Full length article

Midterm radiologic and functional outcomes of minimally-invasive fixation of unstable pelvic fractures using anterior internal fixator (INFIX) and percutaneous iliosacral screws

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ABSTRACT

Background: Anterior pelvic external fixation is associated with pin site infections, aseptic loosening with loss of reduction, frame bulkiness hindering patient mobilization and consequent difficulties in inpatient nursing. We performed a single-center prospective series to evaluate the feasibility, safety, limitations and midterm radiologic and functional outcomes of an alternative minimally invasive pelvic internal fixation technique using an anterior subcutaneous pelvic internal fixator (INFIX) and percutaneous iliosacral screws in unstable pelvic ring fractures.

Methods: Fifteen consecutive patients with vertically and/or rotationally unstable pelvic fractures, presenting to a Level-1 trauma center were treated with closed reduction, appropriate posterior stabilization with percutaneous iliosacral screws and anterior INFIX application. Outcomes were analyzed with respect to the quality of fracture reduction (Matta’s radiologic criteria), ease of inpatient nursing, patient mobility and comfort, functional outcomes at final follow-up (Majeed score, SF-12 score), social reintegration and complications.

Results: Most common injury pattern was AO/OTA type 61-C pelvic fracture in thirteen patients. Mean procedure time and intra-operative blood loss were, 57.1+/−4.9 min (range,51–68 min) and 115.3+/−26.7 ml (range,80–170 ml) respectively. Mean follow-up was 34.9+/−4.1 months (range,31–42 months). Fracture reduction was excellent in twelve and good in three patients (Matta’s criteria). Functional outcomes were excellent in eight and good in seven patients (Majeed score). Mean SF-12 scores for physical and mental health were 48.58+/−5.61 and 50.89+/−3.97 respectively. Thirteen patients returned to their pre-injury jobs. All fifteen patients reintegrated into society without any restrictions. INFIX was removed at a mean post-operative period of 7.3+/−1.5 months (range,5.5–11 months). Complications included, lateral femoral cutaneous nerve irritation(n = 1), superficial wound infection(n = 1) and loss of reduction(n = 2).

Conclusion: Minimally invasive pelvic stabilization using INFIX and percutaneous iliosacral screws is easy to learn and apply, achieves good fracture reduction and definitive stabilization with minimum complications and offers excellent functional outcomes at a minimum follow-up of 31 months.

Level of evidence: Level IV.

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1. Introduction

High energy pelvic fractures often disrupt the integrity of the anterior and/or posterior osteoligamentous structures, thereby resulting in vertical or rotational instability of the pelvic ring. Early restoration of the structural integrity and stability of the pelvic ring is imperative to normalize the patient's acute physiology and to allow for early restoration of mobility and function. While posterior pelvic ring stability is typically restored by open or percutaneous methods, percutaneous fixation with cannulated iliosacral screws is now popular as it offers less blood loss, shorter operative times and fewer surgical wound complications compared to open techniques.1–9 Concurrent anterior stabilization significantly improves biomechanical stability and can be performed as a temporary or definitive procedure. Definitive anterior

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pelvic ring osteosynthesis has traditionally been performed with open plating, transramus intraosseous screws, or external fixation. Open reduction and internal fixation (ORIF) of comminuted unstable anterior ring fractures is associated with excessive soft tissue damage resulting in increased incidence of surgical site infection and wound complications, risk of neurovascular injury, injury to bladder and spermatic cord, surgical site hernia and implant failure.1 Anterior external fixation has been used temporarily in damage control scenarios, to rapidly stabilize an unstable pelvic ring with restoration of hemodynamic stability, although their application can be made definitive in combination with posterior fixation.10–13 It is associated with several complications including pin site infections, osteomyelitis, aseptic loosening with loss of reduction, frame bulkiness hindering hip flexion with limitation in patient mobilization, difficulties in nursing care, and hindrance to wound access or surgical access to abdomen.14–16 As an alternative to traditional external fixation, Vaidya et al. in 2012, described a novel anterior subcutaneous internal fixation device, “INFIX” for stabilizing unstable pelvic fractures using the established principles of anterior external fixation. The INFIX involves insertion of supra-acetabular spinal pedicle screws connected by a contoured subcutaneous rod.17 Biomechanical studies have shown that the INFIX has superior stability to external fixation in the management of vertically and rotationally unstable pelvic ring injuries.18–20 We evaluated the merits, limitations, outcomes and complications of this minimally invasive technique in unstable pelvic fractures.

2. Methods

An Institutional Review Board approved, single-center prospective clinical series was performed on patients who presented to a Level-1 trauma center between January 2013 and February 2014. All patients were treated as per ATLS (Advanced Trauma Life Support) protocol. GCS (Glasgow Coma Scale) score, ISS (Injury Severity Score) and serum lactate levels were recorded. All patients underwent a detailed neurological examination and a complete radiological evaluation including anteroposterior, pelvic inlet and outlet views and computed tomography (CT) scan of pelvis.

None of our patients received INFIX as an emergency procedure for pelvic tamponade and restoration of hemodynamic instability. In patients with hemodynamic instability resulting from pelvic ring injury, emergent pelvic tamponade and stabilization was accomplished with an anterior external fixator as a “damage control” procedure. Conversion of external fixator construct was carried out once the patient’s physiology became stable and serum

Fig. 1. Anteroposterior plain radiograph (A), axial (B) and coronal (C) CT scan images of pelvis demonstrating a left sacroiliac joint fracture-dislocation with complete instability and displacement of left hemipelvis, with concomitant bilateral superior and inferior pubic rami fractures. Post-operative plain radiographs – anteroposterior (D), inlet (E) and outlet (F) views of pelvis at 5 months showing healing of anterior and posterior pelvic ring fractures. Plain radiographs – anteroposterior (G), inlet (H) and outlet (I) views of pelvis taken after implant(INFIX) removal at 6 months showing healed anterior and posterior pelvic ring fractures with good maintenance of reduction.
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