Asymmetric Bilateral Hip Dislocation after Motor Vehicle Accident
A Case Study and Review of the Literature

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Abstract
Bilateral asymmetric dislocations of the hip are rare compared to unilateral dislocations. This case study describes a female restrained passenger involved in a motor vehicle accident who sustained asymmetric bilateral hip dislocations. The patient underwent successful closed reduction of both hips. The clinical course and follow-up assessment of the patient was otherwise uneventful. Computed tomography scans, essential for diagnosing intra-articular loose bodies and subtle fractures, were performed after reduction and revealed in the right hip a nondisplaced acetabular rim fracture of the posterior wall on the side of the posterior dislocation. Hip dislocations are an injury requiring careful trauma evaluation to rule out concomitant injuries. Time to presentation and, more importantly, reduction of a hip dislocation, is essential in treating this injury and preventing long-term complications, such as avascular necrosis and posttraumatic arthritis. The incidence, anatomy, mechanism of injury, treatment options, and long-term sequelae of hip dislocation, with literature review, are discussed.

Hip dislocations occur infrequently and almost always after traumatic injury; 85% to 90% of these are posterior dislocations.1 Bilateral hip dislocations are rare and asymmetric are even more rare, with only 14 reported cases in the literature. A Medline search was performed for articles, using the key words “traumatic bilateral hip dislocation.” The search resulted in 14 cases of asymmetric bilateral hip, all of which occurred in male patients and the majority of which resulted from a motor vehicle accident. To the best of our knowledge, this case report is the first to describe this injury pattern in a female patient. All of the cases reviewed had varying times of reduction of the femoral heads, but all resulted in positive outcomes. Associated injuries that were described included femur fracture2 and acetabular fracture.3

Case Description
A 31-year-old female restrained passenger in a motor vehicle accident was brought by ambulance to the trauma bay after the automobile in which she was traveling collided with a brick wall at approximately 30 mph. Upon arrival, she was found to be hemodynamically stable, with a Glasgow Coma Scale (GCS) score of 15. During the initial evaluation, it was found that there was no loss of consciousness (LOC) or internal injuries sustained during the accident. The patient arrived at the trauma bay within 2 hours of the accident and had obvious deformities of both lower extremities. On physical examination, the right hip was shortened, adducted, and internally rotated. The patient had limited external rotation, with passive and active range of motion, and had greater than 45° passive internal rotation. The left hip was shortened, flexed, abducted, and externally rotated. There was limited internal rotation, with passive and active range of motion, and greater than 45° of passive external rotation. The lower extremities had palpable pulses, with sensation and motor function intact bilaterally.

Initial imaging included anteroposterior radiographs of the pelvis that revealed a right posterior hip dislocation and left anterior-inferior hip dislocation (Fig. 1A). Using conscious sedation (100 mg of IV fentanyl and 4 mg of IV Versed®), the right posterior hip dislocation was reduced first.
with gentle traction and countertraction with both the hip and knee in 90° of flexion. This maneuver was accompanied by gentle internal rotation to clear the posterior acetabular rim, followed by external rotation to position the femoral head within the acetabulum. Once the right hip was reduced, traction and countertraction was applied to the left hip in 45° of flexion and the knee in 90° of flexion. With traction being held, the hip was gently externally rotated to clear the anterior acetabular rim and then internally rotated to seat the femoral head within the acetabulum. A post-reduction radiograph of the pelvis demonstrated reduced hips without any obvious fractures (Fig. 1B). A post-reduction computed tomography (CT) scan showed a small right-sided acetabular rim fracture of the posterior wall (Fig. 2). Radiographs of the wrist and hand showed a fifth metacarpal fracture, treated by delayed operative fixation. At 6 months, the patient was jogging 15 miles per week and complained of an occasional dull aching right hip pain (side of posterior dislocation) only during sudden changes in weather.

**Discussion**

**Anatomy**

The hip joint is a true ball-and-socket joint in which the head is incompletely covered. Because of the depth of the acetabulum, enhanced by the labrum, and its thick capsule and strong muscular support, the hip joint is less likely to dislocate than any other joint in the body. The ligamentous support is provided by strong capsular ligaments that run from the acetabulum to the femoral neck and the intertrochanteric region. The iliofemoral, or Y ligament, is located anteriorly. The ischiofemoral ligament is located posteriorly. The short external rotators adhere to the capsule posteriorly, providing additional stability. The blood supply to the femoral head has been well described. In adults, the main arterial supply is derived from the cervical arteries, which originate from an extracapsular ring at the base of the femoral neck. This ring is formed by contributions from the medial femoral circumflex artery posteriorly and the lateral femoral circumflex artery anteriorly. The capital branches pass through the
capsule close to its insertion to lie on the femoral neck. They then ascend the neck and enter the femoral head just below the articular surface. The superior and posterior cervical arteries are derived primarily from the medial circumflex artery. They are larger and outnumber the anterior vessels. A lesser contribution to the femoral head comes from the foveal artery via the ligamentum teres. With a hip dislocation, whether anterior and posterior, the tenuous blood supply will be compromised, which can lead to an increased risk of avascular necrosis (AVN).

**Mechanism of Injury**

In multiple case studies, the mechanism of bilateral asymmetric dislocation of the hips has been shown to be
The direction of the dislocation is dependent on the position of the hip and the direction of the force vector applied, as well as the anatomy of the femur. Asymmetric dislocation in a patient is due to the differing positions of the lower extremity during impact. The impact on the knee with the hip in an adducted position leads to a backward force, causing a posterior dislocation. In contrast, an anterior dislocation occurs with the hip in abduction and external rotation.

**Associated Injuries and Pathoanatomy**

Associated injuries include those directly related to the hip dislocation and those due to the traumatic incident itself. Ipsilateral injuries include femoral head, neck, and shaft fractures; acetabular fractures; pelvic fractures; sciatic nerve injury; knee injuries; and foot and ankle injuries. Knee injuries, including patellar fractures, ligament rupture, and knee dislocation, are associated with posterior dislocations due to direct trauma to the knee. Intra-abdominal, head, and chest trauma have also been widely reported. A high index of suspicion must be maintained and careful trauma evaluation is necessary for all patients with a hip dislocation. It should also be noted that the frequency of severe associated injuries often causes delay in the diagnosis of dislocation.

With hip dislocations, the capsule and the ligamentum are usually disrupted. Labral tears and muscular injury can occur as well. In anterior dislocations, the psoas is a fulcrum for the hip, and the capsule is disrupted anteriorly and inferiorly. Posterior dislocations tear through the capsule either interposterior or directly posteriorly, depending on the amount of flexion present. The Y ligament is usually intact, and the capsule is stripped from its acetabular attachment posterior to it. In some cases, however, the Y ligament may be avulsed from the acetabulum with a fragment of bone. Fractures of the femoral head are common and may be the result of impact injuries, avulsions, or shear fractures. Impaction injuries commonly occur in anterior dislocations. Avulsed fragments of bone are frequently found attached to the ligamentum teres and lying in the fovea. Posterior dislocations may be associated with acetabular fractures, similar to our patient who sustained a posterior wall fracture.

### Table 2  Systems for Classifying Hip Dislocation

<table>
<thead>
<tr>
<th>Stewart-Milford System</th>
<th>Thompson-Epstein System</th>
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<tr>
<td>Type I Simple dislocation without fracture</td>
<td>Type I Dislocation with or without minor fracture</td>
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<tr>
<td>Type II Dislocation with one or more rim fragments but with sufficient socket to endure stability after reduction</td>
<td>Type II Dislocation with single large fracture of the posterior rim of the acetabulum</td>
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<tr>
<td>Type III Dislocation with fracture of the rim, producing gross instability</td>
<td>Type III Dislocation with a comminuted fracture of the rim with or without a large major fragment</td>
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<tr>
<td>Type IV Dislocation with fracture of the head or neck of the femur</td>
<td>Type IV Dislocation with fracture of the acetabular floor</td>
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<tr>
<td>Type V Dislocation with fracture of the femoral head</td>
<td>Type V Dislocation with fracture of the femoral head</td>
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### Classification System

The first part of the description is the specification of whether the direction of dislocation is anterior or posterior. Those of Stewart and Milford, and Thompson and Epstein are the most commonly used. These classification systems have been found to have prognostic significance, as fractures associated with operative acetabular or femoral head fractures have a worse prognosis than others. In our patient, the classification was SM 2 for the right hip and SM 1 for the left hip (Table 1).

### Diagnosis

In the absence of femoral shaft or neck fractures, the position of the leg is the key to diagnosis. For the posterior dislocation, the leg is flexed, adducted, and internally rotated. With an anterior dislocation, the leg is externally rotated with varying amounts of flexion and abduction. A detailed examination of the entire lower extremity is required to rule out concomitant injury. A single AP radiograph as part of the standard Advanced Trauma Life Support (ATLS) protocol is usually sufficient to confirm the diagnosis. The head will not be congruent in the acetabulum. In posterior dislocations, the head will appear small and will lie superiorly and overlap the acetabular roof. In anterior dislocations, it will appear larger and will either lie inferiorly near the obturator foramen or overlap the medial acetabulum.

### Treatment

The treatment of hip dislocations is aimed at the avoidance of complications. This begins with an emergent reduction. The incidence of AVN increases if reduction is delayed. A closed reduction should always be attempted unless there is an associated hip or femoral neck fracture.

There are several described techniques in the reduction of both anterior and posterior hip dislocations. Regardless of the direction of the dislocation, the reduction can be attempted using in-line traction with the patient lying supine, with countertraction exerted by an assistant holding the pelvis, and with the reversal force of the injury. The preferred method is to perform a closed reduction under general anesthesia; if this is not feasible, reduction under intravenous sedation is possible. Regardless of the direction
of the dislocation, traction should be applied in a steady manner to overcome muscular spasms and elastic restraints. Femoral neck fractures may be caused by overly enthusiastic reduction maneuvers. Three popular methods for achieving closed reduction of the hip are:

1. **Allis method**: Traction is applied in line with the deformity. The patient is placed supine, with the surgeon standing above the patient on the stretcher. Initially, the surgeon applies in-line traction, while the assistant applies countertraction by stabilizing the patient’s pelvis. While increasing the traction force, the surgeon should slowly increase the degree of flexion to approximately 70°. Gentle rotational motions of the hip and slight adduction will often help the femoral head clear the lip of the acetabulum. A lateral force to the proximal thigh may assist in reduction. An audible “clunk” is a sign of a successful closed reduction.

2. **Stimson gravity technique**: The patient is placed prone on the stretcher, with the affected leg hanging off the side of the stretcher. This brings the extremity into a position of both hip and knee flexion of 90° each. In this position, the assistant immobilizes the pelvis and the surgeon applies an anteriorly directed force on the proximal calf. Gentle rotation of the limb may assist in reduction.

3. **Bigelow and reverse Bigelow maneuvers**: These have been associated with iatrogenic femoral neck fractures and are not as frequently used as reduction techniques. In the Bigelow maneuver, the patient is supine, and the surgeon applies longitudinal traction on the limb. The adducted and internally rotated thigh is then flexed to at least 90°. The femoral head is levered into the acetabulum by abduction, external rotation, and extension of the hip. In the reverse Bigelow maneuver, used for anterior dislocations, traction is again applied in the line of the deformity. The hip is then adducted, sharply internally rotated, and extended.

   Approximately 2% to 15% of hip dislocations are irreducible. In anterior dislocations, this may be due to buttonholing through the capsule or interposition of the rectus, capsule, labrum, or psoas. In posterior dislocations, the piriformis, gluteus maximus, capsule, ligamentum teres, or the labrum or a bone fragment may prevent reduction. If the hip is irreducible, urgent, open reduction is recommended. If possible, Judet views, inlet and outlet views of the pelvis, and a CT study should precede the procedure to identify coincident bone injury and possible obstructions to reduction.

   Following closed reduction, radiographs should be obtained to confirm adequate reduction. The hip should be examined for stability while the patient is still sedated or under anesthesia. If an obvious large, displaced acetabular fracture is found, the stability examination need not be performed. Stability is checked by flexing the hip to 90° in neutral position. A posteriorly directed force is then applied. If any subluxation is detected, the patient will require additional diagnostic studies and possibly surgical exploration or traction. After successful closed reduction and completion of the stability examination, the patient should undergo a CT scan to assess for any acetabular femoral head pathology and to evaluate possible loose bodies within the hip joints. If the hip is unstable, then skeletal traction is used.

### Operative Management

The absolute indications for surgery include irreducible dislocations and nonconcentric reductions with intra-articular fragments of bone or cartilage. Irreducible dislocations should be treated as surgical emergencies. Open reduction should be performed from the direction that the hip dislocated. Posterior dislocations are addressed via a Kocher-Langenbach approach. The sciatic nerve is protected, and direct access to impediments to reduction is provided. The capsular disruption may require extension, and interposed soft tissue must be removed from the joint. The acetabulum should be examined for loose bodies before the hip is reduced. After the joint has been cleaned out, the hip is reduced. If an associated posterior wall fracture exists, stability testing is required. After confirmation of the reduction, the bony, capsular and soft tissue injuries are repaired.

Irreducible anterior dislocations are addressed through an anterior or an anterolateral approach. The direct anterior approach will allow better visualization of the anterior joint and femoral head fractures, if present; the anterolateral approach allows access to the posterior hip through the same skin incision, if needed. The approach used depends on the associated lesions.

   Removal of intra-articular fragments of bone or cartilage, especially if the reduction is not concentric, is another indication for surgery. Small fragments that are seen in the fovea and which do not impinge on the head need not be removed. This is a common finding and usually represents a small piece of bone avulsed from the femoral head by the ligamentum teres. The fragments that require removal are interposed between the articular surfaces of the head and the acetabulum. For small intra-articular fragments that will not require fixation, arthroscopic removal may be performed. Using this technique, redislocation of the hip joint is not needed to debride the joint, and additional vascular insult to the head can be avoided. It may also be used to diagnose labral tears. Regardless of the type of surgery, a concentric reduction of the hip should be confirmed before wound closure.

   The final indication for surgery is an unstable fracture-dislocation and requires surgical fixation of an acetabular fracture. Often, stability testing under general anesthesia is required to determine stability. The definitive test for stability is a stress test. Since clinical instability leads to repeated subluxation and arthritis, the most conservative estimate must be used to determining stability. If more than 20%
of the posterior wall of the acetabulum is fractured, stress testing should be performed.\textsuperscript{14} If an open reduction is being performed, direct examination of the hip should be done at the same time. If the hip is being reduced in a closed manner, the use of fluoroscopy will be helpful in assessing stability. The patient is positioned supine. The hip is flexed to 90\degree, internally rotated slightly, and a posterior force is applied.\textsuperscript{4}

**Post-Reduction Treatment**

Strict immobilization leads to intra-articular adhesions and arthritis, and therefore should be avoided. Some recommend a temporary period of traction or balance suspension until the patient’s initial pain has subsided.\textsuperscript{4} After this, controlled passive range of motion exercises with a continuous passive motion (CPM) machine and early mobilization are thought to benefit the patient’s overall condition. Extremes of motion should be avoided for 4 to 6 weeks, to allow for capsular and soft tissue healing. At our institution, the patients with hip dislocations are mobilized as soon as pain permits, with no traction used. The patients are allowed to weightbear, as tolerated. Although early weightbearing has not been shown to add to the initial ischemic insult, it is believed that the amount of collapse in patients who develop AVN may be diminished if weightbearing is delayed.\textsuperscript{24}

Rehabilitation should include strengthening exercises for the musculature about the hip. Proprioceptive training, such as that with the use of a tilt board can be helpful. Return to high demand activities and sports should be delayed until hip strength is near normal.

**Outcome**

In general, anterior dislocations without femoral head injury have a better long-term prognosis than posterior dislocations.\textsuperscript{1} Other variables have also been associated with poorer outcomes, although these may have their effect by inducing AVN or arthritis. Associated injuries have a negative prognostic effect on the clinical result. The most important prognostic factor is probably time to reduction.\textsuperscript{4,15,17,25}

AVN of the femoral head has also been found to occur in dislocations and is a poor prognostic indicator of clinical outcomes. AVN in previous studies was seen in 4.8\% of those patients who received hip reduction in less than 6 hours; however, a 52.9\% rate was seen in those whose hips were reduced after 6 hours. Weightbearing was not shown to have a significant effect on AVN in this study.\textsuperscript{25} The dislocated hips of the patient being reported here were reduced within the first 3 hours and at last follow-up there was no radiological evidence of AVN. Long-term follow-up using imaging to monitor would benefit patients. AVN usually appears within 2 years, but has been seen to occur as long as 5 years after injury. None of the patients in the literature had developed AVN after 6 months of bilateral hip dislocation.

Arthritis is the most common complication in those patients with dislocations from traumatic injuries. It has been shown to occur in up to 24\% of patients, with those who have a sedentary lifestyle having lower rates after 14 years of follow-up. In those involved in the highest levels of manual work, up to 37.5\% were shown to develop arthritis after traumatic accidents.\textsuperscript{5} The damage to the chondrocytes at the time of the injury is probably responsible for the incidence of late arthritis seen after dislocation. It is important to counsel patients about the long-term impact of these injuries.

Sciatic nerve injury is more common after fracture-dislocation than after pure dislocation. If it occurs, it is usually partial and most often affects the peroneal distribution. Resolution after reduction of the dislocation is the rule, and exploration is not required unless nerve function was intact before the reduction and then lost afterward.

**Conclusion**

Hip dislocations are uncommon injuries that result from high energy trauma and require careful trauma evaluation to rule out concomitant injuries. Bilateral asymmetric dislocations are rare. This is the first report of such an injury in a female patient. Early reduction, within 6 hours, and close radiological follow-up, including CT scans, is recommended. It is also essential to educate and follow the patient for evidence of AVN and posttraumatic arthritis.

**Disclosure Statement**

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

**References**