TECHNICAL NOTE

Treatment of Displaced Sacroiliac Fracture Using the Lateral Window for Short Plate Buttress Reduction and Percutaneous Sacroiliac Screw Fixation

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Abstract

Fractures through the sacroiliac joint are very challenging to treat, technically difficult to reduce through closed methods on account of the multiaxial displacement of fractures fragments, frequently occur in very unwell patients, and have poor outcomes if malreduction is present. We describe a technique utilising the lateral window and a short buttress plate to reduce and stabilize the fragments prior to percutaneous fixation with sacroiliac screws.

Keywords: Fracture, Pelvic trauma, Sacrum

Introduction

Posterior pelvic ring injuries are complex, variable, frequently unstable, difficult to treat and associated with increased morbidity and mortality (1). Sacroiliac (SI) fracture-dislocations are a variant of pelvic injury associated with high energy. Outcomes are poor following the injury if displacement is present.

Treatment of fracture dislocations of the sacroilium is difficult. Displaced and unstable fractures require reduction and fixation. Percutaneous reduction and fixation is recommended, with good results, however dislocation and or displacement makes accurate reduction more challenging and sacral malreduction endangers adjacent neural and vascular structures, with resultant long term sequalae (2).

Terminology can be confusing especially given the frequent overlap in fracture patterns between vertically unstable pelvic fractures and fracture dislocation of the SI joint - and their respective treatments. The term 'anterior plating' frequently refers to open reduction and internal fixation (ORIF) of the symphysis pubis as part of stabilizing the vertically unstable pelvic fracture. Less commonly, for fracture dislocation of the SI joint, 'anterior plating' is used to refer to plating across the anterior aspect of the SI joint as an adjunct to SI screw fixation.

By convention, any sacral or posterior pelvic fracture-displacement of 1 cm is considered to be unstable. Internal fixation is indicated for injuries of the posterior pelvis classified as vertically unstable or in which all the ligamentous structures of the SI joint have been disrupted.

Although many of these injuries are reduced with simple 2D fluoroscopically assisted imaging intraoperatively, 3D fluoroscopic systems, CT and Navigated systems have been described since the early 1990s. We describe a technical tip for reducing and maintaining reduction of a displaced vertical fracture of the sacroiliac joint in a polytraumatised patient in the supine position using the lateral window to insert a short buttress plate prior to percutaneous SI fixation, with 2D and 3D fluoroscopically assisted imaging.

Surgical technique

A 39-year-old female was involved in a pedestrian versus car road traffic accident. She sustained multiple injuries, including a displaced fracture of the left sacroiliac joint [Figure 1] classified as an OTA 61-C1.2, with left superior and inferior pubic rami fractures and a minimally displaced pubic symphysis [Figure 2]. Once stabilized from her initial injuries, surgery was scheduled for her left pelvis. The patient was positioned supine, on a fully radiolucent table, with a folded towel under the left buttock to elevate her hemipelvis. Using the lateral window, and with the left hip and knee flexed, iliacus was reflected from the medial wall of the ileum, and a Deaver retractor placed onto the sacrum under direct vision to display both the

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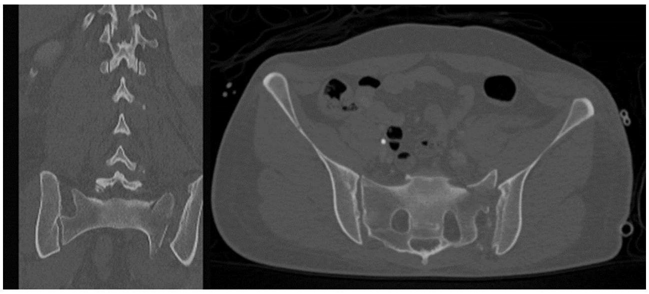

Figure 1. Coronal and axial CT cuts showing marked asymmetry between the left and right sacroiliac joints and left sided sacroiliac fracture dislocation.

fracture and the L5 nerve root. The SI joint was highly unstable; the lateral segment of the ilium fracture was displaced 1.5 cm posteriorly, and it displayed marked vertical instability, with 1cm proximal retraction at rest, displaced to 1cm distally on applying longitudinal traction. After debriding the edges of the SI joint of muscle and interposed periosteum, a 3 hole low profile Reconstruction plate was placed perpendicular to the SI joint, with the middle hole just lateral to the line of the fracture. A 3.5 mm fully threaded screw was applied into the middle hole after drilling with 2.5 mm drill, and, with careful combination of controlled longitudinal limb traction and antero-posterior traction with Farabeuf's retractors applied to the iliac crest to align the fragments (in particular to draw the ilium anteriorly relative to the sacrum) the screw was tightened to reduce and hold the fracture, again under direct vision [Figure 3, 4]. With the fracture reduced, SI screws were then passed percutaneously from the lateral ileum to the body of S1 in the standard fashion, using a C-Arm device with both 2D and 3D fluoroscopic imaging capability (Arcadis® Orbic 3D, Siemens AG, Germany). Prior to tightening these SI screws into the body of the sacrum, the 3.5 mm screw in the buttress plate is loosened slightly, allowing firm compression across the SI joint with the percutaneous screws. Traditional 2D views were obtained - to obtain the inlet and outlet images and to target the lateral sacral image, which, as per Letournel and echoed by Routt et al. "provides the surgeon with a better understanding of the sacral alar slope and can help prevent iliosacral screw placement errors" (3). We then utilise 3D fluoroscopic imaging to assess screw position relative to the body of the sacrum and sacral foramina for immediate confirmation of the safe placement of screws [Figure 5].

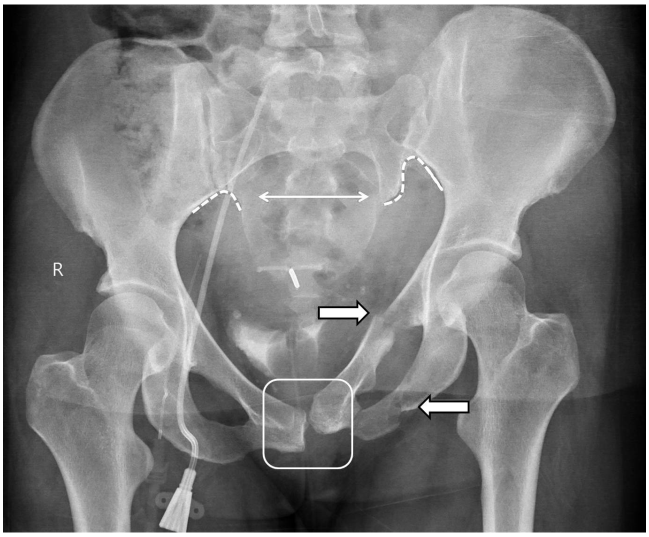

Figure 2. AP Pelvis radiograph demonstrating marked vertical displacement of the left hemipelvis (broken curves and arrow), with superior and inferior pubic remus fractures (full thickness arrows), and mild displacement of the pubic symphysis (rectangular box).

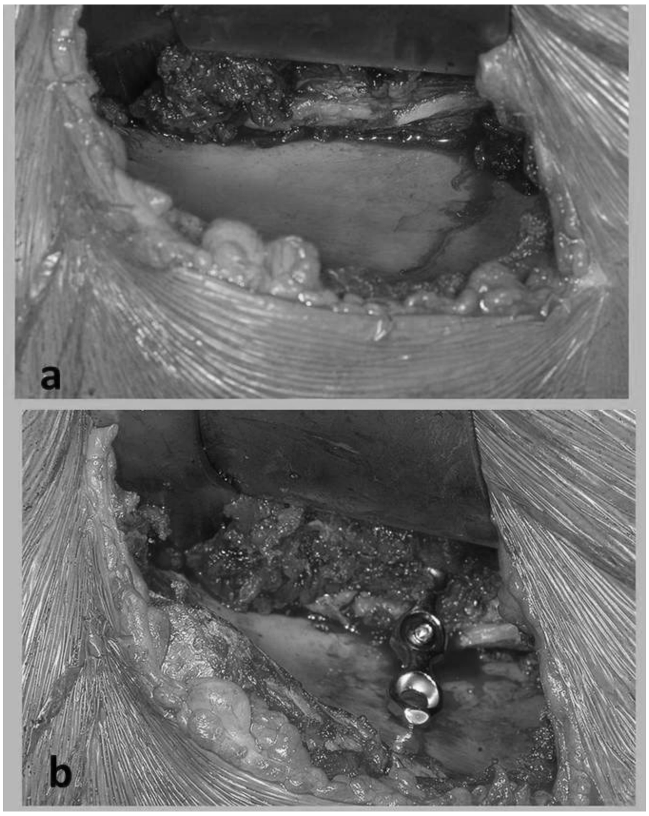

Figure 3. Intraoperative images showing the displaced sacroiliac fracture (Figure 3a) being reduced using a 3 hole Reconstruction plate (Figure 3b).

Discussion

Treatment of fracture dislocation of the sacrum and SI joint is by reduction and fixation; reduction can be extremely challenging, even for the experienced pelvic surgeon due to the multi-axial nature of the fracture and deforming forces rendering axial manual traction insufficient. Traction devices and pelvic frames to assist closed reduction - although well described - are expensive, infrequently available and may be contraindicated in cases of polytraumatised patients with ipsilateral limb injuries. Using a posterior approach without traction devices has been described, but this

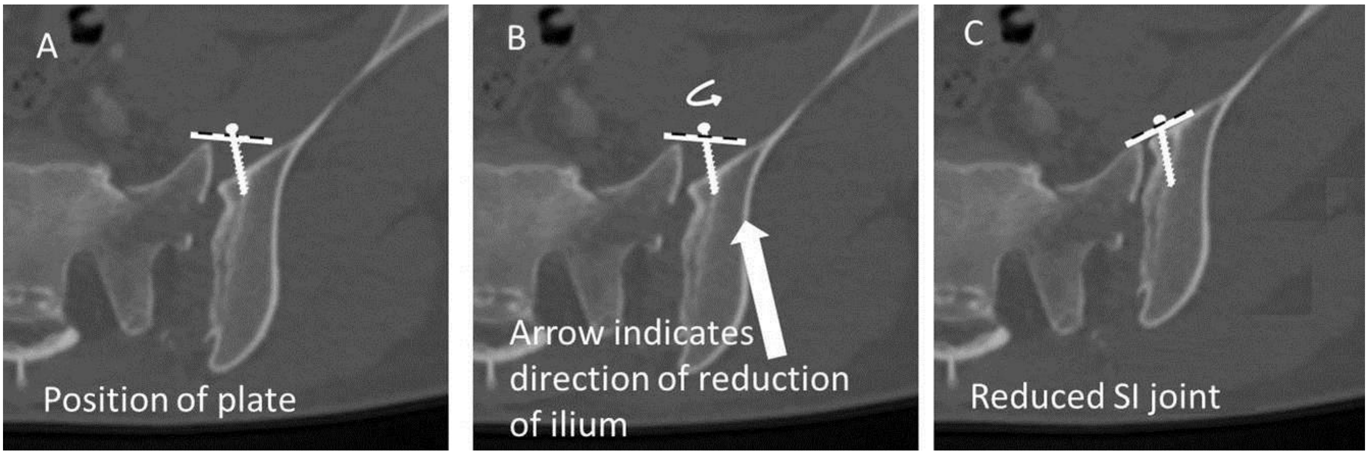

Figure 4. Diagrammatic representation of reduction of sacroiliac joint achieved with 3-hole Reconstruction plate and single cortical screw. Figure 4A) Positioning of 3 hole recon plate, Figure 4B) Reduction of posteriorly displaced sacrum when rotation applied to cortical screw, Figure 4C) Reduced sacroiliac joint facilitating standard percutaneous sacroiliac screw fixation.

frequently requires a polytraumatised patient to be turned prone, and has been associated with a high complication rate, in particular wound breakdown and infection due to prominence of metalwork.

Although complications associated with anterior plating are well described, frequently relating to L5 and sacral nerve root proximity, the anterior approach for sacral fractures is recommended by many authors. Traditionally, the ilioinguinal approach with its three windows (medial, middle and lateral) has been used, and more recently the modified Stoppa approach has become popular, with a traditional Pfannensteil incision coupled with the lateral window of the ilioinguinal approach. This approach, a modification of the intrapelvic approach described by Stoppa, was described by first by Hirvensalo and later Cole avoids the dissection of the middle window of the ilioinguinal approach, sparing dissection of the femoral neurovascular bundle (4). Visualization through this approach is adequate for access for most of the inner true bony pelvis. The lateral window - common to both approaches- is relatively uncomplicated and gives excellent access across the pelvic brim and SI joint.

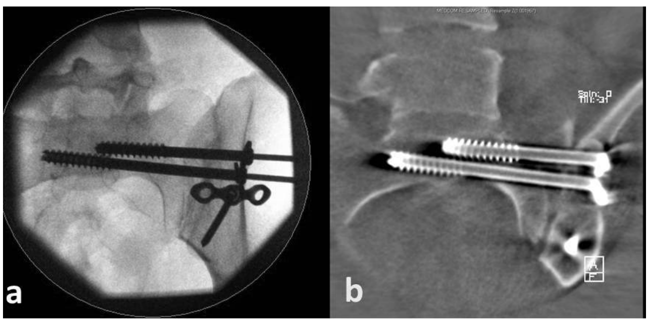

Figure 5. Intraoperative 2D (Figure 5a) and 3D (Figure 5b) images following reduction with small plate and percutaneous screw fixation of the left sacroiliac fracture.

Griffin et al. demonstrated that in patients for whom the main posterior injury was sacroiliac joint dislocation, SI screw fixation is successful, but where the main posterior injury is a vertical sacral fracture re-displacement occurred within 13% cases (5). There is no agreement for an acceptable upper limit for reduction (by either closed or open methods) and fixation with percutaneous SI screws. Accurate reduction is key, as malreduction not only is associated with worse outcomes long term, it also increases risk for a myriad of iatrogenic injuries. Reilly et al. showed that malreduction of a sacral fracture can compromise the area available for the insertion of percutaneous SI screws and 'the safety of the surgical procedure' (6). Pre-existing sacral deformities is another established risk factor for reducing the safe corridors, increasing the risk of SI screw misplacement and neurovascular complications. The incidence of sacral dysmorphism in a prospective trauma cohort can range between 14% and 42% (7).

Although particularly useful for displaced iliosacral fractures, we find that this technique of using a short buttress plate to reduce and stabilize fragments is applicable for many types of pelvis fractures, particularly when multiple fractures are present, as a means of aligning larger fragments to facilitate formal reduction and plating. This is particularly relevant in vertically unstable fractures, where the posterior displacement of the ilium relative to the sacrum is difficult to reduce anatomically in a closed manner. This technique is far from novel, being advocated by Tile back in 1988 (8). However, with the trend towards percutaneous fixation, and the rise of interventional-radiology assisted procedures, Tile's advice risks being forgotten – that a simple intervention with a three hole plate, through an uncomplicated approach, can transform a highly technically challenging procedure into one that is far more straightforward.

We feel this method of primary intervention with open reduction of the SI fracture under direct vision prior to sacroiliac screw fixation has a number of advantages: i) it is simple and relatively low risk in terms of approach and visualization, ii) it helps reduce rotational instability, iii) it allows the percutaneous SI screws to be passed without the distraction of simultaneous multiplanar reduction manoeuvers, and iv) it is ideal for the polytraumatised patient allowing supine positioning.

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