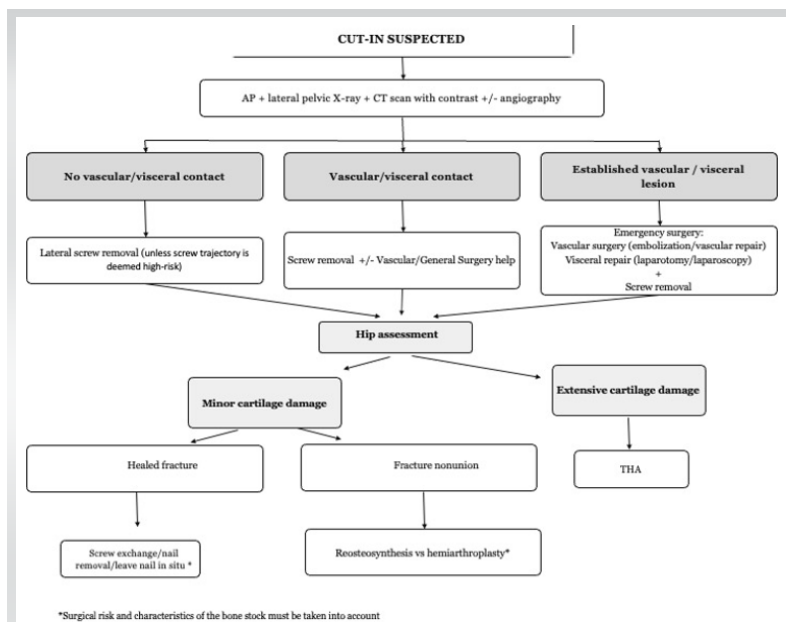
Five weeks after index surgery, the patient was readmitted with severe left inguinal pain with radiation to the ipsilateral knee. Plain radiographs confirmed sudden mechanical failure (Fig. 1e). During readmission, the patient developed acute post-operative delirium with severe agitation. A non-contrast computed tomography (CT) scan of the pelvis was performed 9 days after readmission to evaluate acetabular violation and pelvic

was identified protruding anteriorly from the femoral head. The lag screw was carefully disengaged and extracted by manual traction using Faure forceps under direct visualization (Fig. 3a and b). Subsequently, after extracting the distal locking screw with dedicated instruments, the intramedullary nail was removed using the lag screw as an extraction aid (Fig. 3d). The femoral head and retrieved hardware are shown in Fig. 3c. Then femoral head removal was performed.

The acetabular medial wall defect was directly visualized to rule out



**Figure 4:** Radiological images. (a) Immediate post-operative. (b) 1 month after surgery. (c) 16 months after surgery.



**Figure 5:** Proposed diagnostic and management algorithm for screw cut-in complications following cephalomedullary nailing.

out excessive bleeding and manually palpated following femoral head excision to exclude further intrapelvic damage. Due to the extensive acetabular articular cartilage destruction, conversion to single-stage THA was performed. Acetabular reconstruction was achieved using a 54 mm Trident II cup (Stryker) fitted with a modular dual mobility (MDM) liner. Considering that the bone stock was preserved at the anterosuperior and posteroinferior aspects of the acetabulum and that adequate press-fit of the cup was achieved, no additional fixation screws were used. Femoral reconstruction was completed using a cemented Exeter stem (Stryker) paired with a 28 mm metallic head and a polyethylene insert compatible with the MDM system. Intraoperative stability was assessed using conventional maneuvers and deemed optimal. Transosseous repair of the short external rotators and posterior capsule was completed. The greater trochanter remained inherently stable attached to the femoral shaft, requiring no secondary tension band or cable fixation.

Immediate post-operative radiographs confirmed satisfactory implant positioning (Fig. 4a). The patient tolerated the procedure well and was mobilized with full weight-bearing on post-operative day 1. Discharge home occurred on day 7 post-revision. At the 1-month follow-up, the patient was ambulating independently with a walker and reported complete pain relief. Radiographs at that time showed adequate component positioning (Fig. 4b). At 18 months of follow-up, the patient maintained the same level of ambulation, though reporting mild groin discomfort. Radiographs demonstrated stable components without hardware displacement or trochanteric migration (Fig. 4c).

## Discussion

The classic failure mechanism in cephalomedullary fixation is “cut-out,” defined as varus collapse of the femoral neck with superior-anterior extrusion of the cephalic implant through the femoral head [4]. Major risk factors for cut-out include an increased (TAD >25 mm) and eccentric (non-center/center) placement of the lag screw [4, 5].

Recently, alternative failure patterns have been recognized, such as “cut-in” (superomedial migration of the cephalic element into the pelvis without lateral protrusion) [6,7,8]. Although cut-in is more frequently observed with helical blade devices (e.g., proximal femoral nail antirotation) [8,9], it has also been reported with standard lag screws across various nail designs [10,11,12,13,14,15,16,17,18].

These mechanisms are not mutually exclusive. In our case, serial radiographs demonstrated initial varus collapse and rotational displacement of the head fragment, characteristic of early cut-out. Subsequently, failure of the internal locking set-screw mechanism allowed progressive medial migration of the screw through the osteoporotic bone, completing a cut-in pattern.

We acknowledge several intraoperative technical factors that contributed to failure:

1. Suboptimal initial fracture reduction leaving residual varus alignment.
2. Eccentric screw placement leading to an unacceptable TAD of 35.2 mm.
3. Incomplete engagement of the set-screw locking mechanism.
4. Omission of cement augmentation or helical blade technology in a severely osteoporotic patient.

Furthermore, immediate full weight-bearing in an unstable fracture configuration (AO/OTA 31-A2) accelerates implant migration through toggling and ratcheting effects, as described by Weil et al. [19]. Cyclic varus loading creates a ratchet phenomenon that drives the uncoupled cephalic screw progressively deeper into the pelvis with each gait cycle [19].

We recognize that performing a preoperative CT angiography would have been optimal to accurately evaluate the relationship between the screw tip and the adjacent pelvic vessels.

Intrapelvic screw migration carries substantial morbidity, with reported complications including iliac vessel laceration, bladder perforation, and sigmoid colon perforation [12,18,20]. Emergency removal is imperative when migration is active or when patient agitation increases the risk of organ damage. A multidisciplinary approach involving vascular surgery on standby is strongly recommended [20].

**Table 1: Summary of reported cases of intrapelvic migration of the cephalic screw/helical blade following cephalomedullary nailing of trochanteric femoral fractures**

| Author / Study                     | Age / Sex | Initial Implant         | Time to Failure | Preoperative Imaging Studies              | Revision procedure                                                                                                                 | Clinical Outcome / Follow-up                                        |
|------------------------------------|-----------|-------------------------|-----------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Tauber & Resch (2006)              | 84F       | Short Gamma nail        | 8 weeks         | Serial X-rays +CT scan                    | Lateral screw and nail removal + THA (cemented)                                                                                    | Sigmoid perforation-recovery after prolonged sepsis/General Surgery |
| Flint et al. (2010)                | 82F       | long Gamma nail         | 7 months        | Serial X-rays + CT scan with contrast     | Removal of screw by lateral approach with GT osteotomy,THA (uncemented)                                                            | NR                                                                  |
| Li et al. (2010)                   | 77F       | Short Gamma nail        | 10 weeks        | Serial X-rays                             | Lateral removal + screw exchange by a shorter one + accessory cannulated screw                                                     | cane assisted ambulation at 1 year FU                               |
| Lozano-Alvarez et al (2013) case 1 | 87M       | Long Gamma nail         | 4 months        | NR                                        | Nail removal                                                                                                                       | At 1 year, varus collapse walks with 2 crutches, no pain            |
| Lozano-Alvarez et al (2013) case 2 | 75M       | Short Gamma nail        | 7 months        | NR                                        | Nail removal + THA                                                                                                                 | walks with a walker without pain (no FU time registered)            |
| Takasago et al. (2014)             | 63F       | Short Gamma nail        | 6 weeks         | Serial X-rays + CT scan with contrast     | 2 stages: 1) lateral removal 2) THA (cementless)                                                                                   | walk without aids at 2 years                                        |
| Thein et al. (2014)                | 69F       | Short Gamma nail        | 5.5 weeks       | Serial X-rays + angiography               | Vascular embolization + lateral removal + THA (cemented stem, cementless cup)                                                      | uneventful at 6 weeks                                               |
| Georgiannos et al. (2016) case 1   | 69F       | Short Gamma nail        | 5 months        | Serial X-rays                             | Lateral removal + reosteosynthesis with long Gamma nail                                                                            | Full weight bearing, uneventful at 5 months                         |
| Georgiannos et al. (2016) case 2   | 82F       | Long Gamma nail         | 6 weeks         | Serial X-rays                             | Hardware removal via lateral approach                                                                                              | Complete clinical and radiological union at 4 months                |
| Kim et al. (2019)                  | 83F       | Short DLT nail          | 3 weeks         | Serial X-rays + CT scan with contrast     | 2 stages: 1)hardware removal + spacer 2)hemiarthroplasty                                                                           | walk without aids at 10 months                                      |
| Cavalcante et al. (2020)           | 70F       | Long Gamma nail         | 3 months        | Serial X-rays                             | 2-stages: 1)Exploratory laparoscopy (vascular control) + lateral approach (screw removal), 2)re-osteosynthesis (locked plate + BG) | Fracture union and restoration of ambulation (4 weeks)              |
| Fredj et al. (2022)                | 90F       | Short Gamma nail        | 2 years         | Serial X-rays + angiography               | Lateral removal + hemiarthroplasty (cemented)                                                                                      | NR                                                                  |
| Kuroshima et al. (2021)            | 82M       | Long Gamma nail         | 1 year          | Serial X-rays + CT scan with contrast     | Combined approach: Laparoscopic extraction of lag screw (general surgery) + lateral removal of nail and distal screw (orthopedics) | wheel-chair bound, asymptomatic with non-union at 1 year            |
| Deichsel et al. (2023) case 1      | 92M       | TFNA with helical blade | 72 days         | Serial X-rays                             | THA (cemented cup)                                                                                                                 | NR                                                                  |
| Deichsel et al. (2023) case 2      | 73F       | TFNA with helical blade | 89 days         | Serial X-rays                             | THA (cemented cup)                                                                                                                 | NR                                                                  |
| Deichsel et al. (2023) case 3      | 89F       | TFNA with helical blade | 26 days         | Serial X-rays                             | THA (cemented cup)                                                                                                                 | NR                                                                  |
| Deichsel et al. (2023) case 4      | 87F       | TFNA with helical blade | 92 days         | Serial X-rays                             | THA (cemented cup)                                                                                                                 | NR                                                                  |
| Mousati et al. (2023)              | 68F       | Short Gamma nail        | 4 weeks         | Serial X-rays + CT scan with contrast     | lateral screw and nail removal with vascular assistance (prophylactic catheterization) +THA (cemented cup + BG, uncemented stem)   | NR                                                                  |
| Nabiyev et al. (2024)              | 70M       | Short Gamma nail        | 8 months        | Serial X-rays + MRI / CT (Bladder injury) | Urology (removal of screw + bladder repair) + lateral removal of                                                                   | walk without aids at 5 weeks                                        |
| Price et al. (2025)                | 85M       | Short TFNA nail         | 4 weeks         | Serial X-rays + CT scan + CT angiography  | 1-failed laparotomy, 2-succesful removal by laparotomy with vascular support                                                       | THA declined. fracture union at 4 months, ambulation with walker    |

**GT: Greater trochanter; DLT: Dyna Locking Trochanteric; BG: Bone graft; NR: Not reported; FU: Follow-up.**

While two-stage procedures or isolated hardware removal have been described [15,16,21,22,23], single-stage revision to THA using dual-mobility bearing surfaces may provides definitive management. Dual mobility minimizes the risk of instability in elderly patients with soft-tissue compromise, and may allow immediate weight-bearing and early restoration of functional independence. Table 1 summarizes the literature review [9,10,11,12,13,14,15,16,17,18,24,25,26,27,28], and Fig. 5 shows the proposed algorithm for the decision-making process.

### Conclusion

Intrapelvic migration of a cephalic screw is a rare but hazardous complication of trochanteric fracture fixation. Careful surgical technique, proper TAD reduction, and correct set-screw

engagement are critical to preventing failure. When migration occurs, prompt hardware retrieval with single-stage conversion to dual-mobility THA may be a reasonable salvage option in selected frail elderly patients.

### Clinical Message

Vigilant clinical and radiological follow-up is essential after intramedullary fixation of trochanteric fractures. Medial migration of cephalic hardware requires urgent multidisciplinary surgical planning – with vascular surgery standby – to avoid catastrophic intrapelvic visceral or vascular injury. Single-stage conversion to total hip arthroplasty may provide immediate stability and permit early full weight-bearing in frail orthogeriatric patients.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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