



International Journal of Case Reports in Orthopaedics

E-ISSN: 2707-8353
P-ISSN: 2707-8345
IJCRO 2024; 6(2): 01-06
www.orthocasereports.com
Received: 07-06-2024
Accepted: 08-07-2024

João Carvalho E Cruz
Orthopaedics and Traumatology,
Hospital do Divino Espírito
Santo, Ponta Delgada, Portugal

Rute Pereira
Orthopaedics and Traumatology
Department, Hospital do Divino
Espírito Santo, Ponta Delgada,
Portugal

Joana Rodrigues
Orthopaedics and Traumatology
Department, Hospital do Divino
Espírito Santo, Ponta Delgada,
Portugal

Tiago Canas
Orthopaedics and Traumatology
Department, Hospital do Divino
Espírito Santo, Ponta Delgada,
Portugal

Raquel Branco
Physical Medicine and
Rehabilitation Department
Hospital do Divino Espírito
Santo, Ponta Delgada, Portugal

Cláudio Garcia
Orthopaedics and Traumatology
Department, Hospital do Divino
Espírito Santo, Ponta Delgada,
Portugal

Renato Soares
Orthopaedics and Traumatology
Department, Hospital do Divino
Espírito Santo, Ponta Delgada,
Portugal

António Rebelo
Orthopaedics and Traumatology
Department, Hospital do Divino
Espírito Santo, Ponta Delgada,
Portugal

Dr. André Cunha
Orthopaedics and Traumatology
Department, Hospital do Divino
Espírito Santo, Ponta Delgada,
Portugal

Corresponding Author:
João Carvalho E Cruz
Orthopaedics and Traumatology,
Hospital do Divino Espírito
Santo, Ponta Delgada, Portugal

Open pelvic ring fracture with floating hip and knee: A case report

**João Carvalho E Cruz, Rute Pereira, Joana Rodrigues, Tiago Canas,
Raquel Branco, Cláudio Garcia, Renato Soares, António Rebelo and Dr.
André Cunha**

DOI: <https://doi.org/10.22271/27078345.2024.v6.i2a.211>

Abstract

Open pelvic ring fractures are rare injuries typically resulting from high-energy trauma, often leading to significant morbimortality. The simultaneous occurrence of an ipsilateral floating hip and knee is rare, with no prior reports in literature of all three conditions coexisting. These are prone to severe complications due to the rich blood supply in the pelvis and femur, causing substantial blood loss and potentially leading to traumatic shock, retroperitoneal haematoma, and organs damage. Despite classification systems for these injuries and established treatment protocols for individual fractures, their collective occurrence presents significant clinical challenges. This report discusses a polytrauma case featuring an open pelvic fracture with floating hip and knee.

A 22-year-old obese male with no significant medical history was involved in a high-energy motorcycle accident. In the emergency room, he was conscious but agitated and had stable vitals. He had a significant wound in the left inguino-scrotal-perineal region and right lower limb deformity. Diagnostic imaging revealed a complex pelvic ring fracture, a segmental fracture of the right femoral shaft, and an open fracture of the right leg. A damage control strategy was started, with reduction and stabilization of the pelvic and lower limb fractures. The patient underwent multiple surgical procedures, including external fixation and intramedullary nailing. Postoperatively, he was stable and transferred to the Intensive Care Unit. The evolution was good, and he was discharged on the 36th postoperative day. At 12 months post-op, he displayed full functionality, no pain, and no neurovascular or genito-urinary impairments.

These injuries are uncommon. Stabilizing with an external fixator over a C-clamp may yield better outcomes for Tile B1 fractures. Excessive resuscitation can exacerbate hypothermia and systemic inflammatory response, leading to multiple organ dysfunction or infections. Damage Control focuses on preventing additional surgical harm, emphasizing timely stabilization and nutritional support for recovery.

Keywords: Open fracture, pelvic ring, floating hip, floating knee, mortality, outcomes

Introduction

Open fractures of the pelvic ring are a rare injury type resulting from high-energy trauma.^[1, 2] A floating hip is also a rare occurrence, and the presence of both conditions is associated with a high morbidity and mortality rate^[3]. The coexistence of an ipsilateral floating hip and knee is an exceedingly rare occurrence^[4], and the concomitant presence of all three conditions has not been reported in the literature.

The abundant blood supply of the pelvis or acetabulum and femur predisposes these structures to significant blood loss and serious complications following fracture. These include traumatic shock, retroperitoneal haematoma, urinary system injury, and abdominal organ damage, which can result in death or disability^[3, 5].

In 1997, Jones and Powell proposed a classification system for open pelvic ring fractures, comprising three classes: Class 1, characterised by a stable pelvic ring; class 2, defined by an unstable pelvic ring without rectal or perineal injury; and class 3, which encompasses unstable pelvic rings with rectal or perineal injury^[1].

In 1992, Liebergall described two types of floating hip: Type A, which is a pelvic ring fracture with an ipsilateral femoral fracture; and Type B, which is an ipsilateral acetabular and femoral fracture^[6].

In 1975, Blake and McBryde described two types of floating knee: Type 1, an extra-articular femoral and tibial fracture and type 2, a femoral and/or tibial fracture with articular extension to the knee [7].

Although there are established protocols for the treatment of specific types of fractures, such as pelvic ring, femur and tibia fractures, the rarity of combining these types of fractures and the high rate of complications associated with them make it a challenging clinical situation [3].

Here we present a polytrauma case with an open complex pelvic fracture with floating hip and knee injury.

Case report

A 22-year-old obese male, with no other significant medical history and no known drug allergies, was involved in a high-energy motorbike accident, colliding with a car and being thrown. Upon arrival at the emergency room, the patient was assessed and treated according to the Advanced Trauma Life Support (ATLS) protocol. He was found to be conscious and oriented, but exhibited signs of agitation and uncooperativeness. The patient exhibited a permeable airway, was haemodynamically stable (blood pressure 128/75 mmHg, heart rate 100 bpm, normopneic with a respiratory rate of 20 cpm), and had a revised trauma score (RTS) of 12.



Fig 1: Extensive wound in the left inguino-scroto-perineal region with active bleeding.



Fig 2: Right lower limb deformity with right leg open fracture



Fig 3: CT-scan axial cut of the diastasis of the pubic symphysis and evidence of communication with external environment



Fig 4: CT-scan coronal cut of the anterior diastasis of the right sacroiliac joint and left ala of the sacrum aligned fracture

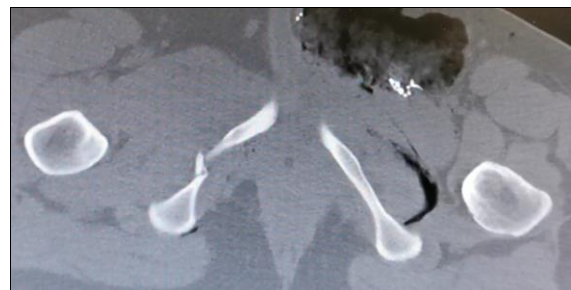


Fig 5: CT-scan axial cut of the right ischiopubic ramus fracture

The patient also presented with an extensive wound in the left inguino-scroto-perineal region with active bleeding (Figure 1), which was controlled with local compression. Additionally, the patient exhibited a deformity of the right lower limb with palpable and ample posterior tibial and pedal pulses (Figure 2).

The results of the analysis indicated a haemoglobin concentration of 12.5 g/dL and lactate levels of 4 mmol/L. Intravenous antibiotic therapy with 2 g of cefazolin and fluid therapy were initiated. The E-FAST examination in the emergency room excluded the presence of haemothorax and haemoperitoneum.

Following the acquisition of X-ray and CT scan data, the patient was diagnosed with complex open fracture of the pelvic ring, characterised by diastasis of the pubic symphysis, diastasis of the right sacroiliac joint, and aligned fractures of the sacrum on the left and right ischiopubic ramus (Figure 3-5). These injuries were classified as Tile B1, Jones & Powell class 3 and Gustilo-Anderson (GA) type 3A. The findings also included a segmental and comminuted fracture of the right femoral shaft (AO 32C3, Liebergall type A floating hip), (Figure 6), and an open fracture of the right leg bones (AO 42A2, 4F2A, GA type 2) (Figure 7).



Fig 6: X-ray of the right diaphyseal femur fracture



Fig 7: X-ray of the right leg bones fracture

Given the patient's haemodynamic instability and active bleeding, a multidisciplinary team (comprising Orthopaedics, General Surgery, Vascular Surgery and Plastic Surgery specialities) proceeded to perform a damage control strategy. This entailed reduction of the pubic symphysis, with the subsequent placement of a C-clamp and transarticular osteotaxis of the right lower limb. The area of exposure on the leg was meticulously washed and disinfected. The inguino-scroto-perineal wound, which exhibited no evidence of damage to the femoral vessels, was subjected to a thorough cleansing, debridement, and haemostatic control procedures, after which it was closed using a skin flap.

Given the patient's haemodynamic instability and active bleeding, a multidisciplinary team (comprising Orthopaedics, General Surgery, Vascular Surgery and Plastic Surgery specialities) proceeded to perform a damage control strategy, which involved reduction of the pubic symphysis with a C-clamp and transarticular osteotaxis of the right lower limb (Figure 8-10). The area of exposure on the leg was meticulously washed and disinfected. The inguino-scroto-perineal wound, which exhibited no evidence of damage to the femoral vessels, presented with a testicular haematoma. The subsequent surgical procedure involved orchidopexy, abundant washing, debridement, myorrhaphy of the long adductor, haemostasis and closure of the wound using a skin flap.

The patient was transferred to the Intensive Care Unit for continued observation. On the second postoperative day, due to the loss of fixation of the C-clamp pins, the pelvic ring was stabilised with external fixators and definitive fixation of the right sacroiliac diastasis (Figure 11-12) was carried out using a percutaneous ilio-sacral screw.



Fig 8: X-ray of the pubic symphysis and right sacroiliac joint reduction and stabilization with C-clamp



Fig 9: X-ray of the right lower limb transarticular osteotaxis



Fig 10: X-ray of the right lower limb transarticular osteotaxis



Fig 11: X-ray of the pelvic ring after external fixation with iliac crest pins and right sacroiliac joint fixation with ilio-sacral screw



Fig 12: CT scan axial cut of the right ilio-sacral screw

Following a favourable postoperative course with stable haemodynamics, closed reduction and retrograde intramedullary nailing of the femur and antegrade

intramedullary nailing of the tibia were performed on the 12th postoperative day (Figure 13).



Fig 13: Postoperative X-rays of the right femur retrograde and tibia antegrade intramedullary nailings.



Fig 14: X-rays of the right femur and tibia fractures showing signs of consolidation

Due to a dehiscence of the inguinal wound and the necessity for plastic surgery dressings, it was not feasible to perform osteosynthesis of the pubic symphysis. Consequently, external fixation was selected as the definitive treatment.

The patient's clinical condition showed a favourable evolution during the course of his hospitalisation, and he was discharged on the 36th postoperative day for an orthopedic outpatient consultation and an intensive rehabilitation programme conducted by the department of physical medicine and rehabilitation.

At 11 weeks post-operative, the external fixators were removed, the patient proceeded with the rehabilitation programme and the X-rays revealed evidence of fracture in the process of consolidation (Figure 14).

At 12 months post-operative, the patient exhibited no pain (VAS of 0), a LEFS (lower extremity functional score) of 97.5/100, the ability to ambulate with a full load without support, the absence of neurovascular or genito-urinary lesions, and the presence of good lower limb muscle trophism with bilateral polysegmental muscle strength on the MRC scale of 5/5.

Discussion and Conclusion

To our knowledge, there's no report of a case with a open complex pelvic fracture with ipsilateral floating hip and knee.

In our patient, following the onset of haemodynamic instability, our patient could have been initially stabilized with a pelvic binder and in the operating room, stabilization could have been achieved with an external fixator in place of the C-clamp, as it is a more stable alternative and allows for better reduction in Tile type B1 fractures^[8].

Excessive resuscitation can dilute blood coagulation factors, worsening hypothermia. Traumatic shock and hypotension may trigger a systemic inflammatory response (SIRS) that can lead to multiple organ dysfunction syndrome if overly strong, or infections if insufficient^[9, 10]. The damage control strategy in orthopedics aims to prevent further injury from surgical procedures, known as the second hit, and emphasizes advanced life-saving interventions. Once hemorrhage is controlled and the patient is stable, aggressive wound debridement and irrigation should be performed, with definitive fixation reserved for stable periods. Nutritional support is crucial to ensure adequate blood volume and protein supply for recovery^[9, 10].

A systematic approach based on the principle of damage control can achieve favourable outcomes. However, open fractures of the pelvic ring in conjunction with other floating joints are the consequence of high-energy trauma. It is therefore imperative that an interdisciplinary assessment is conducted to rule out injuries caused by traumatic injury to the head, chest and abdomen. This will ensure that the

patient is stabilized hemodynamically at the earliest opportunity.

Acknowledgments

None declared. The authors report no conflicts of interest.

References

1. Roszman AD, John DQ, Patch DA, Spitler CA, Johnson JP. Management of open pelvic ring injuries. *Injury*. 2023 Feb;54:250-257.
2. Giordano V, Koch HA, Gasparini S, Serrão de Souza F, Labronici PJ, do Amaral NP. Open pelvic fractures: Review of 30 cases. *The Open Orthopaedics Journal*. 2016 Dec 30;10(1):772-778.
3. Yang Y, Peng Y, Yu B. Management of floating hip injury: A review of the literature. *EFORT Open Rev*. 2024 Mar 1;9(3):150-159.
4. Benannoubha A, Boussouga M, Fjouji S, Lamkhanter A, Jaafar A. Simultaneous ipsilateral floating hip and knee: A complex combination and difficult surgical challenge. *Case Rep Orthop*. 2020 Feb;2020:1-5.
5. Mi M, Kanakaris NK, Wu X, Giannoudis PV. Management and outcomes of open pelvic fractures: An update. *Injury [Internet]*. 2020 Feb 21;52(10):1947-1956.
6. Liebergall M, Lowe J, Whitelaw G, Wetzler M, Segal D. The floating hip. Ipsilateral pelvic and femoral fractures. *J Bone Joint Surg Br*. 1992 Jan;74-B(1):93-100.
7. Vives J, Bel JC, Agundez AC, Rodríguez F, Palomo Traver J, Schultz-Larsen M, *et al*. The floating knee: A review on ipsilateral femoral and tibial fractures. *EFORT Open Rev*. 2016 Nov 1;1(11):375-382.
8. Lerner A, Fodor L, Keren Y, Horesh Z, Soudry M. External fixation for temporary stabilization and wound management of an open pelvic ring injury with extensive soft tissue damage: Case report and review of the literature. *J Trauma*. 2008 Sep;65(3):715-718.
9. Zhou Y, Guo H, Cai Z, Zhang Y. Complex pelvic ring injuries associated with floating knee in a poly-trauma patient. *Medicine*. 2017 Dec, 96(48).
10. Watkins RJ, Hsu JM. The road to survival for haemodynamically unstable patients with open pelvic fractures. *Front Surg*. 2020 Sep 2;7:58.

How to Cite This Article

Cruz JCE, Pereira R, Rodrigues J, Canas T, Branco R, Garcia C, *et al*. Open pelvic ring fracture with floating hip and knee: A case report. *International Journal of Case Reports in Orthopaedics* 2024;6(2):01-06.

Creative Commons (CC) License

This is an open-access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.