CASE REPORT

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Percutaneous Anterior Column Screw Fixation Using Retrograde Guidewire Entry: A Hybrid Technique

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Abstract

Background: Acetabular anterior column fractures are challenging to manage due to the complex anatomy and limited surgical corridors. While retrograde screw fixation is commonly used, it often poses technical difficulties. We report a case of a 32-year-old female with an anterior column acetabular fracture, treated with percutaneous antegrade anterior column screw fixation using a retrograde guidewire entry. The technique facilitated accurate screw placement, minimized intraoperative difficulties, and allowed for early postoperative mobilization with favorable radiological and functional outcomes. This hybrid technique may represent a practical alternative for anterior column fixation by combining the accuracy of retrograde guidewire placement with the biomechanical advantages of antegrade screw fixation.

Keywords: Anterior column, Antegrade, Retrograde

Introduction

Acetabular fractures involving the anterior column require stable fixation to restore hip joint congruency and allow early mobilization. Open reduction and internal fixation (ORIF) has been considered the gold standard traditionally; however, it is associated with significant surgical morbidity, including blood loss, infection, soft-tissue complications, and prolonged recovery.[1]

Percutaneous fixation in pelvi-acetabulum surgeries has emerged as a minimally invasive alternative in minimally displaced fractures or fractures amenable to closed reduction. It can provide stable fixation while avoiding the complications of an open approach.[2] Percutaneous anterior column screw fixation may be performed using either antegrade or retrograde techniques, both of which require precise knowledge of pelvic osseous corridors and fluoroscopic guidance. The antegrade insertion corridor is typically larger than the retrograde corridor, suggesting that antegrade screw placement may be easier and safer, especially in obese patients or those with altered pelvic anatomy.[3] However, pure antegrade screw placement faces challenges, primarily difficult trajectory control from the proximal iliac entry point, risk of cortical breach or maldirection, and reliance on precise fluoroscopy. Retrograde screw fixation remains useful for certain low anterior column fractures, as the screw can achieve stable purchase without crossing the superior constriction and does not require precise alignment with the anterior column axis.[4]

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This report describes a hybrid approach - retrograde guidewire placement for accurate path confirmation followed by antegrade screw insertion to combine the strengths of both methods.

Case presentation

A 32-year-old woman presented after a road traffic accident with left hip pain and inability to bear weight. Imaging, including pelvic X-rays and a CT scan, revealed a left anterior column acetabular fracture (Figure 1 A-B). She also had associated injuries—a right iliac wing fracture and spinal injuries (L4 burst fracture and L2 compression fracture)—which were stabilized with posterior instrumentation during the same hospital stay. The patient remained hemodynamically stable and had no neurovascular deficits.

The patient weighed 76 kg and measured 155 cm in height, corresponding to a body mass index (BMI) of 37.1 kg/m², and difficulty with conventional percutaneous screw placement was anticipated. Following multidisciplinary evaluation, the acetabular

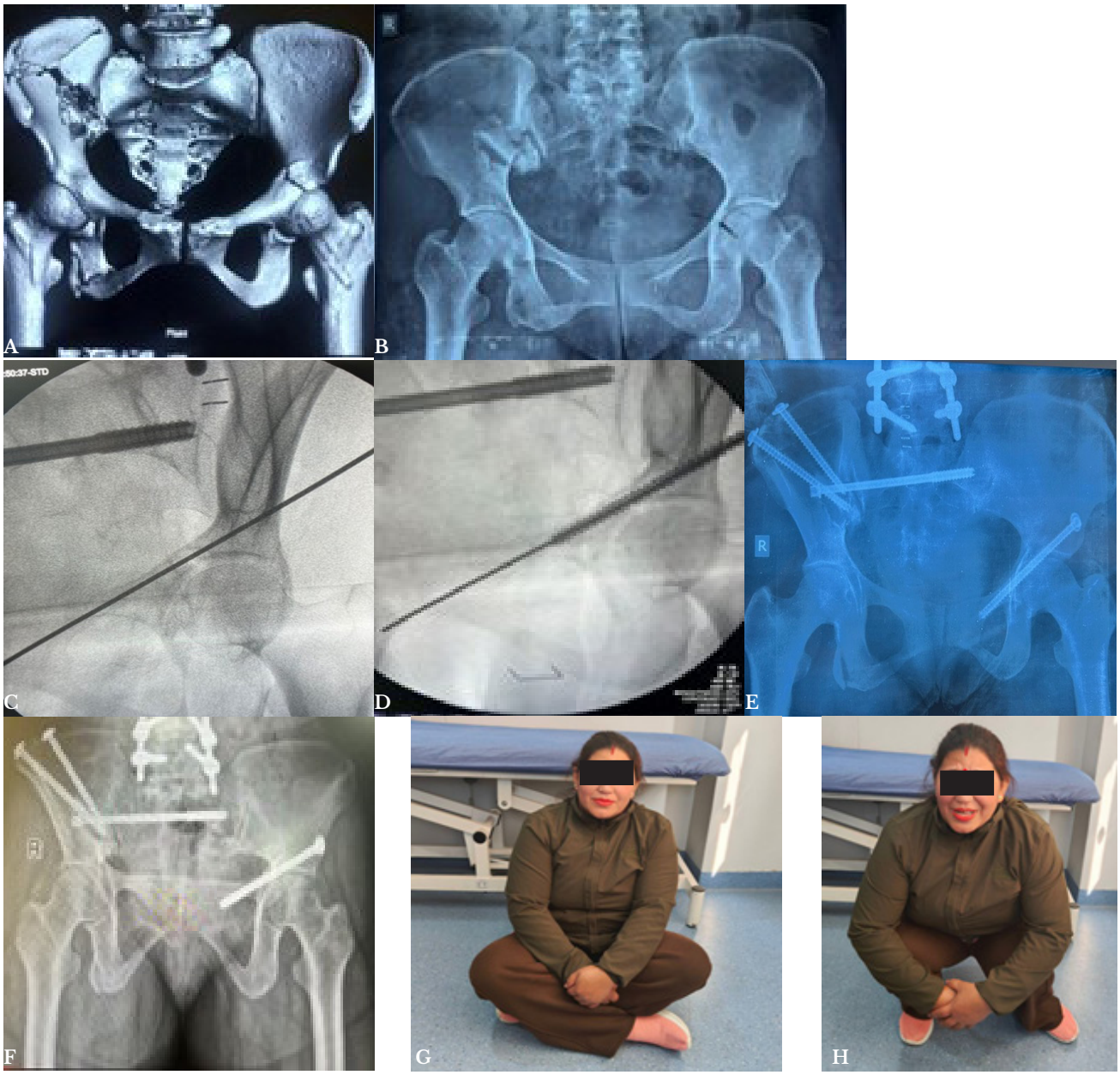

Figure 1 (A, B) 3D pelvic CT and pelvic X-ray demonstrate a left-sided anterior column fracture along with right iliac wing and sacral fracture. (C) Retrograde placement of a 2 mm guidewire along the anterior column corridor exiting from the iliac wing and skin. (D) Antegrade insertion of a 6.5 mm cannulated screw after antegrade drilling over the guidewire. (E) Immediate postoperative radiographs showing anterior column fixation along with hardware for associated fractures. (F) Pelvic X-ray demonstrating a well-healed fracture with stable screw fixation; (G), (H) Clinical photographs of the patient showing an excellent functional outcome.

fracture was treated with percutaneous anterior column screw fixation using a modified hybrid technique on day 3 post-injury, with additional percutaneous screws for the right ilium and an iliosacral screw for the right sacral fracture. Lumbar spine fractures were managed with posterior instrumentation.

The patient remained hospitalized for 7 days postoperatively. Early mobilization with non-weight-bearing ambulation using a walker was initiated on postoperative day 2. A structured rehabilitation protocol, including hip range-of-motion exercises and gradual progression to partial weight bearing at six weeks, was followed.

At follow-up, radiographs demonstrated maintained reduction and satisfactory screw position, and the patient gradually progressed to full weight bearing by 10 weeks.

Surgical Technique

Positioning:

After induction of general anesthesia, the patient was placed supine on a radiolucent operating table. The patient was positioned close to the edge of the table to allow unrestricted C-arm maneuverability for inlet, outlet, anteroposterior (AP), iliac oblique, and obturator outlet views. Prior to incision, the World Health Organization surgical safety checklist was reviewed. Perioperative antibiotics were used according to hospital policy.

Anterior column fixation:

A hybrid technique using a conventional retrograde approach for guidewire insertion, followed by antegrade placement of an anterior column screw, was used.[5]

A small longitudinal incision was made over the pubic tubercle, and blunt dissection was carried down to expose bone. The entry point was identified at the pubic tubercle.

Under fluoroscopic guidance (using oburator oblique and iliac oblique projections), a 2 mm guidewire was introduced at the entry site and advanced in a retrograde manner along the anterior column corridor toward the iliac wing until it exited the skin (Figure 1C).

A small incision about 1 cm in size was then made at the wire's exit point, through which antegrade drilling was performed with a 4 mm cannulated drill bit, crossing the fracture line. Screw length was measured, and a 6.5 mm cannulated screw was subsequently inserted from the antegrade entry site (Figure 1D).

Postoperative management and Follow-up:

The postoperative course was uneventful. The patient remained hospitalized for seven days for monitoring and management of associated injuries.

Early mobilization was initiated on postoperative day 2, with non-weight-bearing ambulation using a walker. A structured rehabilitation program, including hip range-of-motion exercises, was initiated during the early postoperative period.

At six weeks, partial weight bearing was initiated. Full weight bearing was gradually allowed at 10 weeks based on clinical and radiological assessment.

Follow-up radiographs demonstrated maintenance of fracture reduction and appropriate screw position without evidence of loosening, joint penetration, or secondary displacement. Patient demonstrated excellent functional outcome. (Figure 1 G-H).

Discussion

Percutaneous fixation techniques have become increasingly popular in the management of selected acetabular fractures because they minimize surgical morbidity while maintaining fracture stability. Compared with open reduction and internal fixation, percutaneous techniques offer advantages including reduced blood loss, limited soft-tissue dissection, and faster postoperative recovery.[6]

However, safe screw placement requires accurate knowledge of pelvic osseous corridors and accurate fluoroscopic guidance. The anterior column corridor is narrow and curved, making accurate trajectory control difficult. Complications reported with retrograde screw fixation include cortical perforation, intra-articular screw penetration, and injury to surrounding neurovascular structures. Antegrade screw fixation offers several potential advantages. Antegrade screws can be longer and may provide improved fixation strength across the fracture site. However, identifying the correct entry point in the supra-acetabular region and directing the guidewire safely through the anterior column corridor can be technically challenging, particularly in obese patients or those with altered pelvic anatomy.[3]

Multiple percutaneous fixation techniques and intraoperative fluoroscopic assessment methods have been described in the literature to facilitate safe anterior column screw placement. However, there is no clear consensus regarding a single optimal technique. These methods aim to improve the safety of screw insertion, overcome technical difficulties associated with the narrow osseous corridor, and reduce operative time and radiation exposure.[7]

Several modifications have been proposed to address these challenges. Sen et al. described an in-out-in technique using an open approach that allows direct visualization of the screw as it passes through the lateral cortex of the pubic ramus, thereby minimizing the risk of cortical breach.[8] Similarly, Weatherby et al. proposed a retrograde-antegrade-retrograde technique to address technical difficulties encountered during conventional retrograde screw fixation.[9] In another approach, Wang et al. utilized a blunt hollow pedicle finder to facilitate fracture reduction while minimizing the risk of cortical penetration during

screw placement.[10] Abunayan et al. described a surgical technique of reversing the guidewire tip for antegrade anterior column screw insertion.[11]
These variations reflect the ongoing efforts to improve the accuracy and safety of anterior column screw fixation. The hybrid technique described in the present report follows a similar principle, aiming to simplify guidewire trajectory control while maintaining the biomechanical advantages of antegrade screw fixation. The hybrid technique described in this report combines retrograde guidewire placement with antegrade screw insertion. By introducing the guidewire retrogradely from the pubic tubercle, the surgeon can more easily identify the correct starting point and confirm the safe intraosseous pathway under fluoroscopy. Once the guidewire trajectory is confirmed, screw insertion can be performed in an antegrade direction, allowing the biomechanical advantages of antegrade fixation.

This technique offers several potential benefits:
1. Improved accuracy of guidewire placement.
2. Reduced risk of intra-articular screw penetration.
3. Ability to insert longer screws for improved fixation
4. Simplified surgical technique with potentially shorter learning curve.
5. Easier trajectory control with reduced fluoroscopic time.

Postoperative imaging in the present case confirmed accurate screw placement within the anterior column corridor, and the patient achieved satisfactory functional recovery with early mobilization.
Nevertheless, this report represents a single case, and the findings cannot be generalized. Further studies involving larger patient cohorts are necessary to evaluate the reproducibility, safety, and long-term outcomes of this hybrid fixation technique. Despite the advantages of percutaneous fixation, surgeons should remain cautious in situations where satisfactory fracture reduction cannot be achieved or adequate fluoroscopic visualization is not possible. In such cases, conversion to a limited open reduction with percutaneous fixation or formal open reduction and internal fixation (ORIF) should be considered to ensure accurate reduction and safe implant placement while avoiding excessive radiation exposure.

Conclusion

Percutaneous antegrade anterior column screw fixation using retrograde guidewire entry represents a simple and practical hybrid technique for the management of anterior column acetabular fractures. By combining the accuracy of retrograde guidewire placement with the biomechanical advantages of antegrade screw fixation, this method may simplify trajectory control and improve fixation reliability. Further clinical studies are required to validate its safety and reproducibility.

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