Healio ORTHOPEDICS

TIPS & TECHNIQUES

Percutaneous Fixation of Anterior and Posterior Column Acetabular Fractures

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Abstract

Although open reduction and internal fixation (ORIF) has been the standard of care for acetabular fractures, recent advancements in minimally invasive techniques have allowed percutaneous fixation to gain popularity. Percutaneous technique has been described in the literature as an adjuvant to ORIF. However, isolated percutaneous fixation has the advantage of limiting soft tissue disruption, length of surgery, and blood loss when compared with ORIF. The technique also allows for earlier return to activity and better pain control when compared with nonsurgical management. This article reviews both indications and limitations, while highlighting the technique for percutaneous fixation of both anterior and posterior column acetabular fractures. [*Orthopedics*. 2014; 37(10):675–678.]

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Acetabular fractures remain one of the most difficult orthopedic injuries to treat successfully. These fractures are often the result of high-energy trauma with the femoral head transmitting axial load through the acetabulum, commonly seen in car accidents when the knee contacts the dashboard.[1] For decades, there has been much debate over which fractures are amenable to conservative treatment and which require surgical management.

Acetabular fractures were treated nonsurgically until the 1960s, when Judet and Letournel described the acetabulum as being composed of both an anterior and a posterior column of bone oriented in an inverted Y-configuration.[2–4] This description has allowed surgeons to view the acetabulum as a 3-dimensional structure, focusing on fixation of each column as an independent entity. Ultimately, the goal of treatment is to achieve the so-called “reduction parfaite” described by Letournel, as even the slightest defect (>1 mm) in the articular surface can lead to post-traumatic arthritis and poor functional outcomes.[5,6] Advanced imaging has aided in the ability to analyze fractures by elucidating the orientation, pattern, size, accompanying loose fragments, and evaluation of the subchondral angle on computed tomography (CT).[4,7]

Using the 3-dimensional concept, open reduction and internal fixation (ORIF) is considered the gold standard of treatment for displaced acetabular fractures. Fractures involving the weight-bearing surface of the acetabulum or a large section of the posterior wall benefit most from ORIF.[1,8] Furthermore, Matta[7] published a retrospective study showing poorer outcomes in patients with fractures displaced greater than 3 mm.[3] Alternatively, smaller, nondisplaced fractures can be managed with short-term bed rest in traction followed by several weeks of non-weight bearing.[9] With skeletal traction, outcomes are unpredictable and there is the risk of pin-site infection and knee stiffness.[3,7,10] Most would now agree that skeletal traction is a suboptimal treatment strategy, with high morbidity and mortality, especially in the elderly patient.

Recently, percutaneous techniques have emerged for management of the less-displaced acetabular fractures, limiting associated soft tissue disruption, length of surgery, and blood loss when compared with ORIF. This modern treatment method has a steep learning curve and potentially significant morbidity. In this article, the authors discuss the indications, limitations, and surgical technique for using percutaneous fixation in both column fractures. The authors stress that this technique does not replace ORIF of displaced acetabular fractures. It is used as an adjunct to ORIF, for fixation of certain osteoporotic acetabular fractures (bone stock procedure), or in young, active patients with undisplaced fractures who have expressed their desire to be back on their feet early.

Indications and Limitations

Indications for percutaneous fixation are still under debate, but would include the management of acetabular fractures in the elderly and moderately or undisplaced fractures in younger patients aiming for an early return to weight bearing and to full activity. Analyzing the roof arc angle can help predict the inherent stability of the fracture and prevent unnecessary surgery. Additionally, morbidly obese patients can benefit from this minimally invasive approach.

Technique Guide

Preoperative Consideration

Preoperative planning is crucial to understand the fracture pattern and the ideal screw corridor. The use of 3-dimensional CT reconstructions, in addition to plain films, will help determine the location of the fracture line and angle of the safe corridor used for screw fixation. The authors prefer to fix low anterior column fractures using retrograde fixation (from the base of the penis aiming proximal and lateral) and high anterior column fractures using antegrade fixation, although both methods are valid for either fracture. The authors have recently changed their practice for the fixation of posterior column fractures from antegrade fixation using the lateral window of the ilioinguinal approach (which is not a percutaneous technique) to retrograde percutaneous fixation from the ischial tuberosity. This retrograde posterior column screw works

well for low posterior column or transverse fractures. For more proximal fracture lines, the screw threads will not clear the fracture and an antegrade route through a lateral window should be used. The reason for this recent change is the fact that a smaller starting-point bony surface allows for an easier screw trajectory and shorter operating times overall. The authors also prefer the use of 6.5-mm cannulated screws as opposed to smaller-diameter screws. These larger-diameter screws provide better stability and stronger compression forces when required. The authors further recommend the use of a drill bit instead of the threaded tip guidewire, as the latter does not provide the surgeon with good proprioceptive feedback and can be challenging to maneuver.

Positioning

The patient is positioned supine on a flat top radiolucent table. The operative side should be positioned near the edge of the table for easier access to the hip. The arms should be placed on armrests in an abducted position to avoid interference with the C-arm during the inlet view. No bump under the hip or pelvis is needed for the procedure.

The surgical site is prepared and draped. If a retrograde posterior column screw is planned, it is essential that the distal aspect of the ischial tuberosity can be accessed prior to draping, and the patient's hip must be able to fully flex to 90° and abduct without interference. The ipsilateral hemipelvis, buttock, and proximal thigh are left exposed. The area is outlined with sterile towels set in place with staples. U-drapes are then placed around the surgical field and the area is prepped a final time. Prior to incision, the World Health Organization[11] surgical safety checklist is reviewed. Perioperative antibiotics are used according to hospital policy. The landmarks to outline for this case are the anterior superior iliac spine, the anterior inferior iliac spine, the greater trochanter, the lateral aspect of the femur, and the most distal aspect of the ischial tuberosity.

Anterior Column Fixation

The screw entry point is located at the junction of a line drawn along the lateral border of the femur through the greater trochanter and a line from the pubic symphysis through the anterior inferior iliac spine (**Figure 1**). The trajectory is confirmed with a Kirschner wire placed over the patient using the obturator oblique view. To visualize their trajectory, the authors use the obturator oblique view to confirm position of the guide-wire in the cephalocaudal plane and an inlet view to confirm adequate position in the antero-posterior plane (**Figure 2**). The latter view must show overlap of the superior and inferior pubic rami forming 1 column of bone. Next, a drill bit for a 6.5-mm screw is placed within the superior pubic ramus using both the obturator oblique view and the pelvic inlet view in alternating fashion. The tip of the guidewire should reach the medial superior pubic ramus (**Figure 2**). Once the wire is placed in an acceptable position, the depth is measured and the lateral cortex is drilled. A 6.5-mm partially threaded cannulated screw is then inserted over the guidewire under C-arm guidance (**Figures 3–4**).

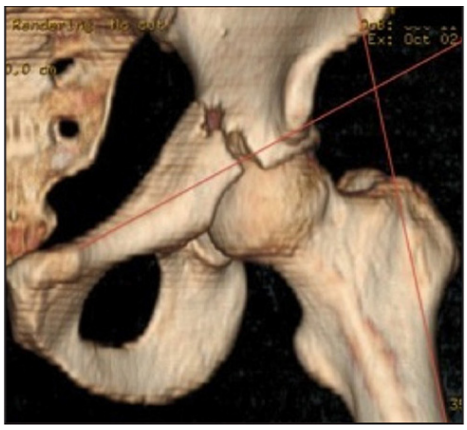

Figure 1:
Bony landmarks are used to create arbitrary lines. The point at which these lines intersect should be used as the entry point for the approach to the anterior column.

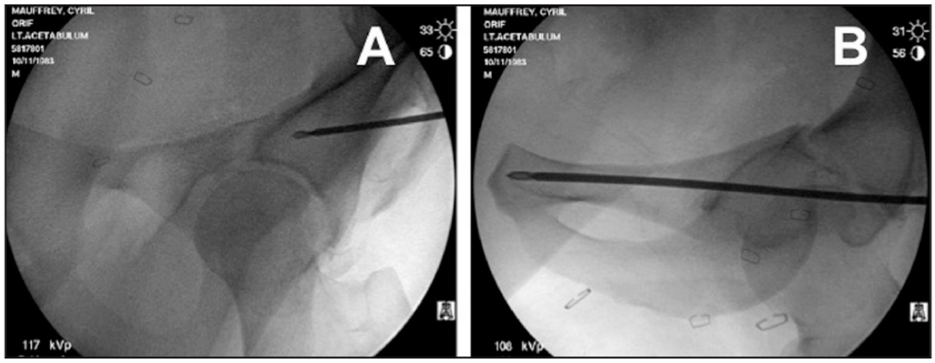

Figure 2:
Guidewire placement seen on the obturator oblique (A) and the inlet (B) views.

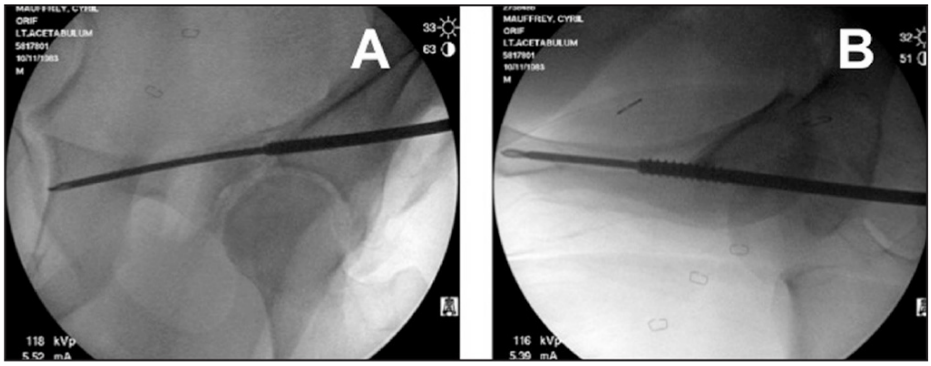

Figure 3:
Cannulated screw entrance on the obturator oblique (A) and the inlet (B) views.

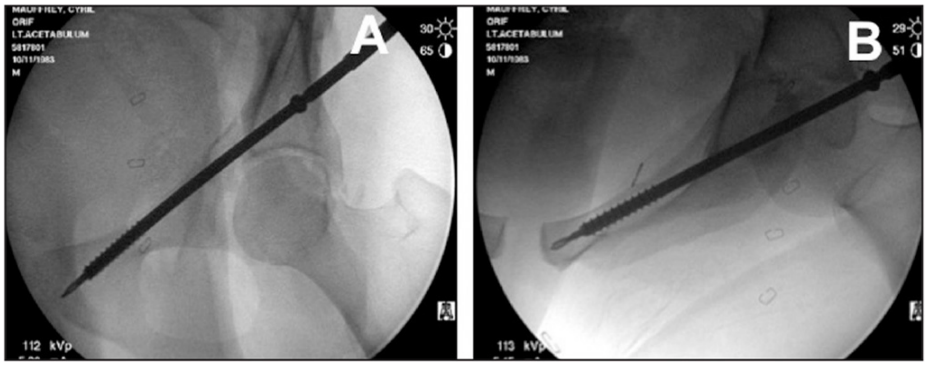

Figure 4:
Cannulated screw in position on the obturator oblique (A) and the inlet (B) views.

Posterior Column

The first step for the introduction of a retrograde posterior column screw is locating the ischial tuberosity with the patient's hip flexed and knee extended. Just 1 cm posterior to the most distal aspect of the ischial tuberosity will mark the entry point for the screw. This ensures that the screw will remain extra-articular with the correct trajectory. The obturator oblique and the iliac oblique views are used for screw guidance. Structures at risk medial to the ischial tuberosity

include the pudendal neurovascular bundle. Structures at risk lateral to the ischial tuberosity include the inferior gluteal artery and vein as well as the sciatic nerve. To identify the entry point, an obturator oblique view should be obtained with the hip flexed and abducted (**Figure 5**). A drill bit for a cannulated 6.5-mm screw is advanced proximally in the ischial ramus with guidance using both obturator oblique and iliac oblique views (**Figure 6**). Next, a lateral view is obtained to ensure the inner pelvic table has just been breached to have a bi-cortical purchase. Once the wire is placed in acceptable position, the depth is measured, the lateral cortex drilled, and a 6.5-mm partially threaded cannulated screw inserted (**Figure 7**).

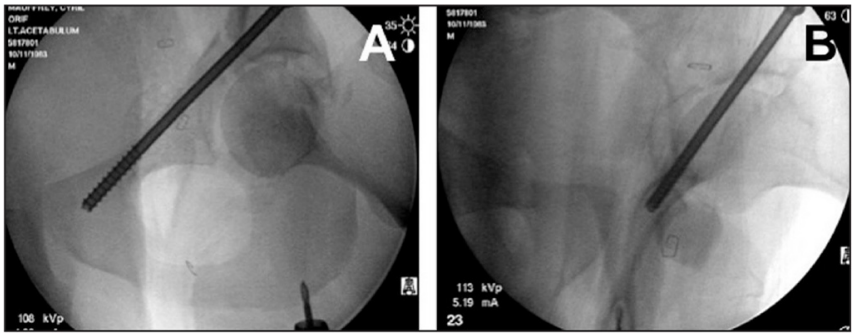

Figure 5:
Starting position of the posterior guidewire from the obturator oblique (A) and the iliac oblique (B) views.

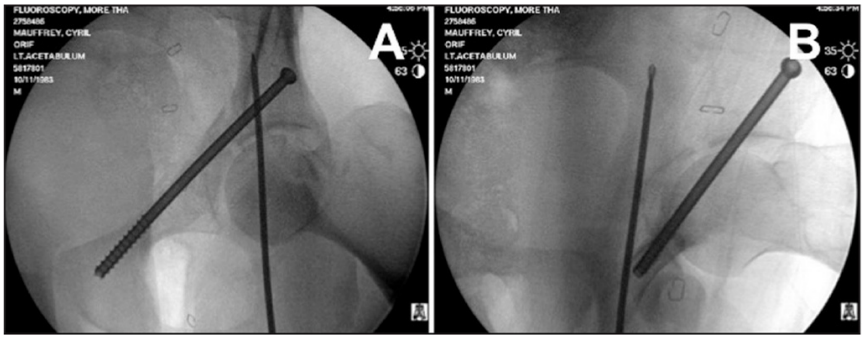

Figure 6:
Guidewire placed in the posterior column on the obturator oblique (A) and the iliac oblique (B) views.

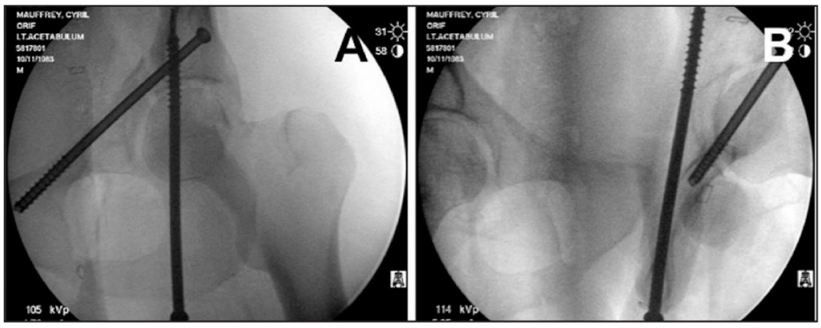

Figure 7:
Final cannulated screw position in the posterior column on the obturator oblique (A) and the iliac oblique (B) views.

Postoperative Care

Patients are encouraged to ambulate early. Depending on fracture pattern and quality of reduction, patients can weight bear as tolerated with a walker or crutches. Patients typically stay in the hospital 1 to 2 days postoperatively for pain control. Important points to emphasize with the patient are gastrointestinal symptoms, fever, and drainage from the wound that would suggest bowel perforation. Radiographic imaging of the pelvis is performed postoperatively to assess final reduction, and in some cases a CT scan may be warranted (**Figure 8**).

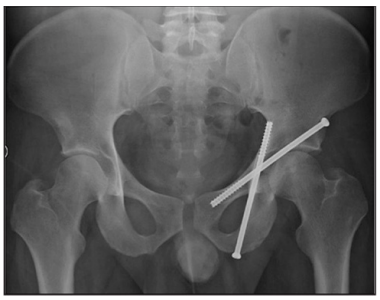

Figure 8:
Anteroposterior radiograph of the pelvis showing proper alignment of the cannulated screws 2 years postoperatively. As seen in the radiograph, both columns of the acetabulum are accurately fixed in acceptable alignment.

Conclusion

In 1991, Gay et al[12] first described percutaneous fixation of acetabular fractures with the use of CT imaging. Starr and several others have published technique guides using supplementary percutaneous screws to complement conventional ORIF of the acetabulum.[12–16]

At the authors' tertiary referral regional level 1 trauma center, innovative advancements have allowed for treatment of these complex fractures using only percutaneous fixation. This is important at a center such as the authors', given the propensity for referral of these complex injuries as well as the broad spectrum of patients who are seen, ranging from young athletes eager to return to sport to elderly patients with significant perioperative risk. Although percutaneous acetabular surgery has a steep learning curve, providing a less-invasive option with rigid columnar fixation can yield earlier mobilization with weight bearing.

Operative positioning and preparation as described are essential for successful outcomes using this technique. In the authors' experience, retrograde insertion of both anterior and posterior column screws causes limited soft tissue damage and allows for adequate fixation without the need for a lateral window.

Although long-term outcome data are unavailable, the authors counsel their patients on this matter, and the potential risks and benefits are discussed at length using a shared decision-making model. With increased interest in this technique, the numbers of patients needed to assess outcomes will be available in the near future.

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