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Case Report

Intra-articular hip joint osteoid osteoma: Challenging diagnosis and percutaneous radiofrequency ablation treatment☆

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ABSTRACT

Atypical intra-articular osteoid osteoma can be difficult to diagnose and challenging to treat. We report a case of a right acetabular subchondral intra-articular osteoid osteoma in a young male patient which was initially diagnosed as femoroacetabular impingement due to its atypical clinical and radiological presentations. After fully working up the patient the lesion was successfully treated with percutaneous CT-guided low-power bipolar radiofrequency ablation using several per procedural articular cartilage thermal protective measures including intra-articular thermocouple, and continuous per procedural joint space cooling with Dextrose 5% solution. A precise RFA electrode placement, using the No-touch technique, and applying different passive and active thermal protective measures were helpful in avoiding collateral damage of the hip joint articular cartilages. atypical intra-articular osteoid osteomas necessitate pertinent correlation between the clinical and radiological presentations. As far as intra-articular or subchondral nidus ablation is concerned, thermal protective measures should be considered.

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Introduction

Osteoid Osteoma (OO) is a benign osseous neoplasm accounting for 10% of all osseous tumors. Of which, about 10-12% are intra-articular osteoid osteoma (IAOO) [1,2]. OO was categorized by Edeiken in 1966 into: cortical, cancellous and subperiosteal [3].

Atypical presentation of hip IAOO makes its diagnosis challenging. Atypical pain with inconstant night pain is one of the clinical symptoms. Associated joint effusion, painful gait, leg length discrepancy, muscle atrophy and synovitis also have been reported [4,5]. Clinically, it can mimic primary osteoarthritis (OA), internal derangement of hip, sacroiliitis, juvenile arthritis and brodie's abscess [6,7,8] which can lead to delayed diagnosis of IAOO, inappropriate management and subsequently development of complications such as premature OA, growth disturbance as well as non-steroid anti-inflammatory drugs (NSAIDs) side effects [9,10]. Atypical radiologic features of IAOO such as absence of sclerosis or calcified nidus with presence of other additional findings such as joint effusion and synovitis with collateral articular cartilage damage or premature OA makes the diagnosis difficult to reach [11,12].

Treatment of IAOO can be non-surgical by administration of oral NSAIDs or surgically through open/arthroscopic resection or through arthroscopic assisted radiofrequency ablation (RFA). However, the gold standard treatment of OO is CT-guided RFA. Other alternative minimally invasive image-guided procedures include cryoablation, microwave ablation, or laser ablation [13-18].

The non-specific clinical and radiologic presentation of IAOO makes the diagnosis challenging and early diagnosis with proper selection of treatment technique prevents the unwanted complications of IAOO. Herein we report our case of hip joint IAOO without sclerotic nidus clinically presented as femoroacetabular impingement (FAI) in a young male which was treated percutaneously using low-power bipolar RFA with intra-procedural articular cartilage protective measures.

Case presentation

An otherwise healthy 26-year-old male was referred to our hospital for chronic right hip pain and was initially diagnosed with right hip FAI. Our patient had a 2-year history of right hip joint on and off pain which was initially triggered by mountain climbing. Pain was aggravated by mechanical stress and relieved by NSAID which he occasionally took for unbearable pain. Pain did not worsen at night. On physical examination the patient had a limited range of motion with painful active abduction and internal rotation of the hip. He had a normal gait. The blood count and inflammatory markers were normal.

His pelvis radiograph was unremarkable while the hip joint CT and MRI scans showed subtle subchondral lucency in the anterior wall of the acetabulum with significant surrounding bone marrow and soft tissue edema and trace amount of joint effusion (Figs. 1a and d). There was no subchondral fracture. We extended our imaging workup to evaluate the labrum and cartilage by performing MR Arthrogram with dynamic enhancement study which demonstrated normal intra-articular structures (Fig. 1e). We observed an early arterial enhancing subchondral lucency and delayed enhancement of the surrounding bone marrow (Fig. 1f). The subchondral lucency was not filled with injectate. On histopathology the specimen collected showed no cartilage component, only inflammatory cells for which a radiologic-histopathologic correlation was recommended. Hence, our final diagnosis was atypical IAOO.

Percutaneous CT-guided RFA was proposed to the patient. After explaining the procedure benefits, risks and complications to the patient, an informed consent was then obtained. Under general anesthesia and CT guidance, the anterior acetabular wall IAOO non-sclerotic nidus was approached antero-laterally using 12G bone trocar (AprioMed BONOPTY AB, Uppsala, Sweden), targeting the anterior aspect of IAOO in order to use No-touch technique to protect the acetabular cartilage. A 7mm active tip 17G low-power bipolar RFA electrode (Medtronic OsteoCool RF Ablation Probe Kit, Mississauga, ON, Canada) was coaxially introduced (Figs. 2a and b). To ensure cartilage safety, we continuously injected cold dextrose solution (D5W) mixed with iodinated contrast medium in the joint space in conjunction with an intra-articular thermocouple placement (Fig. 2a,b). The lesion was ablated for 6-minutes at 70°C (maximum power supply was 20 Watt internally adjusted). Patient was discharged after 4 hours on NSAIDs for 5 days.

The patient presented to the interventional radiology clinic after 2 weeks free of pain with a normal full range of motion. On a 6-month phone interview follow-up, the patient had no complaints. Follow-up dynamic enhanced MRI was done after 9 months and showed complete resolution of the bone marrow and surrounding soft tissue edema with no enhancing nidus (Fig. 2c,d). There were no MRI signs of collateral damage of the hip joint articular cartilage.

Discussion

We present our case of atypical clinical presentation of hip IAOO which presented with chronic on and off pain that had abrupt onset, initially triggered by mountain climbing and alleviated by NSAID. IAOO often causes constant pain that worsen at night and is not associated with trauma, as demonstrated by Spiker et al in their article reviewing 40 hip IAOO cases [19]. They observed 15 out of 18 recorded cases had worsening pain at night, 23 out of the 33 recorded cases had their pain relieved by NSAIDs [19]. Our patient had no worsening pain at night and his pain was occasionally improved by NSAID. Unlike our case Barnhard et al observed abnormal gait in 4 patients [20].

The radiologic features were also atypical due to the absence of both reactive bone sclerosis and centrally calcific nidus. Other possibly encountered radiological features of IAOO include chondrolysis, periarticular osteopenia, joint effusion and synovial thickening [6,12]. Unlike Germann et al's retrospective study on 21 IAOO cases where they observed that joint effusion and synovitis were present in all patients [21], our patient did not have synovitis and only had trace joint

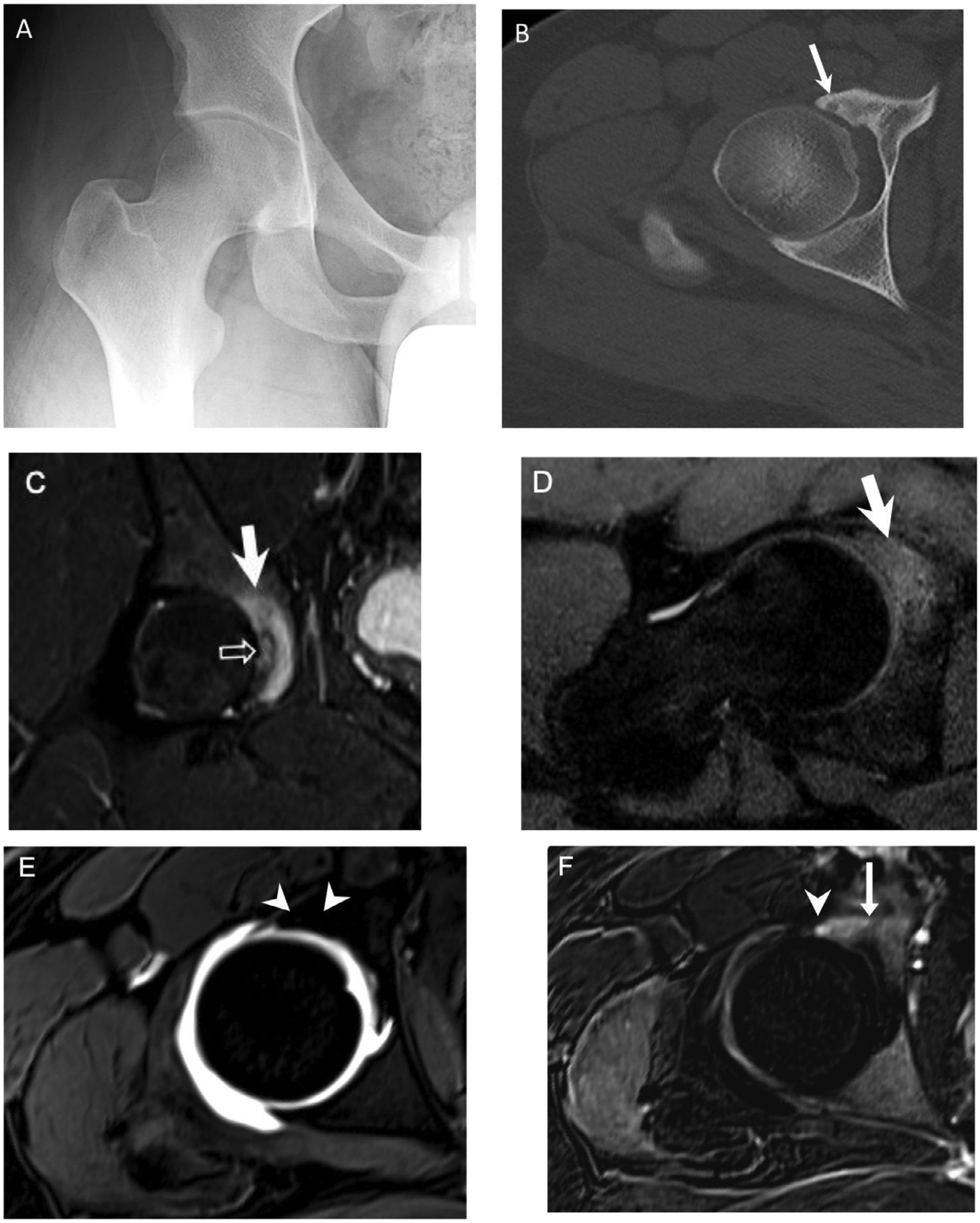

Fig. 1 – (a) Plain radiograph of right hip demonstrates normal hip joint space without osteochondral lesion, or reactive sclerosis. (b) CT scan of right hip demonstrates subchondral lucent lesion (solid arrow) of the anterior acetabular wall without reactive sclerosis or periosteal reaction. (c d) Coronal and axial T2 fat-saturated weighted MR images demonstrate high signal intensity nidus (white open arrow) with surrounding reactive bone marrow edema (white solid arrow). No joint effusion is noted. No injectate fills the subchondral defect. (e) Axial T1 fat-saturated MR Arthrogram image demonstrates normal overlying cartilage without delamination. The subchondral defect is not filled with injectate (arrow heads). (f), Axial subtraction post contrast MR image demonstrates avidly enhancing subchondral nidus (arrow head) with mild perilesional bone marrow enhancement (white solid arrow). (Color version of the figure is available online.)

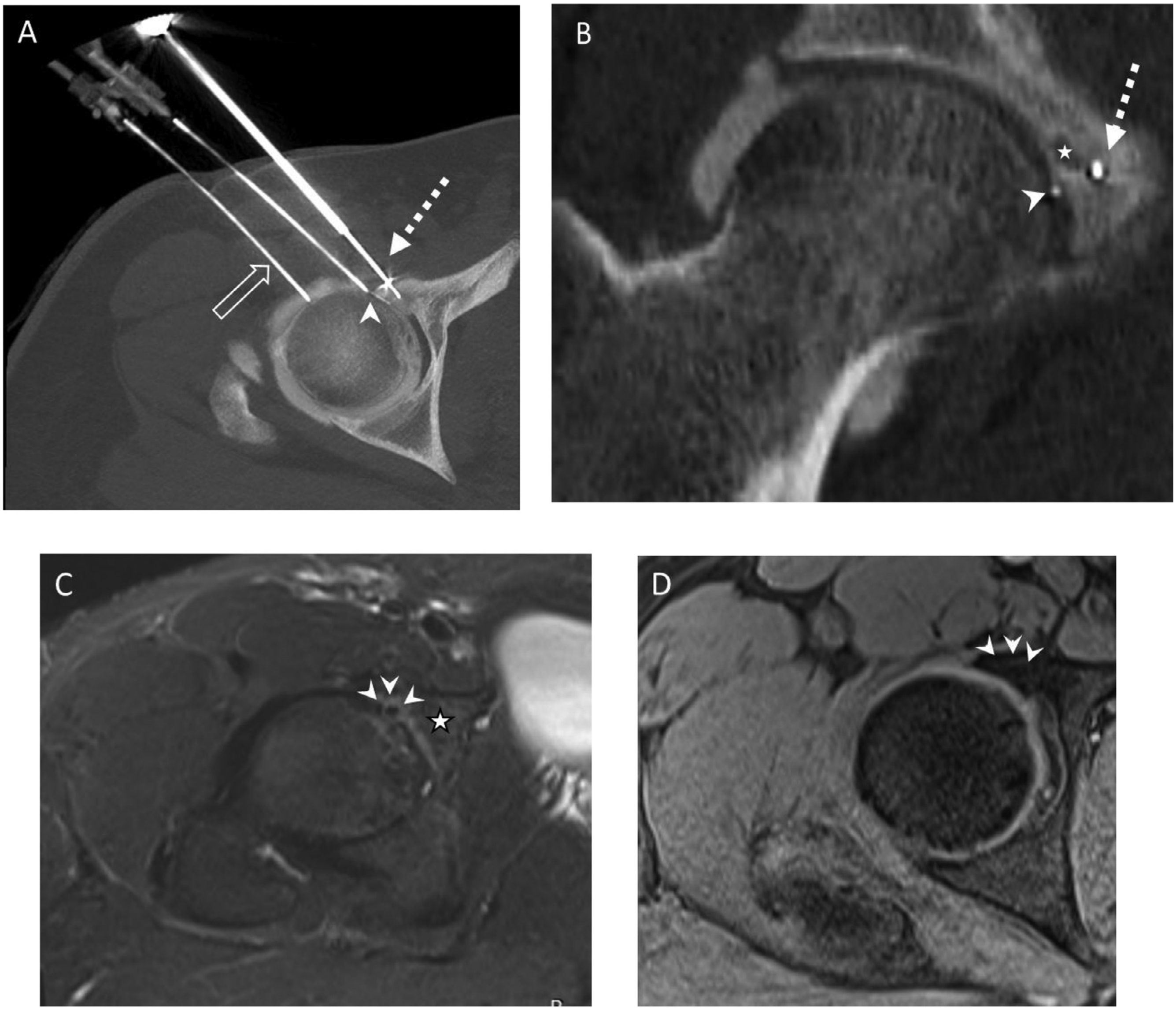

Fig. 2 – (a b) Axial and coronal oblique intra procedural CT scan images, demonstrating placement of low energy bipolar RFA electrode (dotted white arrow) anterior and medial to the osteoid osteoma nidus (white star) using No-touch technique. The thermocouple (white arrowhead) is intra-articularly placed and seated posterior and lateral to the nidus. Intra-articular hydrodissection and cooling with cold dextrose mixed with omnipaque were performed through the spinal needle (open white arrow). (c) Post treatment axial oblique T2 fat-saturated MR image demonstrates low signal intensity nidus with improvement of the surrounding edema and no cartilage damage. (d) Post treatment axial T1 fat-saturated dynamic enhanced MR image demonstrates no enhancing nidus.

effusion. Moreover, because of the lesion's small size, it radiologically mimicked an osteochondral defect, although the overlying cartilage was intact. Le Corroller et al, published a case of a painful knee subchondral focal cartilage defect mimicking osteoid osteoma, which showed by CT arthrogram a chondral flap that was filled with injectate and was treated by RFA [22]. The overlap with other hip pathology like internal derangement of hip, sacroiliitis, juvenile arthritis, brodie's abscess and transient synovitis may lead to delaying in the diagnosis [6-8]. Spouge et al found that the average delay in IAOO diagnosis is 2.5 years and reached up to 10 years in some cases [23]. In our case, there was a 2-year misdiagnosis as an internal derangement of the hip.

The main challenge in our case was to administer percutaneous RFA treatment without causing collateral damage of the joint at this difficult location of the anterior acetabular subchondral IAOO. Thanks to using three different per-procedural protective measures simultaneously we were able to avoid expected complications such as chondrolysis, osteonecrosis and labral damage [24-26]. These protective measures were using a No-touch technique of low-power bipolar RFA electrode, continuous intra-procedural joint cooling and intra-articular placement of thermocouple for passive temperature monitoring.

The No-touch RFA technique aims to ablate the target lesion without directly penetrating it but rather by including the lesion within the RFA probe's ablation zone. Up to our knowledge this technique has not been utilized before in treating IAOO, rather it has been widely used during percutaneous ablation of liver tumors with the interest of reducing risk of tumor recurrence through microscopic satellite cells within the vicinity of tumors and reduced heat sink effect [27,28]. This technique has been successfully used to treat liver tumors in difficult locations including subcapsular tumors [29]. Following a similar logic, we utilized the No-touch RFA technique to minimize the risk of direct acetabular cartilage damage which we successfully achieved. This technique necessitates longer ablation time and higher energy compared to direct lesion ablation. We tried to overcome this obstacle by using bipolar RFA which is efficient in delivering the desired energy in a short time of ablation. The disadvantage of No-touch technique is the produced larger ablation zone compared to direct targeted tissue ablation, especially in bone which has less heat sink effects. The No-touch technique can be exploited as a direct protective method in cases like IAOO by excluding the cartilage from the ablation zone [30-32]. By using bipolar RFA electrode instead of unipolar electrode we achieved a more precise ablation zone, minimizing heat conduction to adjacent structures. Furthermore, using low-power RFA in conjunction with the No-touch technique helped keep the ablation zone to a strict minimum given that the ablation zone will increase in size more than the expected proportional increase as we raise the power [33]. This way the IAOO nidus was covered in half diameter of the ablation zone (Fig. 2a,b). Another advantage of using low-power RFA was reducing the temperature increment within the joint as illustrated by Borne et al in their in vivo experiments[33]. Using high power RFA increased the average temperature for the duration needed to achieve a similar ablation zone size which can be avoided [33].

The greatest risk for indirect cartilage damage was due to increased temperature within the synovial fluid and cartilage damage was observed at 50°C [34]. For femoral cartilage protection, we took advantage of the added space offered by using the No-touch technique to introduce a thermocouple within the joint in close proximity to the cartilage serving an optimal setting to assess synovial fluid temperature, and made sure the temperature did not reach 40°C. Furthermore, intra-procedural joint cooling by injecting cold dextrose (D5W) solution was actively helping in protecting the adjacent femoral articular cartilage. Indeed, both passive (continuous temperature monitoring) and active protective measures were utilized to protect the femoral cartilage but also the acetabular and femoral subchondral bone.

In conclusion we report a diagnostically challenging atypical hip subchondral IAOO which was uneventfully and successfully treated by low-power bipolar RFA with several per-procedural articular cartilage thermal protective measures.

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