CASE REPORT

Acta Orthop Traumatol Turc 2015;49(2):213-216
doi: 10.3944/AOTT.2015.2996

Apophyseal avulsion fracture of the anterior inferior iliac spine due to a simple bone cyst

Mehmet ELMADAĞ, Hasan H. CEYLAN, Mehmet ERDİL, Kerem BİLSEL

Bezmialem Vakif University Faculty of Medicine, Department of Orthopedics and Traumatology, İstanbul, Turkey

Apophyseal avulsion fractures of the anterior inferior iliac spine are rare; they are usually seen in adolescents as a result of sudden contraction of the rectus femoris muscle. Treatment is usually conservative, but surgical management may be necessary in certain circumstances. We present an unusual case of a 14-year-old male who was referred to our department for a suspicious pathological fracture of his right anterior inferior iliac spine; he was found to have an avulsion fracture of the anterior inferior iliac spine due to simple bone cyst. We discuss the treatment of this rare injury caused by a benign osseous tumour.

Keywords: Avulsion fracture; anterior inferior iliac spine; apophyseal injury; simple bone cyst.

Acute apophyseal pelvic avulsion fractures are rare injuries which occur when the musculotendinous unit is suddenly and vigorously contracted, usually with the muscle in a lengthened position. These fractures are most commonly seen in adolescents, affecting the growing apophyses, which are growth centres where tendon attaches to bone. The apophysis is more prone to fracture in adolescents because its cartilaginous growth plate remains weaker than the attached musculotendinous unit until it fuses at the time of skeletal maturation.[1]

The anterior inferior iliac spine (AIIS), which develops from an anterior inferior apophysis of the iliac crest, is the site of origin of the rectus femoris muscle. Avulsion fractures of this attachment point are most commonly associated with forceful contraction of the rectus femoris muscle, as occurs when running, jumping or kicking a ball.[2,3]

Treatment of such injuries is commonly conservative, including rest, analgesia and rehabilitation. However, surgical treatment may be required, depending on the fracture displacement and the patient's condition.[2-5] Fractures of the AIIS due to acute contraction of the rectus muscle have been reported before.[2,3] To the best of our knowledge, apophyseal avulsion fracture of the AIIS associated with a benign bone tumour has not yet been reported.

Case report

A 14-year-old boy was admitted to our orthopaedic outpatient clinic with a 1-week history of pain in his anterior right groin region. He did not explain a trauma out of a hard football game one week before. A mild pain in his right inguinal region developed after the game, but he was still able to walk. Five days later, he was admitted by his physician. Initial x-ray examination revealed an irregularity on the anterior portion of the AIIS. The

Correspondence: Hasan H. Ceylan, MD. Bezmialem Vakif Üniversitesi Tıp Fakültesi, Ortopedi ve Travmatoloji Anabilim Dalı, 34093 Fatih, İstanbul, Turkey.
Tel: +90 530 – 696 60 45 e-mail: drhhc@yahoo.com

Submitted: July 26, 2012 **Accepted:** February 12, 2014

Available online at
www.aott.org.tr
doi: 10.3944/AOTT.2015.2996
QR (Quick Response) Code

examining orthopaedic surgeon could not rule out a possible tumour and referred the patient to our department for further investigation (Fig. 1).

Physical examination revealed minimal impact on the patient's gait. A mild pain was localized in the right inguinal region, which radiated through the anterior of the thigh. Further examination revealed localized tenderness to the AIIS on palpation and minimal limitations to hip movements due to pain.

Plain x-ray and CT images showed a separate osseous fragment within the soft tissues 7 mm adjacent to the right AIIS (Fig. 2a), suggestive of a rectus femoris avulsion fracture. An MRI evaluation was ordered to rule out malignancy and infectious processes (Fig. 3). There were no signs of calcification around the fragment. A regular 8×25×16-mm cyst with peripheral enhancement was noted at the site of fracture (Fig. 2a, 3). These findings were not consistent with simple trauma and suggested a possible underlying simple bone cyst, which can weaken the bone. Based on the clinical history, examination and radiological findings, no signs of a malignant tumour were detected. Monthly follow-up clinical and radiological examination detected signs of normal fracture healing (Fig. 2b). CT-aided radiologic measurement of cyst density was noted at 38 HU (Hounsfield Unit), which indicates a high density cyst. Biopsy was not recommended, but regular clinical follow-up and restriction of forcefull knee extension was required (Fig. 4). At the 1-year follow-up, the patient had a normal gait without any pain and returned to active sports without any restriction. Functional and radiological results were all satisfactory.

Discussion

This case report demonstrates the diagnostic approach to an apophyseal avulsion fracture of the AIIS related to a benign bone tumour. The AIIS develops from an

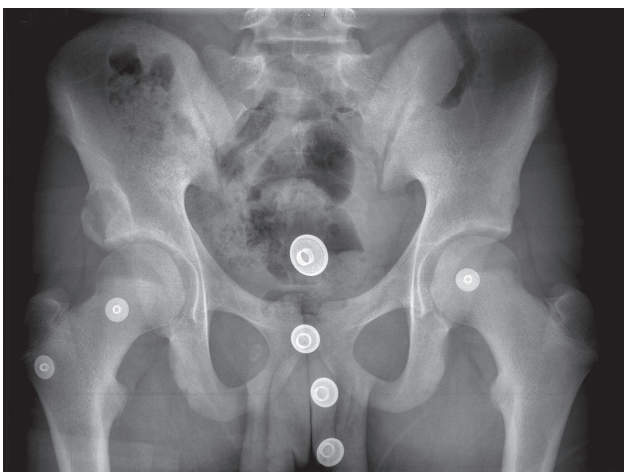

Fig. 1. X-ray examination of the pelvis showing the irregularity at the anterior of the anterior inferior iliac spine.

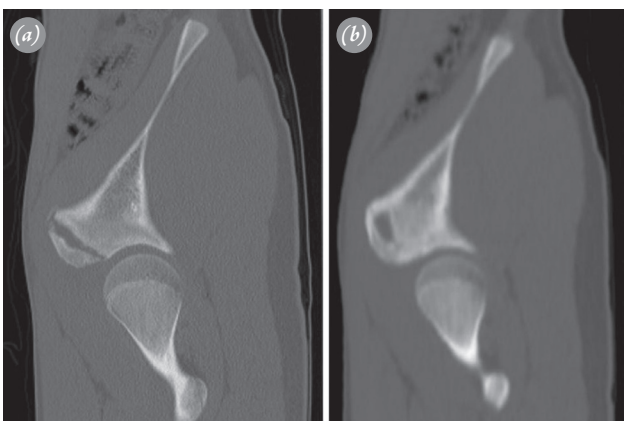

Fig. 2. **(a)** Sagittal computed tomography scan showing the fracture and simple bone cyst and **(b)** signs of normal bone healing after 8 weeks.

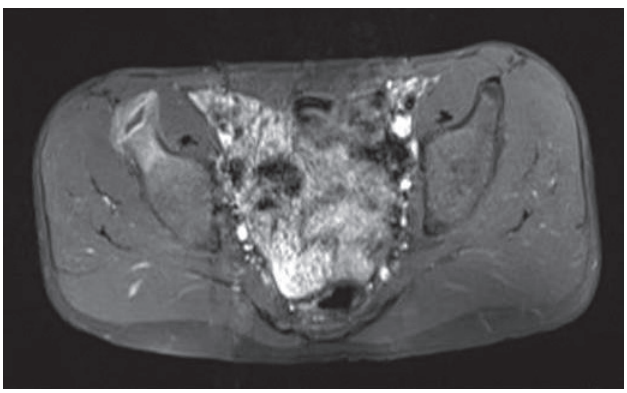

Fig. 3. There were no signs of calcification or malignancy detected at MRI examination. Post-contrast axial image shows a cystic lesion with peripheral enhancement.

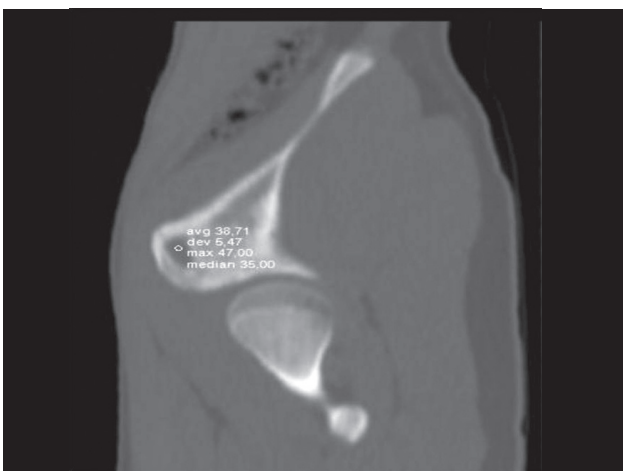

Fig. 4. At the follow-up computed tomography examination, the fracture site density (38 Hounsfield Unit) measurement revealed normal fracture healing.

anterior inferior apophysis of the iliac crest. Avulsion fracture of the this attachment point is most commonly related with the forceful contraction of the rectus femoris muscle in adolescents.[2,3] Avulsion fractures generally occur at secondary ossification centres during early adolescence due to discrepancies in muscular strength and apophyseal strength.[1,6,7] This injury is usually related to sudden or vigorous contraction of the attached muscle. Football players are most often affected, due to sudden and forceful muscle contractions required to perform the repetitive and fast movements; likewise gymnasts, long jumpers and kick-boxers can also be affected.[3-5,9] Avulsion fractures are rarely seen around pelvic apophyses, especially based upon a bone cyst.[4,6-9] Differential diagnosis can be achieved by clinical examination and radiologic imaging.

The rectus femoris muscle arises from the ilium in two heads; AIIS avulsion fractures are caused by the pull of the reflected head of the muscle.[3] The rectus femoris functions as a diarthrodial muscle, which extends the knee and flexes the hip joint. Avulsion fractures are usually caused by movements with concurrent hip hyperextension and knee flexion such as kicking a football. This sudden forceful and unbalanced contraction of the musculotendinous unit causes the avulsion of the muscle origin due to open apophysis in adolescents.[2,3,6,7,10] Pelvic avulsion fractures may also occur due to direct trauma or chronic traction.[2,6,11] The majority of pelvic avulsion fractures in adolescents heal spontaneously with conservative treatment and without complications.[3,6,10]

Several cases of AIIS avulsion fractures have been reported previously.[2-5] An AIIS avulsion fracture may also interfere with fractures of the secondary ossification centre in the superior margin of the acetabulum. Anterior superior iliac spine (ASIS) fracture is more likely to occur in older adolescents and young adults because it fuses later than the AIIS.[2,6,12] Localization of AIIS avulsion fractures is more difficult than fractures of the ASIS due to its deeper localization. The avulsed AIIS fragment is usually minimally displaced inferiorly.[2,6] In our patient, the fragment was located 7 mm below the AIIS. CT imaging can be helpful in an accurate diagnosis.[7]

Simple bone cysts are common, fluid-containing benign lesions, usually located at the metaphyseal region immediately adjacent to the physis.[13] Pelvic localization is very rare and occurs in only about 2% of all cases.[8] Our patient was a 14-year-old skeletally immature boy with an avulsion fracture related to a simple bone cyst under the AIIS apophysis that weakens the bone integrity.

These avulsion injuries usually present with an associated fracture hematoma and develop an excessive callus with post-fracture osteolysis. This may be misdiagnosed with radiological tests as an infective or malignant process such as Ewing's sarcoma or osteosarcoma.[1,4,11] We utilized CT and MRI evaluations to rule out possible malignancy and infectious processes. Biopsy is indicated for inconclusive cases with possible malignancy to rule out tumours prior to planning a management strategy for the fracture treatment.[1,4,8,11,13] Any diagnosed malignant bone tumour should be treated in a multi-disciplinary team setting in an appropriate central hospital. In the case of infection, radiologic signs like periosteal reaction or lytic lesions, and elevation of infection markers like C-reactive protein, can be detected. In our case there were no signs of infection. Our case was a benign tumour case that was diagnosed easily.

Treatment for AIIS avulsions is usually conservative and includes rest and nonsteroidal antiinflammatory drugs in the acute stage followed by gradual mobilization with crutches and toe-touch weight bearing as pain allows over a period of a few weeks.[2-5] The time for full recovery has been reported to vary from 3 weeks to 4 months at literature and our case was recovered in 6 weeks.[3] Non-union was reported in one case that had persistent symptoms and was treated by open reduction and internal fixation.[3]

Surgical intervention for his type of apophyseal avulsion injury has been suggested in selected cases, such as in professional athletes (to shorten rehabilitation time), significantly displaced (more than 1.5-2 cm) fractures, severe rotational deformity, lateral femoral cutaneous nerve entrapment, non-union of the fracture and exostosis formation.[2-5,12,15-17] We preferred a conservative approach for treatment because our patient did not have any of the aforementioned indications. Careful clinical and radiological follow-up is recommended to ensure that the initial lesion is demonstrating signs of normal healing.[14] Surgically treated cases are few, and no improvement in outcomes has been demonstrated.[2] To prevent over-treatment of such cases, each patient must be examined carefully and an essential radiographical evaluation must be done in a cost-effective manner.

Conflicts of Interest: No conflicts declared.

References

1. O'Connor PJ, Groves C. Trauma and Sports-related Injuries. In: Wilson DJ, editor. Paediatric musculoskeletal disease: with an emphasis on ultrasound. Berlin: Springer; 2005. p. 21. CrossRef
2. Gomez JE. Bilateral anterior inferior iliac spine avulsion

fractures. Med Sci Sports Exerc 1996;28:161–4. CrossRef
3. Rajasekhar C, Kumar KS, Bhamra MS. Avulsion fractures of the anterior inferior iliac spine: the case for surgical intervention. Int Orthop 2001;24:364–5. CrossRef
4. Rossi F, Dragoni S. Acute avulsion fractures of the pelvis in adolescent competitive athletes: prevalence, location and sports distribution of 203 cases collected. Skeletal Radiol 2001;30:127–31. CrossRef
5. Saluan PM, Weiker GG. Avulsion of the anterior inferior iliac spine. Orthopedics 1997;20:558–9.
6. Metzmaker JN, Pappas AM. Avulsion fractures of the pelvis. Am J Sports Med 1985;13:349–58. CrossRef
7. Nanka O, Havránek P, Pesl T, Dutka J. Avulsion fracture of the pelvis: separation of the secondary ossification center in the superior margin of the acetabulum. Clin Anat 2003;16:458–60. CrossRef
8. Abdelwahab IF, Hermann G, Norton KI, Kenan S, Lewis MM, Klein MJ. Simple bone cysts of the pelvis in adolescents. A report of four cases. J Bone Joint Surg Am 1991;73:1090–4.
9. Veselko M, Smrkolj V. Avulsion of the anterior-superior iliac spine in athletes: case reports. J Trauma 1994;36:444–6. CrossRef
10. Tüzüner T, Ozturan KE, Karaca E, Ulgür M. Avulsion fracture of the anterior superior iliac spine in a volleyball player. [Article in Turkish] Acta Orthop Traumatol Turc 2003;37:340–3.
11. White KK, Williams SK, Mubarak SJ. Definition of two types of anterior superior iliac spine avulsion fractures. J Pediatr Orthop 2002;22:578–82. CrossRef
12. Kosanović M, Brilej D, Komadina R, Buhanec B, Pilih IA, Vlaović M. Operative treatment of avulsion fractures of the anterior superior iliac spine according to the tension band principle. Arch Orthop Trauma Surg 2002;122:421–3.
13. Hammoud S, Weber K, McCarthy EF. Unicameral bone cysts of the pelvis: a study of 16 cases. Iowa Orthop J 2005;25:69–74.
14. Dhinsa BS, Jalgaonkar A, Mann B, Butt S, Pollock R. Avulsion fracture of the anterior superior iliac spine: misdiagnosis of a bone tumour. J Orthop Traumatol 2011;12:173–6. CrossRef
15. Beisland C, Maehlumshagen PM. Avulsion fractures of the anterior superior iliac spine. Lex coincidentia--again!. [Article in Norwegian] Tidsskr Nor Laegeforen 1997;117:3366–7.
16. Buch KA, Campbell J. Acute onset meralgia paraesthetica after fracture of the anterior superior iliac spine. Injury 1993;24:569–70. CrossRef
17. Cimerman M, Smrkolj V, Veselko M. Avulsion of the anterior superior iliac spine in two adolescent sisters: operative versus conservative treatment. Unfallchirurg 1995;98:530–1.