CASE REPORT

Extra-articular hip impingement due to heterotopic ossification formation at the anterior inferior iliac spine following previous pelvic external fixation

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SUMMARY

Femoroacetabular impingements (FAIs), specifically cam type and pincer type, continue to be accepted as causes of intra-articular hip pathology and sources of hip pain. Reports of other causes of hip impingement including extra-articular causes have surfaced recently. One structure of importance is the anterior inferior iliac spine (AIIS) due to its inconsistent bony morphology and the pull of the rectus femoris muscle putting it at risk for an avulsion fracture. Under certain circumstances, open surgical excision of exostosis formation after an avulsion fracture of the AIIS has been used. The case below represents a clinical scenario in which a medically unstable and multiply injured trauma patient had an external pelvic fixator placed as part of the treatment plan for an unstable pelvic injury. Following this pelvic external fixation treatment, the patient went on to develop clinically significant heterotopic bone formation at the AIIS pin site with extra-articular hip impingement syndrome.

fluoroscopically guided endoscopic removal of the implicated HO about the AIIS.

CASE PRESENTATION

A 33-year-old man presented with a 4-month history of right hip pain after an accident on his motorised scooter. Four years previously he was involved in a severe motor vehicle accident. At that time, he sustained a closed head injury, a comminuted scapular body fracture and multiple high-energy injuries to his chest, abdomen, spine, spinal cord and pelvis, including bilateral Morel-Lavallee lesions. He underwent bilateral internal iliac artery embolisation and required a total of four abdominal surgeries for the significant abdominal, ureteral and pelvic injuries he sustained. After multiple surgeries to stabilise the patient, he underwent pelvic stabilisation with bilateral sacroiliac screws and the application of an external fixator with bilateral supra-acetabular pins 5 days after the initial accident (figure 1).

During his hospital stay, the patient required a total of 14 days of intubation. He went on to have an uneventful but long recovery with residual lower extremity neuropathy, back pain, as well as bilateral foot drop from his initial incomplete spinal cord injury. An anteroposterior (AP) of the pelvis was taken following the removal of the external fixator and supra-acetabular pins ~6 weeks after placement without any evidence of HO at either supra-acetabular pin location.

At the time of most recent presentation, the patient described having right hip pain that was constant in nature, was 8–10 of 10 in intensity, and occurred with all activities and motions. His current medications included gabapentin and diclofenac.

On examination, he had a positive straight leg raise, positive anterior impingement sign and positive Flexion Abduction and External Rotation (FABER) test. The patient's lumbar range of motion was decreased by ~50% of normal in all planes. His right hip range of motion was limited to 90° with forward flexion, and internal rotation limited to 5° with the hip flexed to 90°. His left hip range of motion was limited to 100° with forward flexion and internal rotation limited to 15° with the hip flexed to 90°; however, none of these motions on the left hip were painful.

Multiple radiographical examinations were completed of his right hip that included plain films, a CT scan and an MR arthrogram. The AP of the

BACKGROUND

Femoroacetabular impingement (FAI) continues to be accepted as a cause of intra-articular hip pathology and sources of hip pain.^{1–7} Other causes of hip impingement including extra-articular causes have been reported as well.^{8–10} One structure of importance is the anterior inferior iliac spine (AIIS) due to its inconsistent bony morphology¹¹ and the pull of the rectus femoris muscle putting it at risk for an avulsion fracture. The typical pincer-type impingement occurs at an area of the femoral neck that is fairly proximal along the neck, but AIIS impingement occurs at an area that is more distal on the femoral neck when compared to the pincer-type impingement. Previous reports of AIIS impingement have been described with treatment by open decompression or arthroscopic decompression.^{8–10} Under certain circumstances, open surgical excision of exostosis formation after an avulsion fracture of the AIIS has been performed.^{12 13}

To the best of our knowledge, there are no previous reports of heterotopic ossification (HO) formation after external pelvic fixation causing AIIS impingement. We present a case of AIIS impingement that occurred following external fixator pin placement to treat a complex pelvic ring injury with multidirectional instability in a patient with a closed head injury. This AIIS impingement was then treated with hip arthroscopy and

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Figure 1 Anteroposterior of the pelvis following bilateral sacroiliac screw insertion and external fixator placement 5 days after presentation to the trauma centre.

pelvis and CT scan reconstruction of the right hip (figure 2A, B) demonstrated evidence of mixed-type FAI with additional AIIS impingement and an associated 6 mm area of HO. The MR arthrogram of the hip demonstrated borderline abnormal α (59°) and centre edge angles (37°) and evidence of a complex anterior superior labral tear. On the AP of the pelvis (figure 2A), there was an incidental finding of HO at the left AIIS but this was found to be asymptomatic and did not block hip flexion.

The patient was diagnosed with mixed-type FAI, a labral tear and AIIS impingement secondary to pelvic HO and Brooker type-2 heterotopic bone.¹⁴ Hip arthroscopy was recommended to evaluate and treat his hip pathology, labral tear and mixed-type impingement, as well as an open surgical excision of the AIIS heterotopic bone.

INVESTIGATIONS

Radiographs and CT scanning were used as they best illustrate bone architecture.

DIFFERENTIAL DIAGNOSIS

Through the investigations listed above, as well as a detailed physical examination, the diagnosis was determined.

Figure 3 Intraoperative fluoroscopic view after endoscopic debridement of the AIIS heterotopic bone.

TREATMENT

During surgery, the patient was found to have significant synovitis in his hip joint that was debrided. The labrum was noted to have extensive bruising with a complex tear along the most anterior aspect of the labral attachment consistent with injury due to his known area of AIIS impingement. Owing to the extensive damage, the labrum was debrided and smoothed along its edges. The ligamentum teres was found to be partially torn and was partially debrided with electrocautery. A femoral osteoplasty was completed with a 5.5 mm circular burr. After the intra-articular pathology was treated, the extra-articular pelvic HO around the AIIS was attempted to be addressed endoscopically with fluoroscopic guidance (figure 3). This was completed with a bilongitudinal splitting of the rectus femoris and removal of the bony piece with the 5.5 mm circular burr. The removal of the pelvic HO was confirmed with fluoroscopic imaging, and the need for any additional open surgical excision procedure was aborted. The hip capsule was closed with absorbable suture, the patient was kept overnight and discharged home.

Figure 2 (A) Anteroposterior radiograph of the pelvis 4 years after pelvic external fixator removal showing the large right anterior inferior iliac spine (AIIS) exostosis. (B) CT reconstruction of the pelvis 4 years after pelvic external fixator removal showing the large right AIIS exostosis.

Figure 4 (A) Anteroposterior pelvis radiograph 1 week postoperatively. (B) False profile radiograph of right hip 1 week postoperatively.

with indomethacin 75 mg extended release daily for 6 weeks as prophylaxis against recurrent HO. He remained toe-touch weight bearing and used antirotation boots for 2 weeks while in bed.

OUTCOME AND FOLLOW-UP

The patient followed up in clinic 1 week later where he was found to have 105° of forward flexion (preoperatively 90°) and 20° of internal rotation with 90° of forward flexion (preoperatively 5°). At the time of his 1-week follow-up, an AP of the pelvis, frog leg lateral and false profile views of his right hip were taken (figure 4A, B). By 4 weeks after surgery, the patient was ambulating without difficulty and had painless hip flexion to 90°. One year after surgery, the patient remained pain free without any difficulty ambulating and able to flex his hip to 90° without any pain or limitation.

DISCUSSION

The malalignment and abnormal mechanics of the proximal femur with the acetabulum or pelvis result in the formation of FAI.⁷ There is more recognition of additional causes of FAI beyond cam-type or pincer-type mechanisms.^{7–9} In the above case, the patient's hip impingement created from HO formation at the external fixator pin sites caused significant limitations in hip motion. These restrictions resolved after endoscopic removal of the HO. To the best of our knowledge, this offers an additional cause of FAI that has not been previously reported.

Decompression of AIIS impingement has been previously reported with either an open procedure or an arthroscopic procedure, and both treatment options appear to be effective.^{8–9} In the above mentioned case, decompression of the AIIS was performed in a fluoroscopically guided endoscopic approach. This additional technique offers another option when decompressing the AIIS.

HO has been a recognised area of complication in orthopaedics. Previous reports of the incidence of HO after open reduction and internal fixation of acetabular fractures and in total hip arthroplasty have ranged from 5% to 90%.^{15–17} There have also been reports of both insignificant and clinically significant HO following arthroscopic treatments of hip pathology, ranging from 1% to 12%.^{18–19} Risk factors for the development of HO include traumatic brain injury, spinal cord injury, male sex, history of previous HO, osteoarthritis, older age, ankylosing spondylitis and obesity, among others.^{15–20–21} Our patient had multiple risk factors for HO development including a closed head injury with spinal cord injury, prolonged intubation with

multiple surgeries and immobility, male sex and obesity. The most likely aetiology of this patient's HO at the AIIS was due to a combination of his closed head injury as well as the placement of the supra-acetabular external fixation pins.

Prophylaxis of HO has been described to include non-steroidal anti-inflammatory drugs including indomethacin, diclofenac, naproxen, as well as preoperative or postoperative radiation therapy.^{15–22–30} After the removal of the HO at the AIIS, the patient was placed on indomethacin extended release 75 mg once daily for 6 weeks. At the time of this report, there is no evidence of reformation of the HO at the right AIIS.

Learning points

- ▶ Heterotopic bone formation is a potential sequela of using a pelvic external fixator in a patient with an unstable pelvic fracture.
- ▶ Heterotopic bone formation can lead to extra-articular anterior inferior iliac spine (AIIS) hip impingement.
- ▶ Extra-articular AIIS hip impingement was able to be treated successfully several years later, using a fluoroscopically guided endoscopic approach.

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Competing interests None declared.

Patient consent Obtained.

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