

Arthroscopic Resection of a Large Bony Exostosis Arising from the Anterior Inferior Iliac Spine Causing Extra-articular Hip Impingement: A Case Series

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What to Learn from this Article?

This article highlights the importance of considering and managing the extra-articular AIIS component of symptomatic femoroacetabular impingement.

Abstract

Introduction: Abnormal morphology of the anterior inferior iliac spine (AIIS) is a rarely recognized but important source of extra-articular hip impingement. Chronic progressive symptoms of stiffness and limitation of hip motion with persistent groin pain may place significant restriction on activity. Concomitant femoroacetabular impingement is often present but recognition and effective treatment of the uncommon extra-articular component is important for successful outcome.

Case Report: Three cases of symptomatic extra-articular hip impingement secondary to AIIS deformity and in conjunction with mild underlying femoroacetabular impingement (FAI) are presented. They include two athletic Caucasian males aged 27 and 35-years old with a history of prior rectus tendon injury and secondary bony exostosis formation and a 53-year-old Caucasian male with a nontraumatic, developmental AIIS deformity. In all cases, an excellent clinical outcome with a full return to pain free activity was achieved postoperation. Their clinical presentation, diagnosis and post-operative outcome at 1.5-2 years (mean 1.7 years) following arthroscopic AIIS resection are discussed.

Conclusion: Arthroscopic management of AIIS extra-articular hip impingement has been rarely reported and the longer-term outcome is unknown. We report the successful clinical outcome in a case series of three patients up to 2 years following arthroscopic AIIS resection. This case series demonstrates the sustainable benefits of arthroscopic correction of AIIS bony exostosis as a cause of extra-articular FAI.

Keywords: Hip arthroscopy, extra-articular hip impingement, anterior inferior iliac spine, bony exostosis, femoroacetabular impingement.

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Introduction

Femoroacetabular impingement (FAI) is a common cause of hip pathology characterized by post activity groin pain and joint stiffness due to the abnormal repetitive contact between the femoral head/neck and the acetabular rim [1].

Extra-articular causes of hip impingement have been increasingly recognized with abnormal morphology of the anterior inferior iliac spine (AIIS) considered an important source. Deformity of the AIIS may arise from a developmental abnormality or from secondary ossification following an acute injury to the rectus femoris tendon or its apophysis. Open or arthroscopic resection of the AIIS deformity may be indicated for chronic symptoms of impingement [2, 3, 4].

We present a case series of three active, male patients with distinct clinical features of extra-articular AIIS impingement; the diagnosis and the mid-term post-operative outcomes at a mean of 1.7 years (1.5-2 years) following arthroscopic surgery, with treatment of concomitant intra-articular pathology, are discussed.

Case Report

Patient 1

A 27-year-old football player presented with a history of an acute-onset discomfort in his right thigh and hip when he went to kick a football during a competitive game. Over a 12-month period, he continued to experience sharp pain in the groin particularly with twisting and turning movements. His symptoms failed to improve with conservative treatment including reduction in intensity of sporting activities, physiotherapy, and platelet rich plasma injections into the rectus femoris tendon footprint on the AIIS (the main location of his pain).

Physical examination revealed restriction of flexion (110°) and internal rotation of the flexed hip (27°). Anterior groin pain developed once the hip was flexed above 60° and increased with flexion, adduction, and internal rotation FADDIR maneuver.

Review of an X-ray series of the right hip including anteroposterior (AP) pelvis, Dunn and false profile views revealed a large bony exostosis extending anteroinferiorly from the AIIS (Fig. 1a). The hip joint was in good condition, however, evidence of mixed FAI was present; a crossover sign was present on the AP pelvis view with a lateral centre-edge angle (CEA) of 34° ; a pincer deformity was clearly observed on the false profile views and an anterior labral tear was evident on magnetic resonance arthrography (MRA) of the hip. There was no significant CAM deformity observed at the femoral head neck region with an alpha angle of 53° measured on the Dunn view.

The patient underwent arthroscopy of his right hip through standard anterolateral and modified mid-anterior portals and an anterolateral pincer deformity was removed using a 4 mm mechanical burr under image intensifier guidance. The torn labrum was repaired using two suture anchors and an interportal capsulotomy was repaired using three fiberwire stitches. The large extracapsular bony exostosis was located using image intensifier guidance. The instruments were then repositioned adjacent to the exostosis which was subsequently removed using a 5.5 mm mechanical burr.

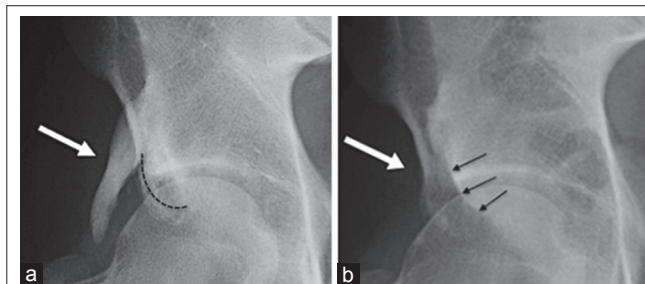


Figure 1: (a) Pre-operative anteroposterior (AP) X-ray image showing large bony exostosis arising from the anterior inferior iliac spine (white arrow) and prominent acetabular rim (black dotted line). (b) AP X-ray image showing complete resection of the exostosis (white arrow) and acetabular rim recession (black arrows) after arthroscopic surgery.

At 3 months postsurgery the patient was able to run with an increased stride and freedom of hip movements. Improvements were observed in flexion by 3° (110° to 113°) and internal rotation by 11° (27° to 38°). Post-operative X-rays revealed complete removal of the large bony AIIS exostosis on all views, with a decrease in the lateral CEA by 9° (34° to 25°) with reversal of the crossover sign evident on the AP pelvis view (Fig. 1b). Optimal resection of the pincer deformity was evident on the false profile view.

Improvements, at 1.5 year postoperation were observed across a range of validated health questionnaires: Modified Harris hip score: 68 (pre-operative) - 100 (post-operative); UCLA activity rating: 9 (pre-operative) - 10 (post-operative); short form-36: 64.8 (pre-operative) - 97.5 (post-operative); WOMAC osteoarthritic index: 28 (pre-operative) - 0 (post-operative).

Patient 2

A 35-year-old physically active male, presented with chronic anterior groin pain for over 5 years. Despite receiving extensive physiotherapy, he had responded poorly with a continued decline in his level of activity due to recurrent symptoms. The patient recalled an injury to his proximal thigh when he was 18 years of age, which settled well with rest and physiotherapy.

Physical examination revealed significant restriction of hip flexion to 112° and internal rotation was limited to 18° (with the hip flexed to 90°); FADDIR testing resulted in pain particularly in the anterolateral region of the joint.

X-rays of the right hip revealed mixed pincer and CAM impingement in a good quality joint with a large exostosis of the AIIS originating at the footprint of the direct tendon of rectus femoris. A loss of lateral head-neck offset was evident on AP pelvis X-rays with an alpha angle of 65° (an alpha angle of 45° was observed on the Dunn view); lateral CEA of 40° was measured and a crossover sign observed; a pincer deformity was evident on the false profile views. MRA scans identified an anterior labral tear in the right hip.

The patient underwent arthroscopy of his right hip with removal of the pincer and lateral CAM deformities. The labrum was found to have a chondrolabral detachment anterolaterally, which was repaired using two suture anchors. The AIIS deformity was located using X-ray

guidance and a complete resection of the exostosis, which was rigidly attached to the pelvis, was performed using a 5.5 mm mechanical burr (Fig. 2a, b, c).

Post-operative X-rays demonstrated an improvement in the lateral CEA by 6° (40° to 34°) and alpha angle by 8° (65° to 57°). Complete resection of the pincer deformity (false profile view) (Fig. 2d, e) and the AIIS bony exostosis (all views) was observed.

At 18 months postoperation the patient was pain free: The range of hip flexion improved by 10° (112° to 122°) and internal rotation (of the flexed hip) by 12° (18° to 30°). UCLA improved from 7 (pre-operative) - 9 (post-operative); WOMAC: 7 (pre-operative) - 3 (post-operative); the mHHS: 100 (pre-operative) - 100 (post-operative) and SF-36: 92 (pre-operative) - 91 (post-operative) remained largely unchanged.

Patient 3

A 53-year-old physically active groundskeeper, presented with a 5-year history of progressive, chronic hip and groin pain, particularly on forward bending or twisting and turning movements. There was a failure to improve with physiotherapy and conservative treatment measures.

Physical examination revealed limited range of hip movement with restriction in flexion (106°) and internal rotation of the flexed hip (28°); a catching sensation and increased groin pain resulted on FADDIR maneuver.

X-rays demonstrated an area of dense ossification from the rectus femoris origin on the AIIS forming a large exostosis over the front of the hip. The quality of the hip joint was good, however, evidence of mixed CAM and pincer impingement was evident: On an AP pelvis view, a crossover sign was observed with a lateral CEA of 33°, an Alpha angle of 57° and 50° was measured on the AP and Dunn views, respectively, and a pincer deformity was clearly observed on the false profile view. An MR hip arthrogram revealed a small, degenerative anterior labral tear.

The patient underwent arthroscopy of the right hip. The labrum was degenerative with an intrasubstance tear anteriorly. Using a (5.5 mm) mechanical burr, the localized pincer deformity beneath the AIIS was removed and the femoral head-neck offset was improved; the labrum was repaired using two suture anchors.

A large 4 cm hardened exostosis originating from the AIIS was resected using the mechanical burr. The exostosis was found to be relatively mobile and not fixed to the AIIS footprint on the pelvis.

Post-operative X-rays demonstrated an improvement in alpha angle by 9° (57° to 48°: AP Pelvis) and by 4° (50° to 46°: Dunn view) and the lateral CEA by 8° (33° to 25°). Complete resection of the AIIS bony exostosis (all views) and pincer deformity (false profile) was observed (Fig. 3), with reversal of the crossover sign also evident (AP pelvis).

At 2 years postsurgery, the patient remained fully engaged in physical activity free from pain with excellent outcome: mHHS - 93 (pre-operative), 100 (post-operative); UCLA 8 (pre-operative), 9 (post-operative); SF-36 - 77.1 (pre-operative), 93 (post-operative); WOMAC - 37 (pre-operative), 2 (post-operative).

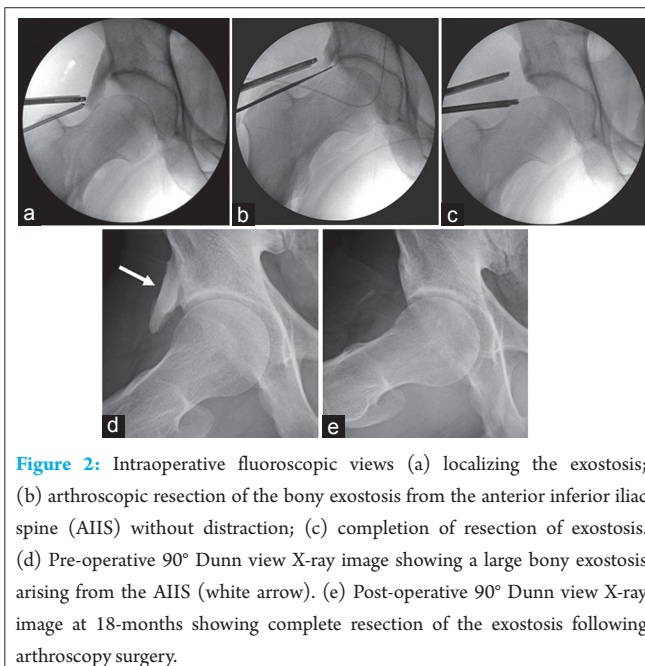


Figure 2: Intraoperative fluoroscopic views (a) localizing the exostosis; (b) arthroscopic resection of the bony exostosis from the anterior inferior iliac spine (AIIS) without distraction; (c) completion of resection of exostosis. (d) Pre-operative 90° Dunn view X-ray image showing a large bony exostosis arising from the AIIS (white arrow). (e) Post-operative 90° Dunn view X-ray image at 18-months showing complete resection of the exostosis following arthroscopy surgery.

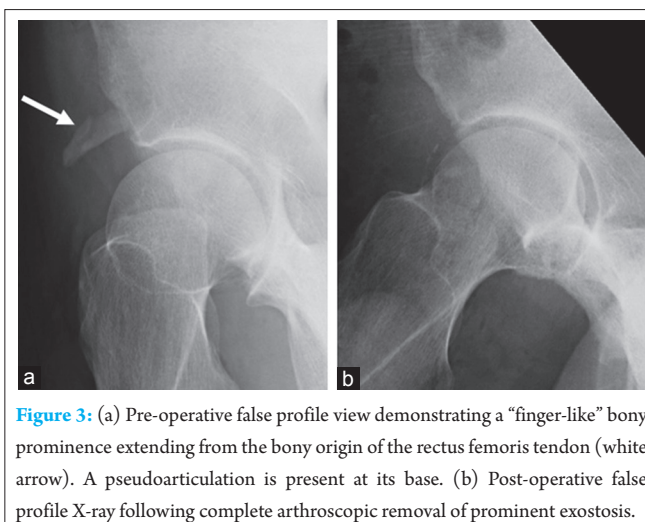


Figure 3: (a) Pre-operative false profile view demonstrating a "finger-like" bony prominence extending from the bony origin of the rectus femoris tendon (white arrow). A pseudoarthrosis is present at its base. (b) Post-operative false profile X-ray following complete arthroscopic removal of prominent exostosis.

Discussion

Abnormal morphology of the AIIS is recognized as a source of extra-articular hip impingement [2, 3, 4]. In patients presenting with AIIS impingement, there is often a history of previous trauma to the rectus femoris muscle or tendon during their adolescence. In most cases, a single explosive contraction of the rectus femoris during hyperextension of the hip joint at the same time as flexion of the knee results in apophyseal avulsion or tearing of the rectus femoris tendon [5, 6, 7]. Athletes who participate in particular impact sports that involve kicking, rapid twisting, and turning or running/acceleration at high speed are at higher risk from this injury [5, 6, 7].

The injury responds well to nonoperative treatment including rest, nonsteroidal anti-inflammatory drugs and physiotherapy with a predicted timeline to full recovery expected anywhere from 3 weeks to 4 months [8]. However, where heterotopic ossification of the injured soft tissues or malunion of the avulsed fragment becomes a source of chronic

or delayed symptoms, surgical intervention may be indicated for relief of symptoms [5, 9].

Abnormal morphology of the AIIS leading to extra-articular impingement may occur as a developmental anomaly without prior injury and may occur from traction hypertrophy by prolonged and excessive strain on the rectus femoris tendon; a retroverted acetabulum with excessive anterior pelvic tilt and following acetabular orientation surgery [4, 10].

In rarer circumstances and less well reported is the presence of the developmental anomaly known as the "pelvic digit" which may contribute to impingement-like symptoms and should be considered in instances of pain and functional impairment in the absence of any history of trauma [11, 12].

In our case series, patients 1 and 2 were involved in high impact sports involving sprinting and forceful kicking motions. These athletes were able to identify a specific instance where injury to the rectus femoris was likely to have occurred. In both cases, a classical pattern of acute injury followed by a chronic or delayed increase in symptoms from extra-articular impingement was evident.

In contrast, patient 3 had no history of trauma but developed a chronic progressive increase in symptoms. A distinct, symptomatic bony projection with a pseudoarticulation with the pelvis was observed, which may represent a developmental abnormality such as a pelvic digit or nontraumatic ossification.

Patients with symptomatic AIIS impingement will generally present to the clinic with limitation of hip movement and associated anterior groin pain. Pain may be present on palpation of the AIIS and rectus tendon origin. Clinical signs may be subtle and similar to that of CAM/pincer FAI, as such an intra-articular injection of local anesthetic may help differentiate the source of the primary symptoms [3, 4].

Imaging is an important resource in helping to confirm the diagnosis: AP pelvis, false profile, and Dunn X-rays should be utilized to assess the hip joints for the presence of CAM/pincer deformity and abnormal AIIS morphology [13]. A computed tomography scan in addition will provide a more detailed three-dimensional image analysis and measures of femoral and acetabular version [14]. MRA will provide information on the presence and location of articular cartilage and labral pathology [15].

While the development of large exostosis in each of our cases was likely the primary cause of impingement-like pain and discomfort, the coexistence with intra-articular abnormalities may have been a contributing factor in each case. An arthroscopic technique was, therefore, utilized in this case series to perform the AIIS deformity resection and to treat the concomitant FAI and associated intra-articular pathology.

Good outcome following open AIIS resection for impingement was originally described by Pan *et al.* [2]. A number of authors have reported good outcome following the arthroscopic resection of AIIS deformity in conjunction with treatment of intra-articular pathology [3, 4, 9, 14].

At a mean of 1.7 years (1.5 - 2.0) following impingement deformity correction, all patients in our series reported excellent functional results, improved range of hip motion, were asymptomatic, with full participation in training and recreational fitness reestablished.

Conclusion

Abnormal morphology of the AIIS may result in symptomatic extra-articular hip impingement and may coexist with intra-articular bony and soft tissue hip pathology.

This case series demonstrates the sustainable benefits of arthroscopic correction of AIIS bony exostosis as an uncommon cause of extra-articular FAI.

Clinical Message

This article demonstrates three distinct clinical presentations of extra-articular hip impingement from abnormal morphology of the AIIS (one post-traumatic case with a failure of conservative management, the second also a post-traumatic case with a delayed return of symptoms 5 years later and the third from a developmental nontraumatic source). Excellent post-operative results can be expected utilizing an arthroscopic technique for resection of the bony deformity with a full return to normal activity up to 2 years postsurgery. The article highlights the need for a high index of suspicion in diagnosis and treatment of active patients with hip and groin pain so that extra-articular sources for impingement are not overlooked.

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