Ischial Tuberosity Avulsion Fracture

Kevin E. Klingele and Jeff Otte

Contents

Abstract

Ischial tuberosity avulsion fractures are uncommon injuries typically seen in adolescent athletes during activities of forced hip flexion with an extended knee position. The injury is often accompanied by the sudden onset of pain and a "popping" sensation in the proximal thigh or buttock region. Initial workup should include a thorough history and clinical exam with pelvic radiographs in the suspected patient. Conservative treatment with rest, restricted activity, and rehabilitation is typically reserved for fractures displaced less than 15 mm. Surgical management is recommended for fragments with displacement greater than 15 mm, those patients who fail conservative treatment, symptomatic nonunions, or for patients with sciatic nerve symptoms. A subgluteal approach is a safe approach that allows adequate reduction and fixation of the fragment. Advantages of this approach include the ability to obtain direct access of the fragment without exposing the sciatic nerve but, at the same time, providing the flexibility of extending the incision to expose the sciatic nerve when necessary. This approach also provides indirect reduction of the displaced ischial fragment with the patient positioned prone and the hip and knee slightly flexed. Symptomatic nonunion can be a complication in patients treated conservatively with severe, initial displacement >15 mm.

1 Brief Clinical History

A healthy skeletally immature, 14-year-old male track athlete presents with history of a sudden onset of pain and "popping" sensation in his proximal thigh, causing him to fall to the ground. Plain radiographs of the pelvis demonstrate a significantly displaced ischial tuberosity avulsion fracture (Fig. 1).

K. E. Klingele (✉) · J. Otte
Department of Orthopedic Surgery, Nationwide Children's Hospital, Columbus, OH, USA
e-mail: kevin.klingele@nationwidechildrens.org; 05ottej@gmail.com

C. A. Iobst, S. L. Frick (eds.), *Pediatric Orthopedic Trauma Case Atlas*,
https://doi.org/10.1007/978-3-319-29980-8_76

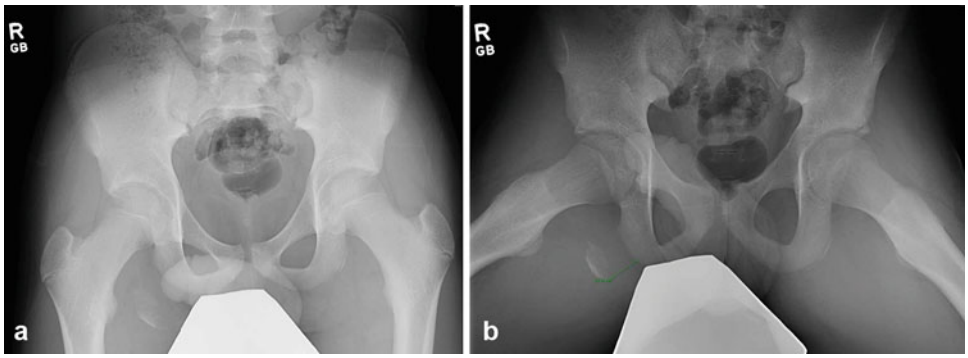

Fig. 1 Plain radiographs at the time of the injury. **a** AP pelvis demonstrating a significantly displaced right ischial tuberosity avulsion fracture. **b** Frog leg pelvis showing 2.2 cm of displacement

On physical exam, he was a healthy-appearing adolescent male with tenderness and a palpable gap about his proximal hamstring origin. He was weak with active knee flexion and had an antalgic gait. No neurologic deficit was present.

2 Preoperative Clinical Photos and Radiographs

See Fig. 1.

3 Preoperative Problem List

- Gait disturbance
- Function-limiting pain
- Acute significantly displaced ischial tuberosity avulsion fracture

4 Treatment Strategy

An initial trial of nonsurgical management with rest, restricted activity, and rehabilitation is recommended in cases with initial displacement of less than 15 mm (Kujala and Orava 1993; Kujala et al. 1997; Kocis et al. 2003). The time to return to full sport activity is approximately 6–12 weeks. Surgical treatment should be considered when the avulsed ischial tuberosity is displaced more than 15 mm, in patients that have failed conservative treatment irrespective of the amount of displacement, or in cases where the sciatic nerve is symptomatic (Kujala and Orava 1993; Vandervliet 2007; Sulko et al. 2011). In the acute setting, the authors recommend open reduction and internal fixation via the subgluteal approach. Following general anesthesia, the patient is placed in the prone position with his hip and knee in a slightly flexed position. A 5–8 cm, transverse incision is made within the gluteal crease. The inferior edge of the gluteus maximus was defined and elevated with blunt dissection. The plane between the gluteus maximus and the hamstring muscles is developed and the gluteus maximus retracted proximally. The avulsed fragment is present at the proximal end of the hamstring conjoint tendon and is reduced and provisionally held in place with one to two smooth K-wires. Prior, limited subperiosteal exposure of the ischial origin will aid in verification of reduction. The use of a large Hohmann retractor may also aid reduction by placing the Hohmann spike at the conjoint tendon-bone interface and levering the fragment proximally. Once reduction is verified and held, screw fixation is performed. Fragment size dictates appropriate fixation, but typically the authors utilize 4.5 mm non-cannulated screws. Postoperatively, the patient is made touch-down weight bearing in a hip abduction brace to prevent hip flexion for a total of 4 weeks.

5 Basic Principles

The ischial apophysis serves as the origin of the proximal hamstring tendon complex, made up of the long head of the biceps femoris, the semitendinosus, and the semimembranosus muscle. This apophysis generally appears between 13 and 15 years of age and fuses to the pelvis at age 16 or as late as 25 years of age (Flecker 1942). As the physis is generally weaker than the tendinous insertion, the apophyseal center is mechanically susceptible to avulsion injury through its physis. Adolescent athletes who have yet to fuse the ischial apophysis are especially at risk for these injuries during activities requiring rapid acceleration and deceleration such as in dancing, track and field, football, and gymnastics (Muscato et al. 2001). If displaced greater than 15–20 mm, such injuries are equivalent to complete, proximal hamstring rupture, and surgical intervention should be discussed.

6 Images During Treatment

See Fig. 2.

7 Technical Pearls

The authors recommend an open approach to the displaced ischial fragment in order to obtain adequate visualization for reduction and fixation. We have found that the subgluteal approach allows safe, easy access to the fragment with the ability to avoid the sciatic and posterior femoral cutaneous nerves located lateral to the ischial tuberosity. Furthermore, this approach requires the patient to be positioned prone with the hip and knee slightly flexed, providing indirect reduction of the hamstring origin and making open reduction of the fragment easier. If there is clinical evidence of sciatic nerve injury or in cases of revision surgery for nonunion, the subgluteal approach can be modified to allow access to the pathology. Using a similar incision in the gluteal fold, proximal retraction of the gluteus maximus first allows exposure of the fragment, but with further dissection lateral, the sciatic nerve can be exposed (Miller et al. 1987). Alternatively, a longitudinal incision running from the gluteal crease down to the posterolateral thigh allows sciatic neurolysis and a z-lengthening of the hamstring tendons if needed to visualize, mobilize, and reduce the fragment.

Fig. 2 Intraoperative fluoroscopic image of the patient from Fig. 1 demonstrating three fully threaded 4.5 mm screws across an anatomically reduced ischial tuberosity avulsion fracture

8 Outcome Clinical Photos and Radiographs

See Fig. 3.

9 Avoiding and Managing Problems

If the symptoms of an ischial tuberosity avulsion fracture are misinterpreted, a significant delay in diagnosis can result, which may ultimately necessitate more extensive surgery (Gidwani and Bircher 2007). Therefore, a correct and timely diagnosis is essential to facilitate optimal treatment. In addition to a thorough history and clinical examination, radiographs of the pelvis should be performed in patients with adequate trauma and clinical findings. In cases of unsuspicious radiographs, ultrasonography or magnetic resonance imaging (MRI) may be helpful to reveal soft tissue injury (Gidwani et al. 2004). Potential complications of conservative treatment include nonunion of the avulsed fragment. The resultant pseudoarthrosis may be associated with chronic pain, the inability to sit for a longer period of time, and a significantly decreased ability to perform sports (Kujala et al. 1997). In such cases, the authors recommend nonunion repair, with a low threshold to extend the approach in order to obtain adequate visualization of the chronic injury and/or the sciatic nerve as described above. Sciatic nerve symptoms may arise in patients treated conservatively or as a

Fig. 3 AP pelvis radiograph of the patient from Fig. 1 demonstrating well-maintained reduction with stable screw fixation with minimal pain on exam

complication after surgical treatment. If the symptoms do not resolve in a reasonable time frame, the authors recommend sciatic neurolysis.

10 Cross-References

- ▶ Hip Dislocation
- ▶ Hip Dislocation with Acetabular Fracture
- ▶ Hip Dislocation with Proximal Femoral Physeal Fracture

References and Suggested Readings

Bahk WJ, Brien EW, Luck JV Jr, Mirra JM (2000) Avulsion of the ischial tuberosity simulating neoplasm–a report of 2 cases. Acta Orthop Scand 2:211–214

Flecker H (1942) Time of appearance and fusion of ossification centers as observed by roentgenographic methods. Am J Roentgenol 47:97–159

Gidwani S, Bircher MD (2007) Avulsion injuries of the hamstring origin—a series of 12 patients and management algorithm. Ann R Coll Surg Engl 4:394–399

Gidwani S, Jagiello J, Bircher M (2004) Avulsion fracture of the ischial tuberosity in adolescents: an easily missed diagnosis. BMJ 329:99–100

Kocis J, Visna P, Vesely R (2003) Traumatic avulsion of the tuberosity of the ischium. Acta Chir Orthop Traumatol Cechoslov 70:311–313

Kujala UM, Orava S (1993) Ischial apophysis injuries in athletes. Sports Med 16:290–294

Kujala UM, Orava S, Karpakka J et al (1997) Ischial tuberosity apophysitis and avulsion among athletes. Int J Sports Med 18:149–155

Milch H (1935) Partial resection of the ischium. J Bone Joint Surg 17:166

Miller A, Stedman GH, Beisaw NE et al (1987) Sciatica caused by an avulsion fracture of the ischial tuberosity. J Bone Joint Surg Am 69-A:143–145

Muscato M, Lim-Dunham J, Demos TC, Lomasney LM (2001) Avulsion fracture of the apophysis of the ischial tuberosity. Orthopedics 12(1127):1198–1200

Pruner RA, Johnston CE 2nd (1990) Avulsion fracture of the ischial tuberosity. Orthopedics 3:357–358

Rossi F, Dragoni S (2001) Acute avulsion fractures of the pelvis in adolescent competitive athletes: prevalence, location and sports distribution of 203 cases collected. Skelet Radiol 3:127–131

Spinner RJ, Atkinson JL, Wenger DE et al (1998) Tardy sciatic nerve palsy following apophyseal avulsion fracture of the ischial tuberosity: case report. J Neurosurg 89:819–821

Sulko J, Olipra W, Oberc A (2011) Ischial tuberosity fractures in children. Chir Narzadow Ruchu Ortop Pol 76:134–137

Vandervliet EJ, Vanhoenacker FM, Snoeckx A et al (2007) Sports-related acute and chronic avulsion injuries in children and adolescents with special emphasis on tennis. Br J Sports Med 41: 827–831

Wootton JR, Cross MJ, Holt KW (1990) Avulsion of the ischial apophysis. The case for open reduction and internal fixation. J Bone Joint Surg Br 4:625–627