Case Report: Pediatric Posterior Wall Acetabulum with Piriformis Entrapment

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Abstract
Pediatric acetabular fractures are rare, accounting for only a small percent of pelvic injuries in children. This is a case of a 12-year-old healthy male who sustained a displaced, right posterior acetabular wall fracture following a ground-level fall. It was ultimately determined to be treated through operative management. Intraoperatively, it was noted that the displaced fragment had become trapped posterior to the piriformis muscle. This prompted the surgical release of the piriformis to mobilize the fragment. Afterward, a quarter tubular plate serving as a buttress and multiple cortical screws were placed to secure the fracture. An additional cortical screw and washer were placed for further compression and rotational stabilization. The piriformis was then repaired. The patient was made nonweight bearing for 6 weeks and seen at routine postoperative visits. At 10 weeks postoperatively, the patient had no complaints of pain or difficulty with ambulation and tolerated full range of motion within his right hip. The patient did not return for follow-up, but the mother was contacted at 1 year postoperatively, and she denied any gait or hip range of motion abnormalities within the patient. Unfortunately, no further follow-up was successfully obtained. While most pediatric pelvic injuries can be treated nonoperatively, it has been shown that nonoperative treatment has increased risk of long-term complications. Therefore, surgical consideration remains important as it presents an opportunity for fewer long-term sequelae.
Introduction

Pelvic fractures account for only 1–4.6% of all pediatric fractures [1]. Of this small percentage, only 0.8–15% involve fractures of the acetabulum [1] making them a rare form of injury. The pediatric acetabulum is composed of the triradiate cartilage, which consists of the three primary ossification centers of the pelvis [2]. Fractures most commonly occur after triradiate closure which takes place around the age of 12 in females and 14 in males [2, 3] and are usually the result of high-energy trauma. A thorough secondary exam should always be performed in these settings as there are many associated injuries to consider including hip dislocations, related pelvic fractures, intra-abdominal and intrapelvic trauma as well as central nervous system injury. Great consideration must be taken regarding the patient’s age, skeletal maturity, fracture pattern, and associated injuries when deciding whether to treat these fractures operatively versus nonoperatively. This report presents a unique displaced posterior acetabular wall fracture with piriformis entrapment of the fracture fragment that was treated successfully with operative management.

Case Report

A 12-year-old male presented to the emergency department with right thigh pain following a fall on his right side after stepping on a basketball while running. He was unable to bear weight on his right leg and complained of anterior and posterior thigh pain. The patient denied hip, knee, and ankle pain. He had 5/5 lower extremity strength bilaterally with normal sensation to light touch throughout. Radiographs of his right femur/hip demonstrated a small bony fragment adjacent to the femoral neck (shown in Fig. 1), and it was documented

Fig. 1. AP right hip radiograph demonstrating a bony fragment superior to the femoral neck.
that this may represent an avulsion fracture. Computed tomography was then performed in
the emergency department demonstrating a displaced posterior acetabular wall fracture
(shown in Fig. 2). The fragment was 3.5 × 1.0 × 1.0 cm (cm) in size and displaced approxi-
mately 1 cm posteriorly.

The orthopedic team was consulted, and it was recommended that the patient use
crutches for toe-touch weight-bearing to avoid stressing the injured region, Tylenol and
Ibuprofen for pain relief, and clinical follow-up early in the week. He presented to the ortho-
pedic clinic using his crutches and stated that his symptoms were improving. His pain was
aggravated by walking and jumping and was relieved with rest, ice, elevation, and over the
counter pain medications. On exam, the patient was able to flex the right hip to 90° without
difficulty. He had minimal guarding with both internal and external rotation of his right hip,
and he had normal sensation to light touch throughout his right lower extremity. The nature
of the injury and treatment options were discussed with the patient and his parents. Given
the size of the fragment and degree of displacement, operative fixation and stabilization
were recommended to ensure hip stability and return to activity in the future. The possi-
bility of later hardware removal to protect the triradiate cartilage and growth plates was
also discussed. Ultimately, the patient and his family wished to proceed with surgery.

The patient was positioned in the left lateral decubitus position, and a standard
posterior approach was taken down to the hip in typical fashion. A small remnant of a labral
tear was identified at the fracture margins which was sharply debrided due to the lack of
reparable tissue. It was noted that the piriformis muscle was interposed between the
fracture site and the displaced fragment which likely inhibited the fragment’s reduction
previously (shown in Fig. 3). The piriformis was ultimately released to allow reduction.
K-wires were used to provisionally stabilize the fracture fragment. It was determined that
a cut and shaped quarter tubular plate would best fit and secure the acetabular wall. This
was then placed posteriorly as a buttress and secured with two cortical screws. An addi-
tional cortical screw and washer were placed on the inferior portion of the wall for further
compression and rotational stabilization (shown in Fig. 4). Afterward, the piriformis was
reattached with 0 Vicryl suture and the hip was placed through range of motion and deter-
mined to be stable.

Intraoperative fluoroscopy imaging was utilized throughout the case. AP and oblique
views of the right hip revealed the surgical hardware to be in place with excellent reduction
alignment across the posterior wall segment (shown in Fig. 5). Postoperatively, the patient
was instructed to avoid hip internal rotation and flexion over 90°. He was to remain nonweight
bearing for 6 weeks and refrain from sports and other high-risk activities. At the 2-week follow-up, sutures would be removed and AP pelvis and Judet views of the right hip would be obtained.

The patient was seen at routine postoperative visits and progressed well. At his 6-week follow-up in the clinic, the patient was ambulating without crutches stating that he had stopped using them 5 weeks postoperatively. He was taking over the counter pain medications at this point and complained only of mild right buttocks pain. At 10 weeks postoperatively, the patient had no pain complaints, was ambulating without difficulty, and tolerated

Fig. 3. Illustration of posterior hip musculature and fracture fragment. From left to right: piriformis traversing from sacrum to the greater trochanter, posterior wall fracture location on acetabulum with piriformis removed, and a lateral view of the fracture fragment overlying the piriformis with resultant displacement.

Fig. 4. Intraoperative fluoroscopic view of the plate and screw construct utilized for fixation of the right displaced posterior wall fracture.
full range of motion of his right hip. X-rays were taken at this 10-week visit (shown in Fig. 6) demonstrating intact hardware. Given the successful avoidance of the triradiate cartilage, there was no plan for hardware removal at this time. Unfortunately, the patient never followed up after this visit. At 1 year postoperatively, the patient’s mother was contacted by phone, and she stated that the patient had no complaints of pain and had returned to sports without difficulty. She further denied any appreciable gait abnormality, restricted range of motion, or decreased leg strength. Future attempts to follow up with the patient and his family were unsuccessful.

Discussion

The main goals of acetabular fracture management include preservation of joint congruency and stability, while minimizing the disturbance of blood supply [2]. The question becomes whether operative or nonoperative treatment will be the most effective. Historically pediatric acetabular fractures had been treated nonoperatively with bed rest, skeletal traction, pelvic slings, or hip spica casts [4–6]. However, more recent studies have demonstrated that...
nonoperative management in the pediatric population has resulted in a high incidence of residual pain, hip instability, growth arrest, limb length discrepancy, and pelvic asymmetry. These studies further demonstrated increased radiographic evidence of post-traumatic acetabular dysplasia, avascular necrosis, delayed union, sacroiliac fusion, and hemipelvic overgrowth [2, 6–9]. In comparison, a separate article retrospectively reviewed surgical outcomes in pediatric patients with unstable pelvic and acetabular fractures. They demonstrated successful outcomes with a low incidence of complications, including a lack of sacroiliac or triradiate growth arrests at 3-year follow-up [10]. Thus, the treatment pendulum has swung in favor of operative treatment, with poorer outcomes resulting from nonoperative treatment.

With the treatment algorithm for pediatric pelvic injuries shifting toward the surgical side, it remains important to have a multidisciplinary approach to these patients. Patient age, skeletal maturity, fracture severity, associated injuries, and surgical risks are crucial factors in this decision-making process to ensure an optimal outcome for the patient. Recent recommendations have defined management based on the fracture displacement and stability. Stable fractures with less than 1 mm (mm) displacement can be managed nonoperatively while fractures with greater than 1 mm displacement, associated hip subluxation, or unstable fracture patterns can be managed operatively [1]. Further studies have stated the importance of preserving the labrum due to its physiologic and anatomic functions in the hip [10, 11]. One study found that a 2 cm labrectomy can lead to reduced hip stability. Therefore, maintaining as much labrum as possible during surgery can result in greater hip stability [11]. Overall, pediatric acetabular fractures remain a rare pathology, and there remains significant room for improved research and outcome studies.

**Statement of Ethics**

This study protocol was reviewed and the need for approval was waived by the University of Michigan Health-West Institutional Review Board. Written informed consent was obtained from the parents of the patient for publication of this case report and any accompanying images.

**Conflict of Interest Statement**

The authors have no conflicts of interest to declare.

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Data Availability Statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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