July Case Presentation: Avulsion Fracture of Ischial Tuberosity

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Chief Complaint: Right Hamstring Pain

HPI: This is 14 year old male who presents for evaluation and treatment of right hamstring pain. The pain started 5/1/09 during long jump competition at school. He heard a pop when he jumped off his right foot and landed in the long jump pit. He had immediate proximal right hamstring pain and an antalgic gait. He was seen by his PMD 3 days later and referred to physical therapy with a diagnosis of a hamstring strain. Initial x-rays were not obtained. He completed 6 sessions of therapy and was instructed to finish therapy at home. He became pain free at rest but always had some mild discomfort with running. He then went to a sports camp in the 3rd week of June, when strenuous activity again caused pain in his right hamstring. Pain is localized to the proximal right hamstring area. He has no pain distal to his knee. He reports no leg weakness. In reviewing his history, there are no unexplained constitutional symptoms including rashes, fevers, weight loss or night time pain or pain at rest.

PMHx: Mild persistent asthma- no recently problems
Developmental History: normal
PSHx: None
Immunizations: UTD
Meds:
Fluticasone Propionate (FLONASE) 50 mcg nasal spray
Albuterol PRN
Fluticasone-Salmeterol (ADVAIR DISKUS) 100-50 mcg MDI
NKDA
Family History: parents and sister healthy
Social Hx: 8th grade student, lives with both parents, older sister is a college athlete

Physical Exam:
Temperature 98.1 °F (36.7 °C), temperature source Oral, height 1.665 m (5' 5.55"), weight 58.3 kg (128 lb 8.5 oz).
Constitutional: Well developed, well nourished, No acute distress
Respiratory: Normal effort, no respiratory distress, no cyanosis
Neurologic: alert, oriented x 3, normal coordination
Psychologic: normal affect, mood and age-appropriate judgment
Skin: Skin over both lower extremities clean, dry, intact, no rash
LE:
Hip and Pelvis:
Palpation: Tenderness: Yes: right Ischial Tuberosity
Masses: Absent bilateral
ROM: Full and symmetric Hip ROM, no pain with internal or external rotation.
Muscle Strength: Right hamstring 4/5 strength
All other muscles of the bilateral hip and pelvis with 5/5 strength Pain with Resistance Testing:
Hamstrings: yes, pain mostly with resisted leg extension, mild pain with hamstring curl
Sartorius: Absent
Rectus Femoris: Absent
Iliopsoas: Absent
Straight Leg Raise: Negative bilaterally
Impingement: Negative bilaterally
FABER: Negative bilaterally
Thomas Test: negative
Ober: negative
Trendelenburg: Negative bilaterally
Popliteal angle 25 R / 25 L

Thigh:
Inspection: No Muscle Atrophy
Soft Tissues: Normal
Palpation: Tenderness: no
Masses: Absent

KNEE
Right knee
Inspection: Normal alignment, Effusion: none, Ecchymosis: none, Soft Tissues normal
Palpation: Tenderness: No, Crepitus: no, Masses: Absent, Range of Motion: normal
Special Tests:
Squat: Patient able to do one leg squat without pain.
Leg Inspection: Calf Atrophy Absent
His foot and ankle exam reveals normal coordination, no effusions or other swelling, and no significant joint instability. His contralateral knee is within normal limits
Neurovascular: Sensation is intact in the Common Peroneal, Tibial and Saphenous nerve distributions with brisk cap refill
Walking Gait: reciprocal with no presence of antalgia

DDx in skeletally immature adolescent athlete:
Chronic Hamstring Avulsion Fracture
Acute Hamstring Avulsion Fracture
Chronic Hamstring strain with scar tissue irritation
Nerve irritation/entrapment secondary to scar tissue
Myositis ossificans
Intra-articular hip pathology
Referred pain from lumbar spine including spinal cord tumor
Soft tissue mass in thigh
Sacroiliac dysfunction
RADIOGRAPHS (images at end of document):
Date: 7/21/10
Views: AP pelvis
My interpretation: avulsion fracture right ischial tuberosity- about 18 mm displaced - fragment is about 40 mm long, small amount of surrounding callus
Assessment:

AVULSION FRACTURE OF ISCHIAL TUBEROSITY - chronic

Case update May 2010:
7/21/09 Case discussed with sports medicine surgeons at host institution. Surgeons not interested in operating without an extended trial of non-operative care. He was treated with complete hamstring rest for 8 weeks. Subsequent repeat x-rays showed no significant changes in avulsion fragment. After 8 weeks of rest, he was pain free walking but still had significant hamstring weakness on manual testing. He was then sent to Physical therapy. During PT, he never was able to return to normal running.
11/25/09 MRI of pelvis showed persistent fracture with edema within the right abductor musculature and right gluteus medius muscle which likely reflecting edema related to altered biomechanics/ muscle strain. Surgeons within the host institution were not enthusiastic about surgical treatment, so alternate surgical opinions were encouraged outside host institution
January 2010- surgical exploration and screw fixation done at an outside institution. According to verbal surgical report, there was significant scar tissue encasing, but not limiting motion of the sciatic nerve. The scar tissue had to be debrided. Screw fixation was complicated by the new callus formation preventing anatomic bony attachment of the fracture fragment back into the ischium.
May 2010- Physical therapy, initially delayed due to delayed bony union, has been initiated. He is still not running.

Discussion:
During adolescence, athletes are at increased vulnerability to pelvic bone avulsion. The apophysis is the attachment site of the tendons to the immature pelvis. In childhood, the apophysis is purely cartilaginous. During adolescence, the apophysis is gradually converted to bone. During this transition phase, the strength of the muscle-tendon junction is generally stronger the bone-cartilage junction. A strong muscle contraction, especially an eccentric contraction, during this developmental age (younger in females) frequently results in an avulsion fracture rather than a muscle strain (1,2,3). This avulsion fracture may be cartilaginous, bony or a combination of both depending on the developmental stage of the apophysis.

Classic clinical presentation of a pelvis avulsion fracture is an acute onset of pain during activity. Athletes will frequently report a popping sensation. On physical exam, athletes will have focal muscle weakness against resistance. Gait is usually impaired. The skin is usually normal (not ecchymotic). Plain x-rays of the pelvis will confirm a bony avulsion, but can miss a pure cartilaginous avulsion.
Common sites for avulsion fractures about the pelvis include the Anterior Inferior Iliac Spine (attachment of rectus femoris muscle), Anterior Superior Iliac Spine (attachment of Sartorius muscle), the Ischial tuberosity (attachment of Hamstring muscles) and the lesser trochanter of the proximal femur (attachment of Iliopsoas muscle). Fractures that are minimally displaced respond well to conservative treatment. Fractures avulsed less than 2 cm from the donor site are generally treated conservatively. Since cartilage will not be visible on plain films, MRI may be required to accurately assess the displacement distance of a largely cartilaginous fracture fragment. Conservative treatment would include limited weightbearing (crutches) until walking pain free. Physical therapy is initiated after the fracture has healed (3).

Acute surgical repair has been advocated for displaced Ischial tuberosity avulsion fractures (4). Surgical access to the ischial tuberosity is usually through a posterior approach. This involves having to cut or retract several muscles. This may lead to some iatrogenic injury, so surgery is generally reserved only for displaced fractures. The amount of displacement needing surgical repair has been debated, but 2 cm is a common cutoff (3, 4). For a large displaced fracture that will need surgical fixation, early identification is important, since the fracture is technically easier to repair during the acute phase of injury.

After the acute phase of injury, scar tissue formation, hamstring shortening and fracture conformation changes all complicate surgical fixation. The scar tissue surrounding the fracture fragment needs to be debrided prior to reattachment. Optimum reattachment requires good bone to bone contact, so the debridement needs to be thorough. The sciatic nerve is at risk for injury during debridement since it is near the surgical field and may be encased in scar tissue. Scarring and retraction of the hamstring muscle may also shorten the hamstring, making reattachment of the fracture fragment to the pelvis difficult. The new callus formation frequently prevents anatomic reattachment of the fracture fragment to the donor site, making stable fixation more difficult. If multiple screws are required to get stable fixation, the risk of complications increases. The combination of these factors all make surgical fixation technically demanding after the acute stage.

References

Hamstring avulsion fracture
Figure 1: Right Ischial Tuberosity Avulsion fracture
Figure 2: MRI Avulsion Fracture with surrounding callus and scar tissue 6mo after original injury
Figure 3: MRI sagittal view of avulsion with fracture fragment rotated
Figure 4. MRI Sagittal view, contralateral side (normal) with normal apophysis orientation