

축구 도중 발생한 좌골 결절 골단의 견열 골절에 대한 증례 보고 및 문헌 고찰

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Apophyseal Avulsion Fracture of Ischial Tuberosity during Soccer: A Case Report and Literature Review

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The incidence of avulsion fracture of ischial tuberosity is reported to present in 1.4%–4% of hamstring injuries. The injury mechanism is known to be caused by a sudden forceful hip flexion in the extended knee with eccentric load to the hamstrings. Although the majority of hamstring injuries are strains of the muscle, avulsion fracture of ischial tuberosity occurs rarely. In this report, a 13-year-old boy with avulsion fracture of ischial tuberosity is presented. Successful clinical outcome was achieved with careful conservative management. Previous literatures including operative indications are reviewed.

Keywords: Avulsion fracture, Ischium, Tuberosity

Introduction

Although the majority of hamstring injuries are strains of the muscle or myotendinous junction, avulsion fracture of ischial tuberosity occurs rarely¹. The avulsion fracture of ischial tuberosity was reported to present in 1.4%–4% of hamstring injuries, caused

by a sudden forceful hip flexion in the extended knee with eccentric load to the hamstrings¹. This acute trauma frequently occurs in adolescents between 15 and 19 years participating sports activity².

Although Kujala and Orava² recommended surgical treatment in cases with bony fragment displacement of >2 cm, there is still no clear cut-off value for surgical indications. In this report, a case of apophyseal avulsion fracture of ischial tuberosity is described with literature review. The patient and his family were informed that the data concerning the case would be submitted for publication and gave their consent.

Case Report

A 13-year-old boy being at 170 cm tall and 64 kg with a body mass index of 22.1 kg/m² sprinted toward the ball during

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playing soccer. His dominant leg was on the right side. He experienced a sharp pain in the left buttock and felt a crack after kicking the ball. He collapsed to the ground due to pain and could not bear weight. At the local orthopedic clinic, he was diagnosed as avulsion fracture of ischial tuberosity with fragment displacement of 1.0 cm and his initial treatment was bed rest with pain control. He was allowed for wheelchair ambulation only for limited purpose such as voiding. However, fracture displacement was aggravated to 1.5 cm and was referred to Hanyang University Guri Hospital. Clinical examination

revealed a palpable gap just distal to the ischial tuberosity with sharp tenderness. Sciatic nerve related symptom or another neurological sign was absent. Pelvis outlet radiograph showed an apophyseal avulsion fracture of the ischial tuberosity with fragment displacement of 1.5 cm (Fig. 1). The computed tomography showed the crescent shaped 5.0×30.0×5.0 mm sized bony fragment (Fig. 2). Magnetic resonance imaging was performed to find other soft tissue related injuries. There were partial tears of hamstrings tendons (biceps femoris, semitendinosus, semimembranosus) (Fig. 3). With progressive displacement of bony fragment within 2 weeks after initial trauma, the patient was admitted to the hospital for absolute bed rest. Knee range of motion was allowed to flex between 30° and 90° on the bed, while avoiding full extension. Having the possibility of further displacement of bony fragment over 2 cm, operative treatment was prepared. However, with conservative management after admission, displacement did not progress. The displacement was maintained as 1.5 cm until 4 weeks after initial trauma. Partial weight bearing was permitted for the next 2 weeks. With progressive improvement of pain and hip range of motion (6 weeks after initial trauma), full weight bearing was allowed. At 6 weeks after trauma, muscle strengthening exercises were added to the rehabilitation protocol. At 2 months, the patient didn't feel any discomfort during walking and local tenderness distal to the ischial tuberosity was absent. On plain radiograph undertaken at 5 months, callus formation was seen on the medial fracture site with proximal bone resorption of bony fragment (Fig. 4). Nevertheless, he had no discomfort in daily life.



Fig. 1. Pelvis outlet radiograph showing avulsion fracture of ischial tuberosity with fragment displacement of 1.5 cm (arrow).

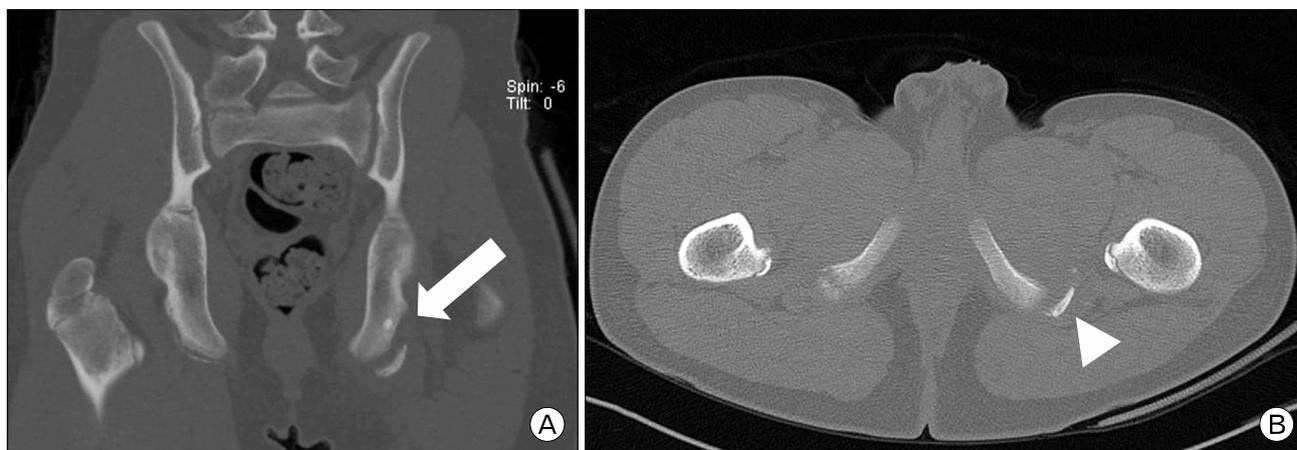


Fig. 2. (A) Coronal bone window computed tomography showing the 5.0×30.0×5.0 mm sized bony fragment which shaped crescentic (arrow). (B) Axial bony window computed tomography showing the bony fragment displaced inferiorly and laterally (arrowhead).

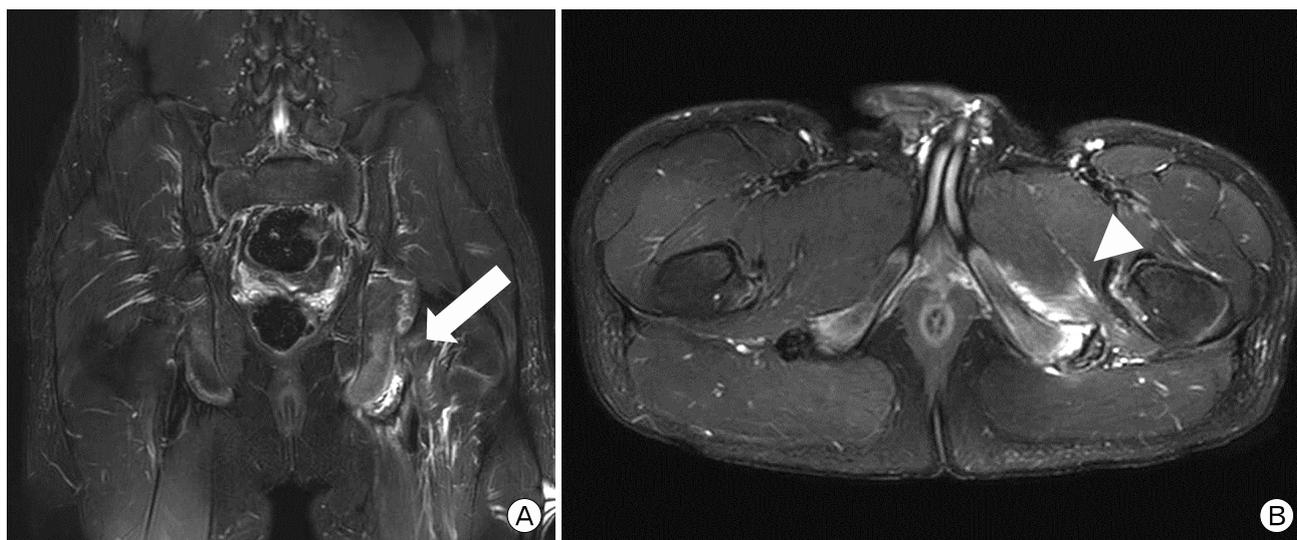


Fig. 3. (A) Coronal T2-weighted magnetic resonance image showing displacement of left ischial tuberosity with partial tear of hamstring tendon (arrow). (B) Axial T2-weighted magnetic resonance image showing apophyseal avulsion of ischial tuberosity and acute strain in adductor magnus muscle (arrowhead).



Fig. 4. Pelvis outlet radiograph at 5 months after trauma showing callus formation on the medial fracture site (arrowhead) with proximal bone resorption of bony fragment (arrow).

Discussion

Avulsion fracture of ischial tuberosity in adolescent is not common and clinicians should be aware of such situations. The presented case occurred during soccer playing and restricted conservative management resulted in successful clinical outcome.

Soccer injuries occur most commonly among other sports with a rate ranging from 3.7 to 29.1 injuries per 1,000 hours of games³. One of the most common soccer injuries involving the lower body is the hamstring injury, which mostly occurs as a hamstring

sprain³. Unlike adults, ligaments and tendons of children and adolescents can withstand more force than bones, thus the apophysis are more prone to avulsion fracture. Additionally, the apophysis of the ischial tuberosity tend to be fused by the age of 25 years which is later than many other epiphyseal centers⁴. Therefore, immaturity of ischial tuberosity during adolescence induces vulnerability to apophyseal avulsion fracture.

Injuries to the ischial tuberosity are in most case related to a sudden forceful hip flexion with knee extended and eccentric load to the hamstrings. Eccentric load generates more force and tension to the insertion than concentric load, causing susceptibility to injuries⁴. In the presented case, repetitive kick motions after intermittent sprinting were likely to have generated excessive eccentric load to the hamstrings, resulting in apophyseal avulsion fracture of ischial tuberosity. Most studies suggested that hamstring injury most commonly occur during the latter part of swing phase when the hamstrings are working to decelerate knee extension in preparation for heel strike⁵. In the biomechanical study, during the follow-through phase of kicking, the knee and hip undergo movements similar to those in the latter part of the swing phase of sprinting⁵. The fatigue effect of decline in eccentric hamstrings strength during the latter stages of the match play might increase the risk of injury³.

Surgical indication for avulsion fracture of ischial tuberosity in adolescent is still in controversy. Ferlic et al.⁶ suggested that

early operative treatment should be considered in physically active patients with the bone fragment displacement of >1.5 cm. They reported that half of conservatively treated patients with the bone fragment displacement of >1.5 cm developed a pseudoarthrosis and received operation finally. Conversely, there are several reports that conservative treatment with fragment displacement less than 2 cm has shown good-to-excellent results in the majority of patients. As reported by Kujala and Orava², surgery is only considered when the bone fragment is displaced more than 2 cm. Conservative treatment with non-weight bearing, limited physical activity, and rehabilitation treatment is usually recommended as primary treatment in cases with bone fragment displacement less than 2 cm. There is a 6-year follow-up case report showing good outcome after conservative treatment for less than 2 cm displaced avulsion fracture of ischial tuberosity⁷. However, further displacement can occur even after conservative management as presented, therefore, close observation and rather strict conservative management such as absolute bed rest may be necessary.

Conservative treatment of displaced avulsion fracture of ischial tuberosity with fibrous union may lead to significant disability including prolonged pain, difficulty of sitting, muscle weakness and decreased functional activity. There are several reports showed that open reduction and internal fixation in chronic cases with disability could relieve symptoms and restore full function⁸. Even if the surgery is done after several months, it is possible to return to normal activities. Sarimo et al.⁹ reported that excellent or good results can be expected with surgery even in chronic cases, but early operative treatment gives better results than late surgery. The possibility of such adverse clinical outcome and possibility of delayed surgical treatment should be warned to the patient and the guardians.

In a systematic review of comparison between operative and nonoperative treatment of proximal hamstring avulsion, operative treatment resulted in superior outcomes as compared with nonoperative treatment¹⁰. Particularly in athletic group demanding excessive activity, surgical treatment should be considered on the preferential basis because operative group showed better hamstring strength and endurance than nonoperative group.

In conclusion, the follow-through phase of kicking in soccer could induce excessive eccentric load, resulting in apophyseal avulsion fracture of ischial tuberosity. Intermittent sprinting and

fatigue effect also might contribute to the vulnerability of injury in soccer. Conservative treatment including well-established rehabilitation program was adequate for apophyseal avulsion fracture of ischial tuberosity case with 1.5 cm displacement. Surgical treatment should be considered preferentially for displaced avulsion fracture of ischial tuberosity if disability prolonged in athletic group.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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