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Case Report

Staged management of a Tile C3 pelvic ring injury with bilateral sacroiliac disruption and T-shaped sacral fracture

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ABSTRACT

We present the case of a 16-year-old female polytrauma patient who sustained a rare and highly unstable pelvic ring injury following a high-energy motor vehicle collision with partial ejection. The injury pattern was classified as Tile C3, combining a right anterior crescent-type fracture with anterior sacroiliac (SI) joint dislocation, a left-sided Denis II sacral fracture, a distal T-shaped sacral fracture, and bilateral pubic rami fractures. Neurological deficits included right L5 and left S1–S2 involvement.

Initial management adhered to damage control principles, including pelvic binder application, preperitoneal packing, and temporary external fixation. Due to cranial migration of the right hemipelvis and neurovascular compression, urgent anterior open reduction and SI joint plating were performed via an ilioinguinal approach. Definitive fixation, performed on day five, included percutaneous dual iliosacral screws for the Denis II fracture and bilateral retrograde pubic ramus screws, while the distal T-shaped sacral fracture was treated conservatively.

The patient achieved stable fixation without implant failure, enabling early mobilization. At 12 months, radiographs demonstrated consolidation of the pelvic ring injuries with maintained alignment and no implant failure. She walked independently with an ankle-foot orthosis for persistent right foot drop, although residual L5–S1 motor weakness and altered reflexes persisted. Functional scores demonstrated marked recovery (Majeed 70/80; Iowa 85/100).

This case highlights the importance of individualized, staged surgical strategies in managing complex pelvic fractures with combined rotational and vertical instability, especially in the presence of neurological injury and visceral trauma.

Introduction

Pelvic ring fractures are relatively uncommon, accounting for only 1–4% of all fractures, yet they are among the most challenging injuries to manage due to their association with high-energy trauma, complex biomechanics, and life-threatening complications [2,4,5]. Their incidence ranges from 3.8 to 4.6 per 100,000 inhabitants, but they are present in up to 20% of polytrauma patients admitted to major trauma centers [4,5]. Among these, unstable fracture patterns—classified as Tile type B and C or Young–Burgess LC II–III, APC II–III, and vertical shear (VS)—are linked to significantly higher rates of morbidity, mortality, and neurological deficits [6,9–11]. Mortality can reach 21% in open or hemodynamically unstable cases [6], with early deaths often due to uncontrolled

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hemorrhage. Thus, immediate mechanical stabilization and damage control strategies such as preperitoneal packing and angioembolization are crucial [2,7].

The complexity of pelvic trauma increases when multiple fracture patterns coexist within the same injury, particularly when rotational and vertical instabilities are present simultaneously. Crescent fracture-dislocations, typically seen in LC-type injuries, are classically rotationally unstable but vertically stable [19,20]. However, atypical variants with anterior translation of the iliac segment can result in vertical shear and neurovascular compression, further complicating management [13,14]. Moreover, sacral fractures—especially those involving Denis zone II—carry a high risk of lumbosacral plexus injury, particularly to the L5 and S1 nerve roots, which lie in close proximity to the sacroiliac joint [8,12].

Herein, we present the case of a 16-year-old polytraumatized patient with a highly unstable Tile C3 pelvic ring injury, combining a right-sided anterior crescent fracture-dislocation with left-sided Denis II sacral fracture, a distal T-shaped sacral fracture, and bilateral pubic rami fractures. This rare combination of high-energy mechanisms posed significant diagnostic and surgical challenges, which were addressed through a staged and individualized management strategy.

Case presentation

A 16-year-old previously healthy female presented to the emergency department after sustaining high-energy polytrauma from a motor vehicle rollover with partial ejection (~6 m) as a front-seat passenger. On arrival, she was hypotensive (BP 88/55 mmHg), tachycardic (HR 125 bpm), tachypneic (RR >35), and somnolent (GCS 13/15), with weak distal pulses and signs of hypoperfusion. The primary survey was completed per ATLS protocol, and initial management included peripheral IV access, fluid resuscitation, and transfusion of 3 units of red blood cells and 1 unit of fresh frozen plasma.

Initial labs revealed leukocytosis (19.2 K/μL), neutrophilia (80.3%), coagulopathy (TTP 48.6 s, INR 1.24), and acidosis (BE −7.2 mmol/L). Liver enzymes were markedly elevated (AST 3080 U/L, ALT 1248 U/L), suggesting hepatic injury. Hematuria (++++) with >1500 RBC/hpf was noted. Her trauma scores were calculated as follows: Injury Severity Score (ISS) 33, Revised Trauma Score (RTS) 7.84, and TRISS (Trauma and Injury Severity Score) 4.17%, indicating severe trauma with high mortality risk.

On focused physical examination, the patient presented with marked tenderness and palpable instability over the anterior pelvic ring. Gentle compression of the iliac crests revealed rotational and vertical instability, more pronounced on the right side, with clinical suspicion of pubic symphysis diastasis. There was no open pelvic wound. Neurologically, the patient exhibited complete motor and sensory deficit in the L5 dermatome and myotome distribution on the right lower limb, including foot dorsiflexion and sensation over the dorsum of the foot. Notably, rectal tone was preserved, suggesting sparing of the S2–S4 roots and the pudendal plexus. These findings were strongly suggestive of a vertically unstable pelvic ring injury with associated lumbosacral trunk compression.

Imaging studies confirmed a complex spectrum of traumatic injuries:

- **Cranial**: No acute traumatic lesions or midline deviation.
- **Thoracic**: Fractures of right ribs 8–11, laminar pneumothorax, subcutaneous emphysema, and passive atelectasis.
- **Abdominal**: Grade II hepatic and splenic lacerations, ~205 cc of perisplenic, perirenal, interloop, and pelvic free fluid.
- **Renal/Genitourinary**: Grade IV right renal injury with perirenal fluid and gross hematuria.
- **Spinal**: Fractures of L3–L5 spinous processes (AO type 0) and S1 posterior elements (lamina and pars), without vertebral instability.

Orthopedic injuries included a complex pelvic fracture classified as **Tile C3**, **Young–Burgess LC III**, and **AO/OTA 61C3.3**, with

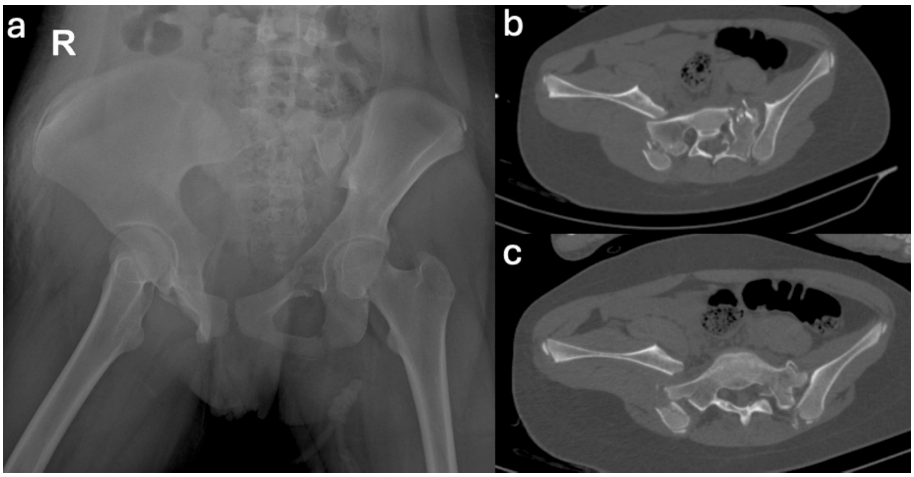

Fig. 1. Complex pelvic fracture classified as Tile C3, Young–Burgess LC III, and AO/OTA 61C3.3. (a) Anteroposterior pelvic radiograph. (b–c) Axial CT scans at the S1(b) and S2 (c) level illustrating the following injuries: a right anterior crescent-type fracture with anterior sacroiliac (SI) joint dislocation, a left-sided simple SI joint dislocation, and a vertically oriented sacral fracture (Denis II).

bilateral vertical shear forces (Fig. 1). Specific findings included bilateral iliopubic and ischiopubic ramus fractures, a right anterior crescent-type fracture with anterior sacroiliac (SI) dislocation, a left-sided simple SI dislocation, and a vertically oriented sacral fracture (Denis II) combined with a transverse component at S2–S4, forming a characteristic T-type sacral fracture. (Fig. 1–2).

This case report was prepared in accordance with the CARE (CAse REport) guidelines to ensure a structured and clinically relevant presentation of the case [1].

Surgical technique

First stage – damage control surgery

Due to the patient's hemodynamic instability and metabolic acidosis on admission (pH 7.21, lactate 4.2 mmol/L), as well as the presence of a retroperitoneal hematoma near the right sacroiliac joint and liver injury (Grade II), the decision was made to perform damage control surgery in supine position, as placing the patient prone was contraindicated by the pediatric surgery team.

Initial attempts at percutaneous supra-acetabular external fixation failed to achieve adequate reduction of the right hemipelvis due to persistent vertical and rotational instability. Therefore, a limited anterior approach was performed using the first window of the Letournel ilioinguinal approach, allowing access to the anterior sacroiliac joint and pelvic brim.

After identification and protection of key anatomical structures (femoral vessels, femoral nerve, lateral femoral cutaneous nerve, and round ligament), dissection proceeded to expose the internal iliac fossa and sacral ala. The L5 nerve root and lumbosacral trunk were found to be contused and compressed by a hematoma in the iliopsoas region, correlating with the neurological deficits identified on initial physical examination.

A laminar spreader was used to distract the right SI joint. The joint was irrigated, and fibrous tissue was debrided. A Schanz pin was inserted percutaneously into the right iliac crest and used as a joystick to aid reduction. Once satisfactory alignment was achieved, two contoured 3.5 mm reconstruction plates were placed across the anterior sacroiliac joint using compression technique, with screws in the sacrum and ilium. Final fluoroscopic views (AP, inlet, outlet) confirmed anatomical alignment and hardware positioning. (Fig. 3).

A supra-acetabular Schanz pin was inserted on the left side, and bilateral external fixation was completed for temporary stabilization. The retroperitoneal hematoma was packed with surgical sponges for tamponade. No suction drains were placed. The surgical site was closed in layers. The patient was returned to the ICU for further stabilization.

Second stage – definitive fixation (day 5)

After four days in the ICU, the patient achieved hemodynamic and metabolic stability, meeting criteria within the “safe definitive surgery window” for polytrauma. On day five post-injury, definitive fixation was planned and executed.

The patient was positioned in prone decubitus under continued hemodynamic monitoring. Through the first and third windows of a left-sided ilioinguinal approach, a Denis II sacral fracture with anterior SI dislocation was accessed. The L5 and S1 nerve roots were carefully decompressed and desimpacted. Percutaneous placement of two fully threaded 7.0 mm cannulated SI screws was performed under fluoroscopic control (AP, inlet, outlet, obturator oblique views), targeting S1 and S2 corridors. Screws were placed without interfragmentary compression due to the neurological injury.

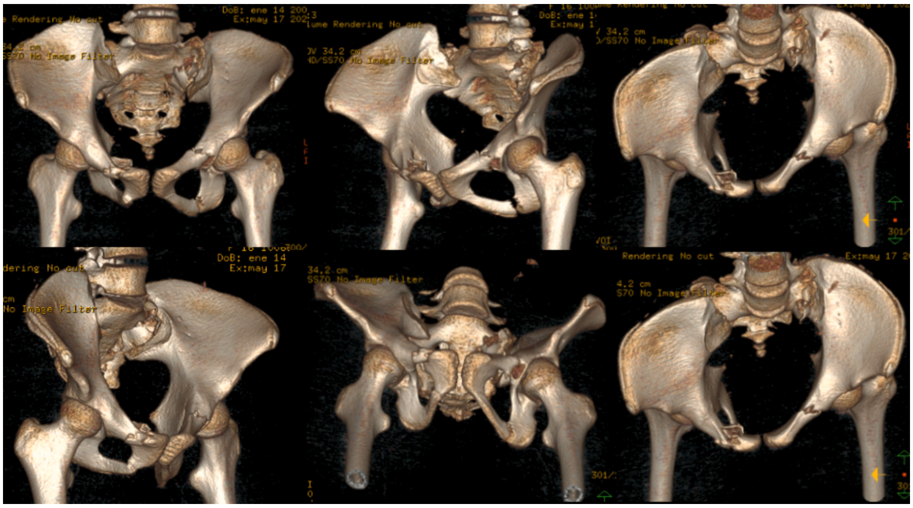

Fig. 2. Complex pelvic fracture classified as Tile C3, Young–Burgess LC III, and AO/OTA 61C3.3. Three-dimensional CT reconstructions in different projections demonstrate all associated injuries described. Specific findings include bilateral iliopubic and ischiopubic ramus fractures, a right anterior crescent-type fracture with anterior sacroiliac (SI) joint dislocation, a left-sided simple SI joint dislocation, and a vertically oriented sacral fracture (Denis II) combined with a transverse component at S2–S4, consistent with a characteristic T-type sacral fracture.

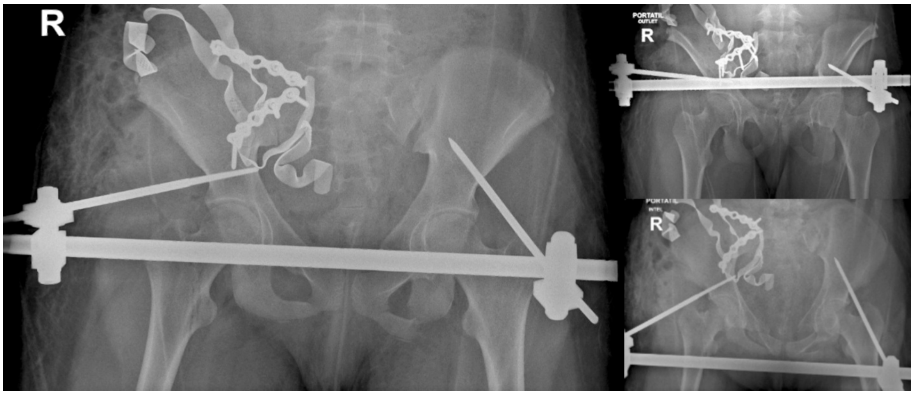

Fig. 3. Anteroposterior, outlet, and inlet pelvic radiographs obtained during the first-stage surgical procedure.

In addition, bilateral retrograde pubic ramus screws were inserted through symphyseal entry points toward the supraacetabular corridors, achieving fixation of iliopubic and ischiopubic fractures. (Fig. 4).

During this surgery, all retroperitoneal packs placed during the first procedure were carefully removed. No active bleeding was observed.

Postoperative course and outcome

After definitive fixation, the patient remained hemodynamically stable. There were no intraoperative or immediate postoperative complications. No wound infections occurred, and stitches were removed at three weeks. Pain was well controlled with multimodal analgesia.

At four weeks, neurological deficits persisted in the L5 and S1 dermatomes and myotomes. Electromyography confirmed traumatic neuropathy. Weight-bearing was allowed at six weeks postoperatively. At three months, the patient was ambulating with full weight-bearing using a walker.

Monthly follow-ups were conducted during the first six months, then every three months. Functional assessments included in Table 1.

The patient returned to school and daily activities with partial independence. At final follow-up (12 months), she walked independently, with persistent right foot drop managed by an ankle-foot orthosis. Neurologic function remained stable, and quality of life improved progressively (as documented with SF-36 scores).

At the 12-month postoperative follow-up, standard pelvic radiographs, including anteroposterior, alar, obturator, outlet, and inlet views, demonstrated consolidation of the pelvic ring injuries, maintained pelvic symmetry, stable sacroiliac and anterior ring fixation, and no evidence of implant failure, secondary displacement, or loss of reduction (Fig. 5). Despite the favorable radiographic outcome,

Fig. 4. Immediate postoperative radiographic control in standard pelvic trauma projections, including anteroposterior, outlet, inlet, alar–obturator, and lateral sacral views, demonstrating adequate fracture reduction.

Table 1
Functional and pain outcome scores during follow-up.

Timepoint	Majeed Pelvic Score (0–80)	Iowa Pelvic Score (0−100)	VAS Pain Score (0−10)
3 months	45	55	6
6 months	60	72	4
12 months	70	85	2

This table summarizes the patient's clinical progress at 3, 6, and 12 months using the Majeed Pelvic Score, Iowa Pelvic Score, and Visual Analog Scale (VAS) for pain. Improvements were observed across all metrics, with the Majeed and Iowa scores indicating progressive functional recovery, and the VAS reflecting a substantial reduction in pain. These results support the effectiveness of staged surgical management and multidisciplinary follow-up.

the patient had persistent neurological deficit, with residual L5–S1 motor weakness graded 3/5, L4 reflex graded 2/5, and S1 reflex graded 3/5.

Discussion

Severe pelvic ring fractures, although infrequent (1–4% of all fractures), are typically the result of high-energy trauma in young male patients and are associated with considerable morbidity and mortality [2–4]. Incidence ranges from 3.8 to 4.6 per 100,000 inhabitants, and in major trauma settings, up to 20% of polytrauma patients present with pelvic fractures [4,5]. Unstable patterns (Tile B/C or Young–Burgess LC II–III, APC II–III, VS) carry increased risk of complications and hospital mortality, which may reach 21% in open or hemodynamically unstable cases [6]. Early deaths are usually due to hemorrhage, requiring prompt mechanical stabilization and, when needed, embolization or preperitoneal packing depending on local resources [2,7]. Definitive fixation is often delayed following damage control principles [7].

In our case, the patient sustained a type C3 fracture (Tile/LC III) with bilateral sacroiliac dislocation and a sacral T fracture, a highly unstable injury with significant bleeding risk. Moreover, she exhibited a complete motor and sensory deficit in L5, consistent with lumbosacral plexopathy. This complication is particularly relevant in sacral fractures, especially Denis zone II, where nerve root involvement reaches 28% [8]. Neurological deficits occur in up to 33% of unstable pelvic fractures, with greater risk in cases of vertical instability, sacral displacement >10 mm, and transverse fracture lines [9–11]. The proximity of the L5 root—only 2–3 cm anterior to the sacroiliac joint—underscores the importance of cautious reduction and fixation to avoid further injury [12].

Initial management of this patient followed damage-control principles due to her hemodynamic instability. Upon arrival, a pelvic binder was applied to achieve immediate circumferential compression—an intervention known to reduce pelvic volume and promote hemostasis in unstable pelvic fractures. However, caution must be exercised in pure lateral compression (LC) injuries, where binders may aggravate the deformity. Although this was observed in our case, the use of the binder remained appropriate given the complex

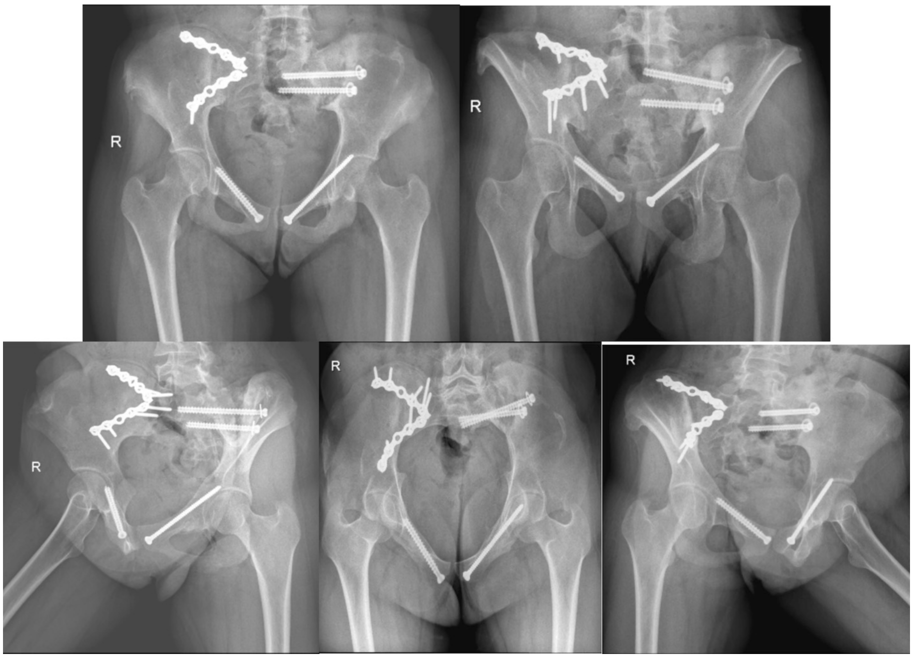

Fig. 5. Twelve-month postoperative radiographic follow-up. Anteroposterior, alar, obturator, outlet, and inlet pelvic radiographs obtained 12 months after definitive fixation showing consolidation of the pelvic ring injuries, preserved pelvic symmetry, maintained sacroiliac reduction, and stable anterior and posterior fixation without implant failure or secondary displacement.

combined pattern involving LC, anteroposterior compression (APC), and vertical instability—an indication strongly supported by international guidelines and recent literature [13,14]. This reinforces the need to correctly identify injury mechanisms and comprehend the stabilizing structures of the pelvis, as emphasized by the AO Foundation [15].

The patient sustained a complex pelvic ring injury consistent with a Tile C3 classification, exhibiting biomechanical failure in both rotational and vertical planes. The right hemipelvis demonstrated a lateral compression (LC) mechanism, characterized by a crescent fracture-dislocation of the iliac wing with anterior translation—an atypical displacement pattern associated with high-energy trauma and complete disruption of posterior ligamentous structures. On the left side, the APC component was evidenced by a Denis II fracture of the sacral ala (involving the right S1–S2 foramina and part of the sacral ramp) in combination with a fracture of the right inferior pubic ramus. This suggested partial failure of the anterior and posterior pelvic ring integrity, although without sacroiliac joint dislocation or major displacement. In addition, a transverse fracture between S3–S4 created a T-shaped configuration. While this secondary sacral fracture did not result in mechanical instability, it raised concerns for possible neurologic involvement of the lower sacral plexus, especially anal sphincter function. Fortunately, no clinical signs of S3–S4 compromise were present. Instead, the patient exhibited a right-sided L5 nerve deficit, likely due to compression from the crescent fragment, and left-sided S1–S2 impairment, attributable to the Denis II fracture.

Radiographic signs of cranial migration of the right hemipelvis, avulsion of iliolumbar ligament attachments, and discontinuity of the posterior ring confirmed vertical instability. Once hemodynamic stabilization was achieved, resuscitation followed Advanced Trauma Life Support (ATLS) protocols, prioritizing early hemorrhage control and perfusion [7]. Although definitive posterior fixation is generally required for vertical instability, the presence of associated hepatic trauma in this case represented a relative contraindication to prone positioning. Physiological studies have shown that prone positioning can acutely decrease hepatic perfusion and cardiac output [16]. In patients with active hepatic injury, such changes may become irreversible or exacerbate bleeding. Hence, a multidisciplinary trauma team opted to avoid prone positioning, in accordance with individualized damage control principles [17].

To achieve stabilization while maintaining supine positioning, a supraacetabular external fixator was applied as a temporary measure. While effective for anterior ring compression, this technique provides limited control over vertical shear forces [18]. The crescent fracture-dislocation on the right, with anterior migration of the iliac segment and compression of lumbosacral nerve roots and iliac vessels, necessitated urgent realignment. Unlike classical crescent fractures, which are rotationally unstable but vertically stable, this variant represented a non-classical mixed injury with vertical instability and neurologic compromise [19,20].

Attempts at closed reduction via skeletal traction were unsuccessful. Therefore, an open reduction was performed through an ilioinguinal approach, providing access to the anterior sacroiliac region and enabling preperitoneal pelvic packing (PPP)—a life-saving strategy for early hemostasis in pelvic trauma [3,24]. This anterior approach allowed for direct decompression of neurovascular structures and anatomical realignment of the right hemipelvis.

Subsequently, the right sacroiliac joint was stabilized with reconstruction plates, placed anteriorly under direct vision through the ilioinguinal window [21,22]. On the left side, although the Denis II fracture disrupted the posterior pelvic ring, it remained minimally displaced and non-luxated, with no neurovascular compression and no signs of progressive instability. Given these characteristics, urgent surgical fixation was not indicated. Temporary stabilization using the supraacetabular external fixator was deemed sufficient at this stage, with plans for delayed definitive fixation during the recovery phase.

This case exemplifies the importance of understanding the biomechanical implications of mixed injury patterns, such as the coexistence of LC on the right, APC on the left, and vertical instability, to guide appropriate surgical decision-making. It also underscores the need for critical appraisal of pelvic binder application, which, while often beneficial, may be inadequate or even detrimental in specific configurations. A comprehensive evaluation of ligamentous integrity, fracture morphology, and hemodynamic context is essential for selecting the safest and most effective treatment pathway.

Once the patient's condition stabilized and bleeding was controlled, attention shifted to definitive fixation of the remaining injuries. At this stage, four fractures still required evaluation and management: [1] a T-shaped sacral fracture involving S3–S4, [2] a Denis zone II sacral fracture involving the right sacral ala and neural foramina of S1 and S2, and [3,4] bilateral fractures of the superior and inferior pubic rami. The sacral T-type fracture at the distal sacrum, combining a vertical transforaminal line with a horizontal fracture through S3–S4, was minimally displaced and did not contribute to the global pelvic instability. On clinical examination, there were no signs of cauda equina syndrome, anal sphincter dysfunction, or perineal sensory loss—findings consistent with sparing of the lower sacral nerve roots. As such, the fracture was managed non-operatively.

Conservative treatment for distal sacral T-type fractures is appropriate in the absence of neurological compromise or mechanical instability. Management included restricted weight-bearing, multimodal analgesia, neurological monitoring, and guided physiotherapy. This approach aligns with current recommendations, which support non-operative care for stable, nondisplaced fractures that do not compromise the pelvic ring or neural elements. Surgical decompression and fixation are generally reserved for displaced fractures with progressive neurological deficits, intractable pain, or confirmed nerve root compression on advanced imaging. In this case, none of these indications were present, and the patient progressed favorably under a structured conservative protocol [26].

The next injury addressed was a Denis zone II sacral fracture involving the right sacral ala and neural foramina of S1 and S2. This lesion demonstrated a compressive pattern with clinical signs of right L5 neurological deficit, consistent with nerve root impingement. According to established guidelines for sacral fractures [26], such cases warrant disimpaction and stabilization of the sacroiliac joint using iliosacral screw fixation. Sacroiliac screws (SIS) have been a foundational technique since first introduced by Vidal et al. in 1973 [27], and have since evolved into a standard method for stabilizing posterior pelvic ring injuries [28]. Today, SIS fixation remains the only minimally invasive technique capable of securing posterior pelvic stability and is widely applied for sacral fractures, sacroiliac dislocations, iliac crescent fractures, and various complex patterns [29]. Given the sacrum's role in transmitting axial and torsional loads from the spine to the pelvis [30], surgical fixation restores pelvic continuity, enables early mobilization, and facilitates overall patient care [31]. To address biomechanical limitations of single screw fixation—particularly under vertical shear forces—the dual iliosacral screw technique was developed [32], with clinical studies confirming its superiority in providing lumbopelvic stability in sacrectomy cases and unstable fractures [33]. Nevertheless, percutaneous iliosacral screw fixation remains technically demanding and is typically performed under fluoroscopic or navigated guidance [34].

In our case, open reduction of the right sacroiliac joint was performed through the anterior window of an ilioinguinal approach. Disimpaction was achieved using pointed clamps on the iliac wing and manipulation near the greater sciatic notch. Once the hemipelvis was realigned and held reduced, two percutaneous cannulated screws (7.0 mm) were inserted under fluoroscopic guidance—one directed into the S1 body and the second into S2—achieving secure fixation of the posterior ring.

Screw trajectory and length were carefully planned considering the patient's sacral morphology and anatomical variations, using preoperative CT imaging. The safe osseous corridors of S1 and S2 were used to avoid injury to neurovascular structures, especially the L5 nerve root anterior to the ala and the internal iliac vessels medially. Both screws were inserted in a neutral position to maintain alignment without excessive compression, in accordance with current recommendations to avoid neural compromise in zone II fractures.

The final two lesions addressed were bilateral superior pubic ramus fractures, treated to restore anterior pelvic ring stability. Given the pre-existing posterior fixation and overall ring instability, minimally invasive retrograde intramedullary screw fixation was performed. This technique has gained increasing use as an adjunct to posterior ring fixation, offering adequate mechanical stability with reduced surgical morbidity, particularly in elderly or polytrauma patients.

Superior pubic ramus fractures, frequently associated with unstable pelvic injuries, can be challenging to manage, especially when occurring medial to the obturator foramen (Zone I and II of the Nakatani classification). Open reduction and plating, though biomechanically effective, are associated with high complication rates, particularly in frail patients. Retrograde percutaneous screw fixation has emerged as a valid alternative, although it presents technical challenges regarding screw trajectory, cortical breach, and optimal bone purchase [35–37].

In this case, retrograde screws were inserted under fluoroscopic guidance using a subpubic entry point, respecting the axis of the anterior column. Optimal screw positioning was verified using inlet, outlet, and obturator oblique views to minimize the risk of cortical or articular penetration. Particular care was taken to ensure sufficient screw length and trajectory across the medial fracture fragments, avoiding compromise of the intrapelvic neurovascular structures [36].

Literature reports a failure rate of approximately 15% for retrograde fixation, often due to insufficient purchase in osteoporotic bone or inadequate alignment of the screw within the bony canal. Failure tends to be more common in women, elderly patients, and fractures medial to the obturator foramen (Zone I). In our case, despite these risk factors, careful preoperative planning, fluoroscopic control, and use of appropriately sized 4.5 mm screws allowed for adequate stabilization without reduction loss [35,36].

Technical considerations included the use of a 2.0 mm guidewire at the subpubic angle, adjustment of trajectory in both sagittal and coronal planes, and confirmation of cortical proximity without violation. Although the anterior column does not follow a uniform cylindrical shape, preoperative evaluation of the ramus morphology allowed for an individualized approach. Particular attention was paid to avoiding excessive force across the fracture line, thus minimizing the risk of hardware-related complications.

This fixation completed the stabilization of the pelvic ring, enabling early mobilization and nursing care in a critically injured patient with multiple associated lesions.

This staged surgical approach exemplifies the complexity of managing unstable pelvic fractures with a combination of high-energy mechanisms, neurological risk, and anatomical variability. Each lesion—ranging from the conservatively managed distal sacral T-type fracture to the percutaneously stabilized Denis zone II sacral fracture and bilateral superior pubic ramus fractures—required a tailored strategy rooted in biomechanical principles, imaging guidance, and clinical context.

Alternative approaches, such as posterior plating or lumbopelvic fixation, were considered but deemed excessive given the stability achieved and the patient's associated injuries. Similarly, anterior plating of the pubic rami was avoided due to soft tissue morbidity and comparable outcomes with percutaneous screw fixation.

Through precise surgical execution and adherence to established criteria, a stable construct was achieved, facilitating early rehabilitation and optimizing the patient's functional recovery trajectory. This case reinforces the importance of individualized fixation strategies based on fracture morphology, patient physiology, and perioperative dynamics in the definitive management of complex pelvic trauma.

Limitations of this report include its single-case design and the lack of longer-term follow-up beyond 12 months. Although the 12-month radiographs demonstrated consolidation and maintained pelvic ring alignment, further follow-up would be required to determine the long-term evolution of the residual neurological deficit and the durability of functional recovery.

Conclusion

This case highlights the complexity and high stakes of managing unstable pelvic ring injuries resulting from high-energy trauma, especially when associated with neurological compromise and visceral trauma. A tailored, stepwise approach—grounded in biomechanical principles and adapted to the patient's physiological status—allowed for effective stabilization without compromising safety. Each lesion required a different fixation strategy, ranging from conservative management to open reduction and minimally invasive screw placement. The integration of anterior and posterior fixation techniques, careful assessment of neural risk, and multidisciplinary collaboration were essential to achieving favorable outcomes. This report underscores the importance of individualized surgical planning, critical evaluation of standard trauma protocols, and the value of anatomical knowledge in complex pelvic reconstructions.

CRediT authorship contribution statement

Edgar Barros: Writing – review & editing, Supervision, Conceptualization. **Felipe Criollo:** Writing – review & editing, Validation. **Francisco Endara:** Writing – review & editing, Writing – original draft, Software, Methodology, Investigation. **Alejandro Barros Castro:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT by OpenAI to improve language transcription. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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