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(CASE REPORT)

Management of a rare case of trifocal femoral fracture associated with central hip dislocation

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Abstract

We report the unprecedented case of a patient presenting with a trifocal femoral fracture associated with a central hip dislocation resulting from high-energy trauma. This combination of injuries, never described before in the literature, highlights the complexity of combined trauma. Management required surgical reduction and internal fixation, followed by progressive rehabilitation. This case underscores the diagnostic and therapeutic challenges associated with these rare injuries and emphasizes the importance of a multidisciplinary approach to optimize functional outcomes.

Keywords: trifocal fracture; central dislocation ; femur; high energy trauma; internal fixation.

1. Introduction

Isolated femoral shaft fractures are relatively common injuries with an estimated annual incidence of 10 per 100,000 person-years [1]. Multifocal femoral fractures are less frequent, with an additional proximal femoral fracture estimated to occur in up to 5% of diaphyseal fractures [2] and an additional distal femoral fracture occurring in 3-4% of cases [3]. Trifocal femoral fractures, consisting of ipsilateral proximal, diaphyseal, and distal femoral fractures, are extremely rare. This injury pattern was first reported by Käch in 1993 [4]. These injuries result from high-energy mechanisms, often following high-speed road traffic collisions. Due to the rarity of such injuries and the heterogeneity of fracture patterns, there is minimal consensus on their optimal management. We present a case of trifocal femoral fracture associated with a central hip dislocation, a combination never described in the literature.

2. Case Report

A 51-year-old patient with a history of chronic smoking (20 pack-years) was involved in a helmeted motorcycle road traffic accident, struck by a car, resulting in a closed trauma to the right lower limb.

On initial clinical examination, the patient was conscious, without signs of shock or fat embolism. The right lower limb was deformed, presenting in external rotation, abduction, and shortening, with bruising on the lateral aspect of the thigh. The area was tender upon palpation and minimally movable, without vascular or neurological deficits .

The radiological assessment revealed a trifocal femoral fracture with a proximal basi-cervical fracture line and an intertrochanteric fracture line, in addition to a mid-diaphyseal fracture detaching a third fragment, all associated with a central hip dislocation due to a transverse fracture of the acetabulum (Figures 1-2).

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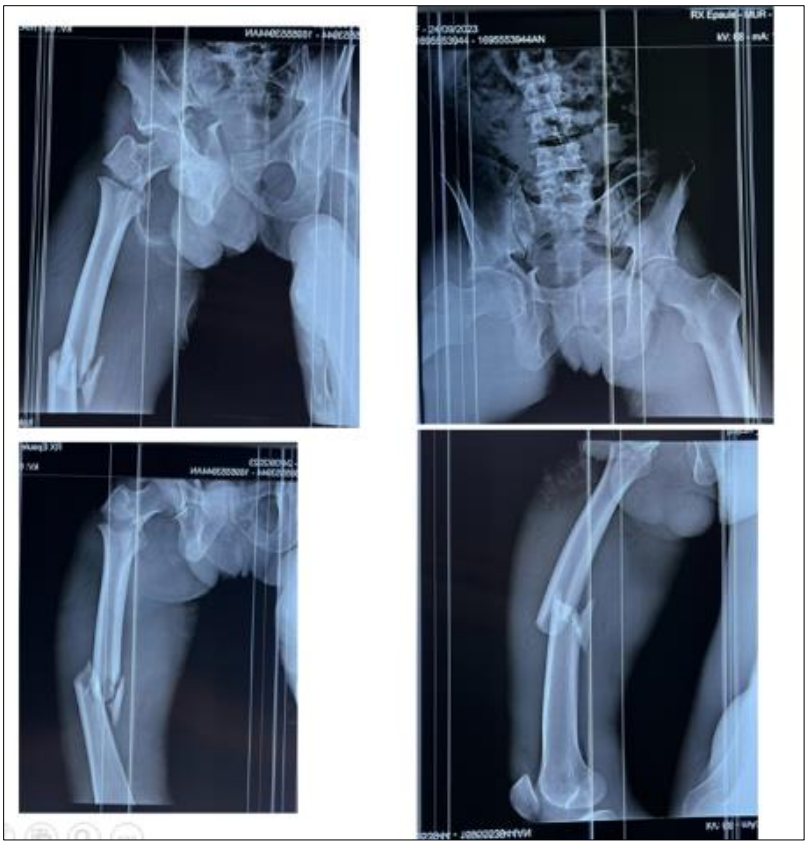

Figure 1 Central hip dislocation, transverse acetabular fracture, trifocal femoral fracture

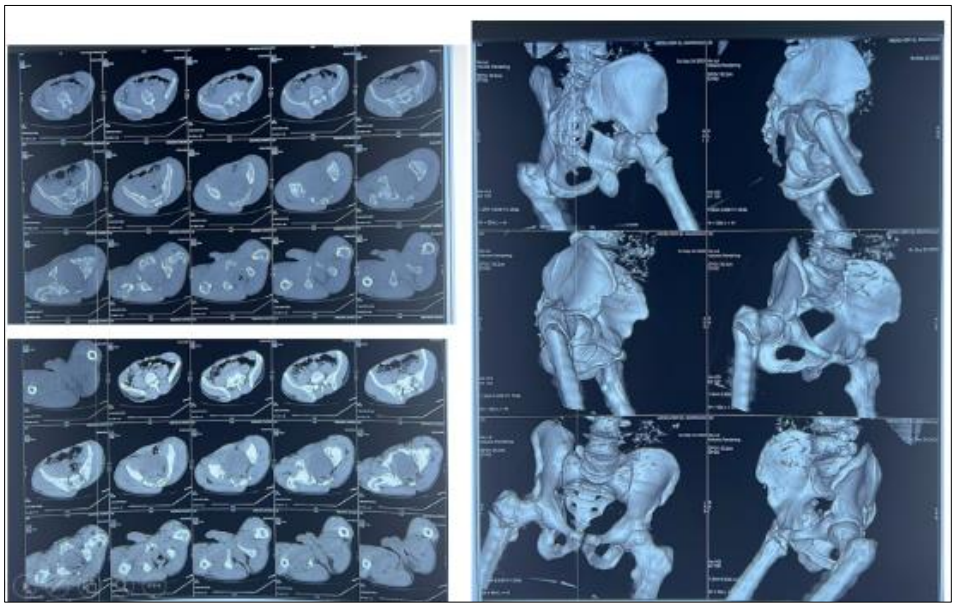

Figure 2 CT scan with 3D reconstruction: juxtacetabular transverse fracture of the acetabulum with central dislocation of the femoral head

The surgery consisted, initially, of a Kocher-Langenbeck approach, during which we performed osteosynthesis of the acetabular fracture after reduction of the central hip dislocation using a reconstruction plate. In the second stage, we performed femoral osteosynthesis with a long gamma nail using closed reduction under fluoroscopic control (Figure 3).

Figure 3 Postoperative radiological assessment

2.1. Postoperative Care and Recovery

Weight-bearing was delayed until the 45th day, and the progression was marked by radiological consolidation of the fracture sites, with the patient gradually regaining functional ability after 120 days.

3. Discussion

The trifocal femoral fracture associated with a central hip dislocation represents an exceptional clinical entity, never before described in the medical literature to our knowledge. A trifocal femoral fracture, defined by the presence of three fracture segments along the femoral axis, is a rare manifestation typically linked to high-energy trauma, such as road traffic accidents or falls from great heights. This already complex condition is further complicated by a central hip dislocation, characterized by the medial migration of the femoral head through the acetabular roof, indicating major joint instability and severe intra-articular injury. The combination of these two entities significantly increases diagnostic and therapeutic complexity, requiring a multidisciplinary approach. This combination of injuries, due to its unusual nature and serious functional implications, deserves to be reported to enrich existing knowledge on the management of complex polytrauma.

The association of a central hip dislocation with a femoral neck or diaphyseal fracture remains a rare presentation, although reported in cases of high-energy trauma. Central hip dislocation, resulting from axial impact on the femoral head forcing it through the acetabular roof, is frequently associated with complex pelvic fractures. When it coexists with a diaphyseal or femoral neck fracture, this association reflects the intensity of the initial trauma. Previous studies have highlighted that these injuries predominantly occur in young, active patients, particularly in the context of road accidents or falls from great heights (Canale et al., 2013; Judet et al., 1964) [5].

The underlying mechanism may include a direct transmission of force through the femoral axis in a specific position of the hip, usually in flexion or adduction, leading to a central dislocation. When a neck fracture is associated, it may result from additional stress on an already compromised structure, while a diaphyseal fracture suggests an overlaid torsional or shear force (Letournel and Judet, 1993) [6]. The literature reports few specific data on the incidence of these associations, likely due to their rarity and the heterogeneity of the traumatic contexts. However, their identification is crucial in clinical practice, as the coexistence of these injuries significantly alters the therapeutic strategy and functional prognosis [7].

Operative treatment of central acetabular fractures includes conservative treatment with skeletal traction, open reduction with internal fixation, and total hip arthroplasty. Hip arthroplasty with acetabular fracture fixation is useful in elderly patients due to the high risk of avascular necrosis [8].

Prabakhar et al. (2018) proposed the case of a central hip dislocation and displaced femoral neck fractures, treated with multiple cannulated screws, which resulted in an unsatisfactory outcome. Post-operation, the patient progressively experienced increased pain while walking, and serial radiographs taken at three and four months showed progressive hardware failure and fracture displacement, despite callus formation and the absence of signs of avascular necrosis of the femoral head [9].

Meinhard et al. reported a case of intra-pelvic femoral head dislocation through a central acetabular fracture in a 27-year-old man following a high-energy motorcycle accident. The authors performed a posterior-lateral approach and were able to release the femoral head and neck through the acetabular fracture. Surprisingly, no fracture lines were found, either anteriorly or posteriorly in the dome. A vascularized muscle-bone pedicled graft was harvested from the greater trochanter and rigidly fixed in the superimposed defect of the neck using two screws. The femoral neck fracture was fixed using four partially threaded screws. After two years of follow-up, the patient had resumed all activities without pain, and radiographs showed preserved joint space without signs of femoral head necrosis [5].

Trifocal femoral fractures are difficult to manage as the surgical techniques and implants used to treat one of the three fractures may compromise the optimal management of the others [10]. Basic principles suggest that a distal intra-articular fracture should be treated with anatomical reduction and rigid fixation, providing absolute stability [11]. A proximal intracapsular fracture in a young patient also requires anatomical reduction for an optimal result [11]. Extracapsular proximal femoral fractures can be fixed with relative stability, as can diaphyseal fractures [12, 13]. There is a wide range of surgical techniques that can ensure stability and proper fixation for each of the fractures, but the difficulty lies in combining techniques to achieve optimal fixation for all three fractures [10]. Previous reports have agreed that it is appropriate to use only two implants, with the diaphyseal fracture stabilized along with the proximal or distal fracture [10, 14].

Due to the rarity of trifocal fractures and the heterogeneity of fracture configurations, there is no consensus in the literature on which implants should be used or the order in which stabilization should occur [15]. The literature strongly suggests an individualized approach to treating these injuries, as the heterogeneity of fracture configurations means treatment must be tailored to the individual fracture patterns [10, 14]. Priority should be given to injuries associated with more severe outcomes if left untreated or poorly reduced [10].

Several techniques have been described for treating the proximal component of trifocal fractures, including the use of cannulated screws, DHS, and intramedullary nails for the hip [10, 15]. Previously described techniques for managing distal fractures included retrograde intramedullary nailing for AO/ASIF type A extra-articular fractures [10], cannulated screws for type B fractures [14], and 95° blade plates for type C fractures [15].

We describe a combination of treatment for the trifocal femoral fracture using a long gamma nail, with reduction and fixation of the acetabular fracture using a reconstruction plate. Both cases were followed for up to 2.5 years and showed complete union without significant complications. To our knowledge, this combination of implants has never been described in the literature.

4. Conclusion

The central hip dislocation associated with a trifocal femoral fracture is a unique case. This clinical case, combining a trifocal femoral fracture with a central hip dislocation, constitutes an unprecedented entity in the medical literature. It illustrates the complexity of high-energy trauma, where the interaction between bone and joint injuries creates major diagnostic and therapeutic challenges. The rarity of this association highlights the need for a multidisciplinary approach and rigorous planning to optimize management and functional outcomes.

This case also underscores the importance of rigorous documentation and sharing of clinical experiences to enrich scientific knowledge and guide future therapeutic strategies. By reporting this previously unrecognized entity, we hope to pave the way for better recognition of complex combined trauma and encourage future studies to improve the management of these rare but severe situations.

Compliance with ethical standard

Conflict of interest statement

All the authors disclose any conflicts of interest

Statement of ethical approval

Ethical approval was obtained

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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