Traumatic Acetabular Fracture in an Intercollegiate Football Player: A Case Report

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Objective: To present the case of a 22-year-old football player who sustained an acute posterior-wall acetabular fracture.

Background: Acetabular fractures can be a difficult injury for the athletic trainer to assess. Aside from the obvious immediate ramifications, proper assessment and care are necessary to decrease the chance of developing posttraumatic arthritis and other long-term complications.

Differential Diagnosis: Anterior column fracture, T-shaped acetabular fracture, segmental fracture of the femoral head, femoral neck fracture, capsular tear, retroperitoneal hematoma, posterior column acetabular fracture.

Treatment: The athlete was treated with open reduction internal fixation using 5 screws and a plate. He pursued a rehabilitation program and returned to full activity 9 months later.

Uniqueness: Acetabular fractures are usually associated with motor vehicle accidents. However, this athlete sustained an injury mechanism that rarely occurs in athletes.

Conclusions: Certified athletic trainers need to recognize the signs and symptoms associated with acetabular fractures. Initial recognition and appropriate management and treatment are essential to avoid long-term complications.

Key Words: posterior wall segment, antalgic gait, avascular necrosis, open reduction, internal fixation

Fractures of the acetabulum, or socket of the hip joint, are relatively common injuries of the pelvis that are most frequently associated with high-energy trauma, such as motor vehicle accidents.1–8 Acetabular fractures, although not usually life threatening, are a potential cause of late morbidity due to the development of osteoarthritis.9,10 However, acetabular fractures rarely occur in athletes, and few cases have been documented in the literature.11,12

The management of a displaced acetabular fracture has improved significantly over the past 30 years. From 1950 to 1970, nonoperative treatment was common, generally consisting of traction with or without manipulation, and good results were reported in 50% to 60% of all cases.8,13 Yet these results were difficult to evaluate objectively because the reports lacked a universal classification or clinical grading system.8 Judet et al3 began encouraging open reduction in the 1960s for all displaced acetabular fractures because closed reduction failed to reduce the fracture fragments in many cases. An accurate reduction with anatomical restoration of an acetabular fracture is probably the single most important factor in achieving a satisfactory outcome.14 During the 1980s and 1990s, the literature reported good to excellent results in 70% to 90% of patients treated with open reduction and internal fixation.4,6,13,15–17

CASE REPORT

During a Division I football game in November 1997, a 22-year-old inside linebacker (height = 187.96 cm, weight = 106.82 kg) was injured. While attempting to recover a fumble, the athlete flexed and internally rotated his hip while the knee remained fully extended. The athlete’s foot was firmly planted in the artificial playing surface. At the end of the play, the athlete remained down on the artificial surface, lying on his left side with the right knee and hip slightly flexed. He was immediately examined on the field by 2 certified athletic trainers. While on the field, the athlete complained of general hip pain but denied any type of subluxing sensation. During a quick assessment, there was no gross deformity, no point tenderness upon palpation, adequate range of motion, and minimal pain, and he eventually walked off the field unassisted. On the sideline, however, he began complaining of hip pain and stiffness. The athlete developed an antalgic gait with sport-specific activity such as jogging, cutting, and zigzag running, but he wanted to return to play. He was referred to the team orthopaedist, who determined that he could not play, and he was sent to the athletic training room to be iced in a pain-free position. After the game, the athlete was placed on crutches, nonweightbearing, for the flight home. Upon arrival, the athlete complained of increased pain and stiffness and was taken to the athletic training room for an additional ice application to the injured area. The athlete was instructed to report to the athletic training room the following morning.

The next morning in the athletic training room, the athlete had diffuse pain in and around the iliofemoral joint and

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exhibited limited to minimal range of motion in all directions. He was examined by the team orthopaedist, who ordered plain radiographs of the pelvis (Figure 1) and an oblique Judet view of the acetabulum. The radiographs revealed a posterior-wall fracture along the posterolateral margin of the dome and the posterior wall of the right acetabulum. After radiographic analysis, the team orthopaedist immediately ordered a computed tomography (CT) scan to better assess the fracture pattern (Figure 2). Findings from the CT scan confirmed the posterior-wall acetabular fracture with some displacement. Transient weakness in the athlete’s right ankle was cause for additional concern. The athlete was then referred to a trauma surgeon.

The athlete and the trauma surgeon met 4 days after the injury to discuss treatment options. The surgeon recommended an evaluation under anesthesia to determine levels of instability and rehabilitation concerns if a conservative treatment option was selected. Conservative nonoperative management would consist of 6 to 8 weeks of touchdown weightbearing (TDWB) activity, followed by a rehabilitation program. However, if the hip was unstable during evaluation under anesthesia, surgical intervention using an open reduction internal fixation procedure would be recommended to reduce the athlete’s chances for an accelerated onset of arthritis. After further consultation, evaluation under anesthesia with possible open reduction internal fixation was scheduled for 1 day later. Open reduction for acetabular fractures should take place no later than 3 weeks after injury.18

Evaluation under anesthesia with fluoroscopic assistance revealed instability of the hip, particularly with flexion and slight adduction; therefore, open reduction internal fixation was performed. The trauma surgeon suspected that the instability was secondary to the posterior-wall fracture. A Kocher-Langenbeck approach was used to surgically repair the damaged hip (Figures 3 and 4). During the surgery, an osteochondral fracture (1 cm × 0.5 cm) off the posterior femoral head was found and surgically debrided (Figure 5). According to Letournel and Judet,4 damage to the femoral head is relatively common with acetabular fractures. In this patient, the avulsed rim of the posterior acetabulum was displaced approximately 5 mm. After surgery, the athlete was extubated and transported to the recovery room in stable condition.

As an inpatient on the first postoperative day, the athlete was placed in a continuous passive motion (CPM) unit. He was initially limited to 30° of hip flexion while on the CPM, but progressed to 60° on the second postoperative day. The athlete was allowed to shut off the CPM unit while napping and sleeping, and the CPM was discontinued after 48 hours. The athlete was discharged from the hospital on the fourth postoperative day.

The athlete reported to the athletic training room on the day he was discharged from the hospital with specific guidelines and protocol from the attending physician regarding his rehabilitation. The athlete was on crutches with limitations of TDWB only for the first month. TDWB is preferred over nonweightbearing with crutches due to the high contact pressures generated by active hip flexion to hold the foot off the ground. He was not allowed to actively or passively flex the hip past 90° or adduct past the midline to prevent initial force across the repaired posterior acetabular wall. Strickland et al18
and had excellent active and passive range of motion. Radiographs indicated good placement of his hardware and no evidence of joint space narrowing or avascular necrosis. The athlete gradually increased his weightbearing at 2 months and was allowed to discontinue the crutches approximately 3 months after injury, but would use them on occasion if pain or an antalgic gait was present. The plan was to continue progressing with his rehabilitation, particularly emphasizing abductor stretching and strengthening. At 4 months after injury, the strength in the hip abductors was equal to the contralateral side. He then gradually increased his activity level by jogging and performing functional activity, with the only limitation being no lower body lifting of free weights (especially squats).

At 5 months after injury, the trauma surgeon noted excellent strength (including hip abduction) and neurologic intactness. Radiographs revealed maintenance of the internal hardware, healing of the posterior-wall acetabular fracture, and no joint space narrowing. The only difference in the radiographs was more pronounced heterotopic ossification in the anterior musculature (Figure 6), which had been present since 1 month postsurgery but became more apparent with time. The athlete was performing at a near-normal level by participating in conditioning drills, weight lifting, and leg presses. He was encouraged to continue with his progression and to begin working with a football blocking sled over the next several months as a gradual return to contact. He eventually participated in the last 2 days of spring football practice (late April) with minimal activity, such as hitting the sled, changing direction, and light running, but no full contact.

He continued a rehabilitative maintenance program throughout the summer, along with progressive strengthening and flexibility exercises. The trauma surgeon saw the athlete just before football double sessions began in August (9 months after injury). Radiographs revealed a well-healed joint, with no positional change of the hardware and no joint space narrowing. At this time, the athlete had been participating in all summer conditioning drills and lifting (squats included) without any problems. He was cleared in August 1998, with no limitations, to participate in full football activity and had no major complications throughout the course of the season.

Figure 5. Osteochondral fragments.

reported that active hip flexion creates the highest acetabular contact pressure within the joint.

The trauma surgeon removed all sutures at 2 weeks after surgery. A straight-leg raise was performed within normal limits, and the athlete was able to actively flex his hip to 80° while the knee was flexed. Limited internal and external rotation of the hip was noted. The athlete was neurologically intact. The short-term goals of rehabilitation were to restore range of motion and to begin isometric and isotonic muscle strengthening within guidelines from the physician.

At 1-month follow-up with the trauma surgeon, the athlete had 0° to 90° of hip flexion without difficulty and good internal and external rotation. Residual weakness was present, particularly in the abductors of the hip. The athlete remained neurologically intact. Radiographic anteroposterior (AP) and Judet views revealed good joint space with no narrowing, healing of the posterior-wall fracture, minimal heterotopic ossification, and no evidence of avascular necrosis. The athlete was allowed to progress to partial weightbearing with crutches. He was instructed to continue with his rehabilitation and follow up in 1 month for additional radiographs. Specific rehabilitation instructions were to be more aggressive with hip-abduction strengthening in order to avoid an antalgic gait once he became weightbearing.

The athlete was then seen back every 1 to 2 months for routine follow-up. He was doing very well, reported no pain,
DISCUSSION

Recognizing a possible acetabular fracture can be a challenge to the certified athletic trainer and other sports medicine specialists. A leg-length discrepancy and a shortened and internally rotated lower extremity on the side of the injury often indicate an acetabular fracture or dislocation.\textsuperscript{1} The Destot sign, or a large scrotal hematoma, may be present in males.\textsuperscript{1} Examination must also include a thorough neurologic evaluation of the motor and sensory function of the sciatic nerve, particularly ankle dorsiflexion and plantar flexion, as well as sensation on the dorsal and plantar aspects of the foot.\textsuperscript{2}

It is important to note that the hip joint lies deep and is surrounded by many muscles; therefore, neither its components nor any possible abnormalities, such as a fracture of the proximal end of the femur or the acetabulum, will be palpable.\textsuperscript{19} Surrounding structures such as the pubic rami, ischial rami, sacroiliac joint, iliac crest, coccyx, and sacrum should be palpated, and any crepitus should be noted.\textsuperscript{1} Applying slight posterior pressure to the iliac crest may elicit pain if an acetabular fracture is present.\textsuperscript{1}

Any athlete who is unable to fully bear weight on an injured hip should be carefully examined and referred immediately for radiographic study. If plain x-rays are negative, further diagnostic imaging, such as a CT or magnetic resonance imaging scan, is indicated to determine the source of pain. During this time, the athlete must be kept on protected weightbearing with crutches until a definitive diagnosis is made.

The mechanism of injury for a posterior acetabular-wall fracture is usually subluxation or luxation of the femoral head as a result of a driving posterior force of the femur when the hip is flexed to 90°. This mechanism is most commonly seen in automobile accident victims who impact the dashboard with a flexed knee, forcing the femur posteriorly.\textsuperscript{1,2,4} A similar mechanism was evident in this patient. The forward momentum of the body, in effect, caused the femur to shift posteriorly. The force resulted in a subluxation of the femoral head posteriorly, with relocation, causing fractures of the posterosuperior dome and the posterior wall of the right acetabulum.

Had the hip been stable, conservative treatment would have been an option. A period of 6 to 8 weeks of nonweightbearing would have been necessary to allow the fracture site to heal, followed by gradual rehabilitation. However, since the hip was unstable, the likelihood of early onset of arthritic changes and an unlikely return to football were all concerns. At the time of injury, the athlete had 1 year of collegiate football remaining and wanted to return and compete during his final year of eligibility.

The surgical option consisted of open reduction internal fixation of the fracture site with screws and a plate. This was followed by a period of TDWB and gradual rehabilitation with an eventual return to full activity. Indications for surgical intervention for a posterior-wall acetabular fracture include more than 3 mm of displacement in the weightbearing roof arc, instability on evaluation under anesthesia, retained intra-articular fragments or incongruent reduction, and involvement of more than 30% to 40% of the posterior articular surface.\textsuperscript{6,7,20–22} The goal of the surgery was to restore the stability of the femoral head and the normal anatomy of the acetabulum.

The Kocher-Langenbeck procedure is the most common surgical approach for posterior-wall acetabular fractures. However, potential complications can occur during the procedure, most notably iatrogenic trauma to the sciatic nerve. Posterior-wall fractures are the leading type of hip trauma associated with sciatic nerve damage and palsies.\textsuperscript{4} Sciatic nerve injury often occurs at the time of a hip injury, and a thorough preoperative examination of the sciatic nerve is necessary to rule this out.\textsuperscript{4} Protection of the sciatic nerve during surgery is essential, and routine monitoring of the sciatic nerve during surgery with electrodiagnostic studies is recommended.\textsuperscript{20,23}

Fractures of the acetabulum present long-term problems for the patient because of the possible complication of posttraumatic arthritis.\textsuperscript{21} Posttraumatic arthritis develops primarily from 2 factors: the damage to the hyaline articular cartilage directly resulting from the high-energy trauma causing the injury and the gradual breakdown of articular cartilage that can occur over the months and years after the injury, especially if articular incongruence is present.\textsuperscript{6}

Another long-term complication of a posterior-wall acetabular fracture is avascular necrosis, especially if the hip has been dislocated.\textsuperscript{24} Typically, avascular necrosis cannot be diagnosed until enough time has elapsed to allow secondary changes to occur, which can take from 6 to 24 months.\textsuperscript{24} However, Letournel and Judet\textsuperscript{4} reported that avascular necrosis is often diagnosed to explain, or blame, a postoperative complication that is actually a wearing of the femoral head against a malreduced fracture line. Patients with avascular necrosis often have severe pain, and persistent symptoms should be investigated.

A late complication that can occur after an acetabular fracture is heterotopic ossification.\textsuperscript{23} In fact, heterotopic bone formation has been reported in up to 70% of all patients whose surgeons have evaluated postoperative roentgenograms for this finding.\textsuperscript{18} Many theories have been proposed regarding the cause of heterotopic ossification, but none have been conclusively proved.\textsuperscript{23} This athlete had heterotopic ossification that gradually increased over several months, but it did not become symptomatic or impede his functional recovery.

CONCLUSIONS

General acute pain in the region of the hip joint can present a challenge for the clinician. By recognizing the signs and symptoms associated with an acetabular fracture, providing proper acute care management, and expediting referral to more definitive care, the certified athletic trainer can reduce the likelihood of multiple long-term complications. Therefore, having a basic knowledge in anatomy and neurovascular structures and understanding the mechanism of injury will assist the certified athletic trainer in managing the athlete with this type of impairment.

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REFERENCES


