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Surgical treatment of an ischial tuberosity avulsion fracture with delayed presentation

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ABSTRACT

Avulsion fractures of the ischial tuberosity usually occur in skeletally immature athletes following eccentric contraction of the hamstrings. When displaced fractures are left untreated, subsequent non-union and proximal hamstring fibrosis may lead to chronic pain and reduced activity. However, the indications for and outcomes of operative fixation when presentation is delayed remain unclear.

We report the case of a 14 year old male athlete who presented to our institution 6 weeks after sustaining a displaced ischial tuberosity avulsion fracture. He underwent open reduction and internal fixation using a cannulated screw system via a posterior approach, with excellent results at 18 months follow-up. We report our surgical findings in detail as well as a novel method for post-operatively assessing functional screw head prominence—the seated radiograph.

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1. Introduction

Avulsion fractures of the ischial tuberosity are rare injuries, usually occurring in skeletally immature athletes following eccentric hamstring contraction due to sudden, forced flexion of the hip with the knee in extension^{1,2}. Failure to treat displaced fractures has been associated with non-union and proximal hamstring fibrosis leading to chronic pain and reduced activity and weakness^{3,4}. The number of reported cases of surgical fixation of these fractures is small.³ Plate fixation provides a stable construct but usually requires an extensive Kocher-Langenbeck approach with risk of damage to the femoral head and injury to the femoral head vasculature^{5,6}. Biodegradable suture anchors may also be used but failure due to suture loosening has been reported.⁷ Cannulated screws represent another alternative, with successful outcomes reported in acute injuries with less than 15mm displacement of the avulsed fragment^{8,9,10,11}. However, results of surgery in cases of delayed presentation are less clear and appear inferior to acute fixation^{4,12}.

1.1. Case report

The subject is a 14-year old boy who is developmentally normal with no past medical history. He was participating in a 400 m athletics race at school when half way through he experienced a palpable and audible popping sensation in his right buttock. He immediately fell to the ground and found it painful to weight bear. He attended a local general hospital where he was advised that the injury could be managed non-operatively and he was allowed to weight bear as tolerated. With ongoing progression of his buttock and posterior thigh pain, five weeks after the initial injury date he was referred to our institution for a second opinion regarding management. At that point the patient was complaining of discomfort around the ischial tuberosity and was unable to return to sports. He had both subjective and objective weakness in his hamstrings on the affected side (MRC Grade 4 out of 5). He rated his pain as 4 out of 10 on the Visual Analogue Scale (VAS), increasing to 6 out of 10 on activity. CT and MRI scans were obtained and, with parental consent, a multidisciplinary discussion around management took place.

Fig. 1 shows radiographs and CT images at the time of presentation demonstrating significant displacement of the avulsed fragment.

With parental consent, a decision was taken to proceed with operative fixation of the avulsed fragment, specifically due to the 26mm separation of the fragment and the activity level of the patient. The operation was performed 6 weeks after the initial injury.

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Fig. 1. 1(a) Anteroposterior and lateral radiographs (upper) and (b) CT (3D reconstruction) at time of presentation showing right ischial tuberosity avulsion fracture.

The patient was positioned prone during the procedure. A longitudinal skin incision was made from the ischial tuberosity along the line of the hamstring tendon origin. Dissection was performed through subcutaneous fat and fascia with blunt dissection close to the zone of injury. The sciatic nerve was identified and protected throughout the procedure with lateral retraction. The posterior cutaneous nerve of the thigh was not seen in the operative field, and therefore was not chased. With the aid of the fluoroscopy images obtained, the fracture was identified. Despite the duration of injury, there was no evidence of any callous formation (either soft or bony) or any scar tissue between the fragment and the inferior pubic ramus. Following mobilisation of the fragment, the fracture site was freshened and prepared using a periosteal elevator. Confirmation of the extent of the fracture bed was confirmed both visually as well as under fluoroscopy. The avulsed fragment was reduced anatomically and held in position temporarily using 2.0mm Kirschner wires under fluoroscopic guidance (Fig. 2).

Three 3.5mm bicortical cannulated screws (20mm, 24mm, 34mm) (Synthes, Raynham, USA) were inserted using 1.25mm guide wires. 3 corresponding washers were used to aid with compression of the screws. The screws were positioned in a divergent manner to increase their biomechanical pull out strength, especially important to resist the strong traction associated with hamstring contraction. Reduction was checked using

Fig. 2. Intra-operative image (left) and image intensifier films showing exposure and positioning of cannulated screws in ischial tuberosity.

fluoroscopy which confirmed anatomical reduction. Soft tissue coverage over the screws was used to reduce screw head irritation. Closure was performed in layers, using 1–0 vicryl to fascia, 2–0 vicryl to the subdermal layer and 3–0 monocryl to skin. A hinged knee brace (locked in 90° of flexion) was then applied.

1.2. Post-operative course

After 2 weeks, a 60–90° range was permitted for 2 weeks, then 30–90° for 2 weeks and 0 to full extension for 2 weeks (i.e. 8 weeks total in the brace, with full extension achieved at 6 weeks). After this he was allowed to fully weight bear, and clinical assessment at this time showed full range of movement of the hip and with recovering but weak hamstrings. At this time, he did complain of some pain in the buttock when sitting on hard surfaces for a prolonged period of time. At 3 months post-operatively he returned to gentle sports at school. By 4 months, hamstring strength was MRC grade 5 out of 5 and he was back to his pre-injury activity level.

Fig. 3 shows a seated radiograph, taken at 3 months post-operatively, performed to assess for screw head prominence, as well as the pelvic radiograph at the time of last follow-up. At 6 months following the procedure, we considered an ultrasound guided corticosteroid injection due to irritation at the site of the most distal screw when seated at school on a hard surface in particular. An Ultrasound scan was performed which revealed that the pain was simply mechanical after sitting for a long period on the ischial tuberosity. There was no evidence of any significant inflammation, bursitis, neovascularity or tendon attrition or fraying. After discussion with the patient and his parents, given the improvement in his symptoms, with simple modifications in the weeks following we elected not to proceed with the injection and not to remove any metalwork. At the 12 and 18 month follow up the patient was engaged in all competitive sports including athletics and football and was discharged from clinic. He scored 80 out of 80 on the Lower Extremity Functional Scale.

2. Discussion

To our knowledge, this is the first reported case of successful surgical fixation of a delayed presentation ischial tuberosity avulsion fracture using screws. The technique we describe utilises a familiar posterior approach with direct exposure and protection of the sciatic nerve.

Ferlic et al. have previously reported successful use of three 4mm cannulated screws in displaced, acute fractures of the ischial tuberosity using a transverse incision with lateral positioning of the patient.⁴ However, in their single reported case of delayed presentation in a 14 year old male, in which the operation was performed 12 months after the initial injury, the child continued to experience pain on sitting and did not return to sport. Patients with

Fig. 3. Seated radiograph used to assess for screw prominence (left) and anteroposterior pelvic radiograph (outlet view) taken at time of last follow-up (right).

less than 15mm of displacement were managed conservatively with excellent result. Kaneyama et al. report on the use of two 4mm cancellous screws, using a subgluteal approach, to successfully treat an acute ischial tuberosity fracture in a 16 year old child presenting within 3 hours of injury. The sciatic nerve was not directly exposed. Time to return to full sporting activity was 4 months¹². An alternative approach that avoids metalwork insertion involves the use of biodegradable suture anchors¹¹. Biedert et al. describe this technique in three athletes who sustained traumatic ischial tuberosity avulsion fractures whilst training. However, one out of the three failed due to suture loosening.

The use of multiple 3.5mm bicortical screws with washers in different projections provided good fixation and compression of the fragment in our case. Of note, there was no evidence of callous formation or difficulty reducing the fragment despite the fact that the time from injury to fixation was 5 weeks. The direct posterior approach we utilised carries less risk of iatrogenic injury than the Kocher-Langenbeck approach described by other authors^{9,13}.

The seated radiograph is a functional method for assessing screw prominence. When taken at 3 months post-operatively, our patient had some discomfort on sitting but based on the radiograph we were able to reassure him that this should settle, and by 4 months post-operatively the pain had subsided with the patient returning to sports at this stage.

Most authors agree that >15mm displacement is an indication for operative fixation in ischial tuberosity avulsion fractures, with the potential complications of conservative treatment in these patients including non-union and chronic pain secondary to shortening and fibrosis at the origin of the hamstrings with an inability to sit for a prolonged period of time.^{3,5} However, the type of operative fixation that should be used has been disputed. We detail a technique that uses a familiar approach with excellent results in a case of delayed presentation.

Conflicts of interest

None of the authors have a conflict of interest to declare.

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