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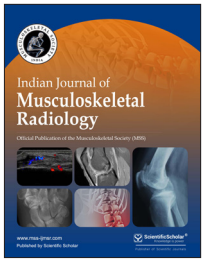

Case Report

Role of MRI in the differentiation of early myositis ossificans and soft-tissue sarcoma

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ABSTRACT

Myositis ossificans (MO) is a benign, self-limiting condition characterized by abnormal ossification of soft tissue. MO occurs most commonly in the setting of trauma, however can also develop spontaneously. A peripheral rim of zonal calcification within the affected region represents the classic late-stage appearance and is considered virtually pathognomonic. During the early stages of MO development, diagnostic uncertainty may, however, arise as its imaging features can demonstrate overlap with malignant lesions such as soft-tissue sarcoma. This may lead to unnecessary further investigations, including image-guided biopsy. Recognition of the imaging features of early MO using magnetic resonance imaging (MRI) can provide the radiologist with more diagnostic certainty and help obviate the need for unnecessary investigation of this benign entity. This case offers an example of how MRI can achieve this diagnosis during the early multimodality investigation of an indeterminate soft-tissue mass.

Keywords: Myositis ossificans, Sarcoma, Tumor mimic

INTRODUCTION

Ultrasound (US) evaluation of soft-tissue "lumps and bumps" is a commonly performed radiological investigation. Frequently, non-specific sonographic findings regarding solid lesions leads to further investigation with magnetic resonance imaging (MRI) for exclusion of sinister pathology. This offers superior tissue contrast resolution in the evaluation of solid soft-tissue masses and as such can offer greater diagnostic information, potentially avoiding the pitfall of an incorrect diagnosis of malignancy. In this article, we report a case of atraumatic myositis ossificans (MO) initially misdiagnosed on imaging as a soft-tissue sarcoma. The MRI features of early MO will be discussed and how if recognized, could have helped achieved an earlier diagnosis.

CASE REPORT

A 75-year-old female presented with pain in her right groin. There was no history of trauma, anticoagulant therapy, or significant medical history. Examination revealed a tender swelling on the medial aspect of her upper thigh. Initial imaging included an US of the right groin showing a deep-seated solid soft-tissue lesion without demonstrable internal vascularity on Doppler interrogation [Figure 1]. Subsequently, MRI was performed which localized the lesion within the adductor brevis muscle. The lesion was isointense to muscle on T1 [Figure 2a], and hyperintense to muscle on T2 and STIR sequences [Figures 2b-d]. The lesion enhanced homogeneously

following contrast administration [Figure 3]. Notably, the T2 sequence demonstrated a "striated" appearance within the lesion [Figure 2b]. STIR sequence demonstrated mild perilesional edema with additional edema extending into the adjacent adductor muscles [Figure 2c and d]. A differential of extraskeletal sarcoma was offered and the patient was referred for US-guided biopsy, 4 weeks after the initial presentation.

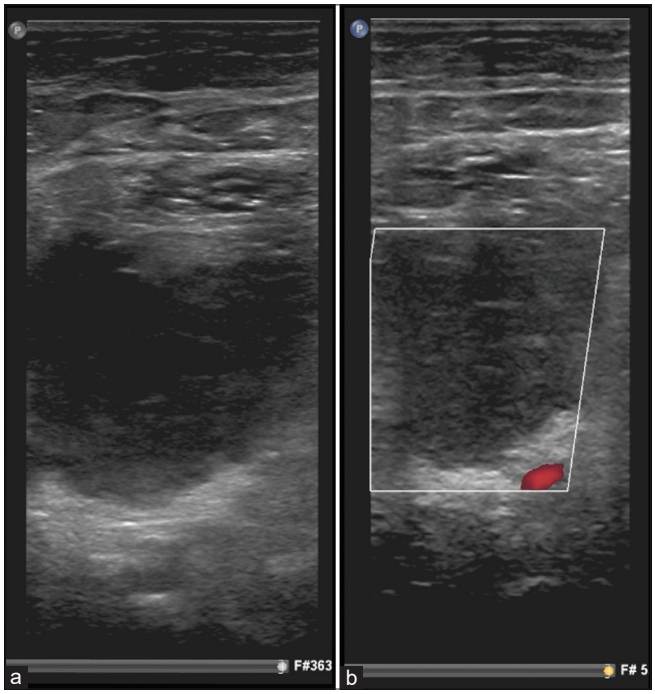

Figure 1: Ultrasound of the right inner thigh shows a hypoechoic soild deep soft-tissue mass (a) without any significant internal vascularity (b) .

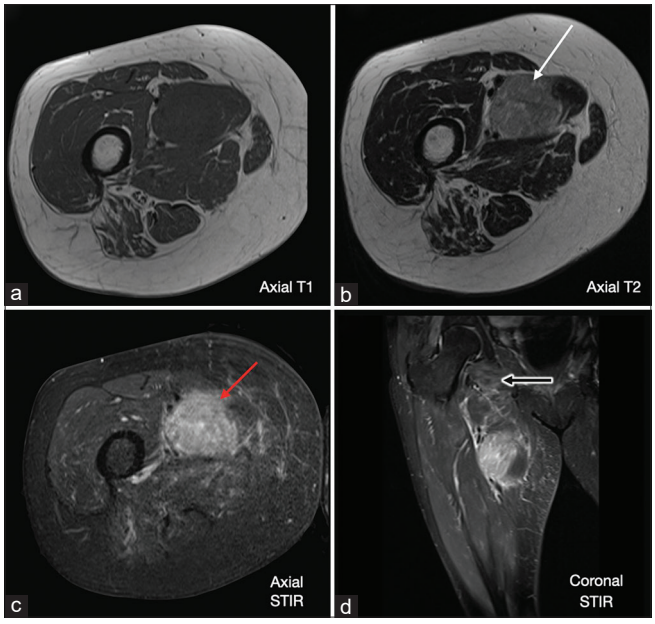

Figure 2: Axial T1-weighted image (a) shows a 3.4 × 4 cm (AP×TV) intramuscular lesion within the adductor brevis which is isointense to skeletal muscle. Axial T2-weighted image (b) shows that the mass is high in signal with an internal "striated" appearance (white arrow). Axial and coronal STIR-weighted images (c and d) demonstrate that the lesion is high in signal with surrounding perilesional edema (white arrow) which extends into the remaining adductor muscles seen superiorly to the mass (black arrow).

US at this stage showed marked posterior acoustic shadowing in the lesion indicating interval development of calcification [Figure 4]. Further, investigation with computed tomography (CT) was advised following biopsy, which showed a rim of peripheral lesional calcification suggestive of MO [Figure 5]. Histopathological analysis confirmed the presence of bony trabecula and intervening spindle cells within biopsied skeletal muscle, in keeping with the diagnosis of MO [Figure 6].

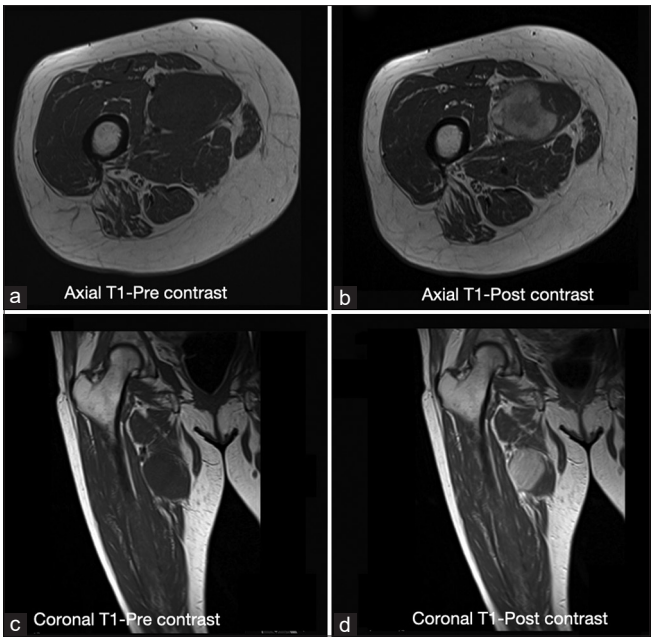

Figure 3: (a-d) Axial and coronal T1 pre- and post-contrast weighted images show relative homogenous enhancement within the intramuscular lesion.

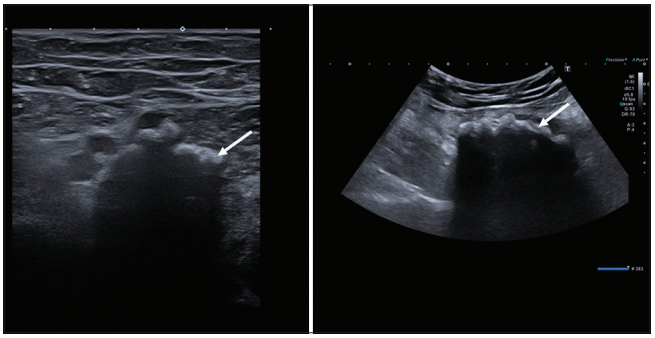

Figure 4: Ultrasound 4 weeks after the MRI demonstrated marked posterior acoustic shadowing to the lesion suggesting calcification (white arrow).

DISCUSSION

MO, or heterotopic bone formation, is a benign self-limiting condition typified by the abnormal ossification of soft tissue. The etiology remains unknown, however, pathologically this condition represents vascularized granulation tissue differentiating to bone.[1] MO is typically secondary to trauma, often involving the large muscles in the lower limbs. Diagnostic pitfalls can arise in non-traumatic cases as benign lesions including MO may be overlooked. Misdiagnosis of MO has been reported in 25–40% of patients who have no associated history of trauma, as in our case.[2]

The imaging and clinical findings of MO vary depending on the stage of development. The process of MO can divide into three phases: Early (<4 weeks), intermediate (4–8 weeks), and mature (>8 weeks). It is during the early phase where distinguishing MO from soft-tissue sarcoma using imaging and histopathology is most difficult due to considerable overlap in the imaging and pathological findings. Histopathological analysis of both lesions at this stage can reveal similar findings, specifically of a mass predominately consisting of fibroblasts, myofibroblasts, and immature osteoid matrix.[3] This is in contrast to the mature stage, when a more assured diagnosis of MO can be made based on the classical peripheral rim of calcification, best assessed on CT, or plain radiography.[1]

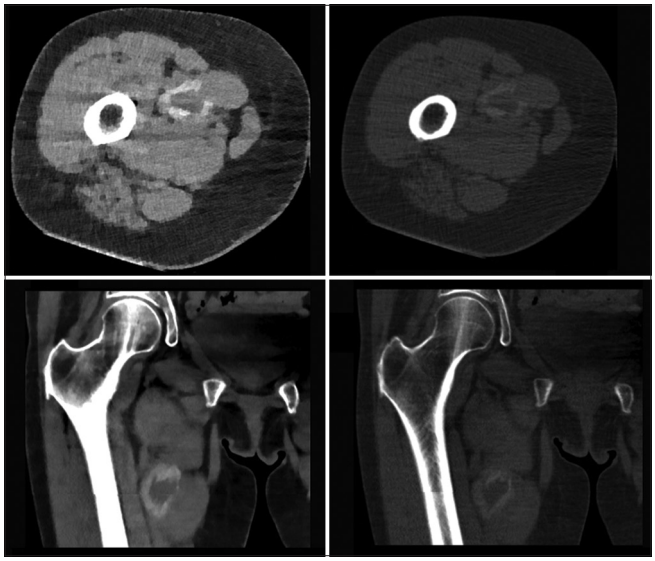

Figure 5: Axial and coronal non-contrast CT with soft tissue and bone windows shows a peripheral rim of calcification.

Non-traumatic causes of MO pose a particular diagnostic challenge, primarily as the absence of trauma makes clinical suspicion low. Furthermore, it is difficult to establish a precise time when the initial hematoma first occurred making the expected phases of MO development on imaging more difficult to establish. In the early phase of MO, appearances on US, MRI, and CT can mimic those of soft-tissue sarcoma; namely, a solid, enhancing intramuscular. An awareness of the specific MR features of MO at this stage can help narrow the differential diagnosis.

During the early phase, MO displays non-specific MRI features appearing isointense to muscle on T1, hyperintense on T2/STIR sequences, and enhancing following administration of contrast.[4] Several specific MR findings have been reported during the early phase, however, which may direct the radiologist to consider a diagnosis of MO rather than a sarcomatous lesion. These include the "striated" appearance, best appreciated on T2 and STIR sequences where there is preservation of the normal muscle fascicles interspersed with proliferating fibroblasts and myofibroblasts. This feature is not usually seen with sarcomas

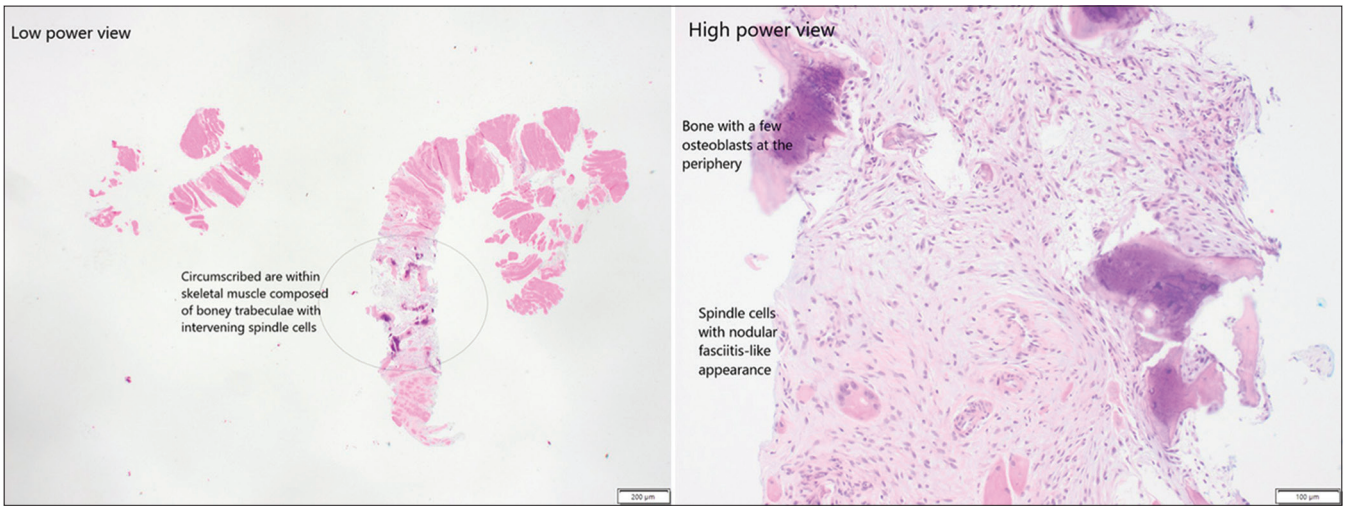

Figure 6: Histopathology micrographs low and high power demonstrating boney trabeculae interposed between striated muscles.

and was demonstrated in our case.[4] The second feature is conspicuous perilesional muscle edema surrounding the lesion, which gradually resolves overtime. This finding is not typically present in the pseudocapsule that often surrounds soft-tissue sarcomas.[5]

CONCLUSION

Atraumatic MO poses a particular diagnostic challenge, with clinical and radiological features that can mimic soft-tissue sarcoma. This case elicits several specific MRI features seen during the early phase of MO that can prompt the radiologist to include this benign process in their differential diagnosis. Follow-up imaging should demonstrate the expected progressive zonal calcification and resolution of edema, obviating the need for biopsy and a misdiagnosis of malignancy.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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