Radiology Case Reports 19 (2024) 1893–1899

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journal homepage: www.elsevier.com/locate/radcr

Case Report

Myositis ossificans in the chest wall: A case report ☆

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ARTICLE INFO

Article history:
Received 25 October 2023
Revised 26 January 2024
Accepted 29 January 2024

Keywords:
Myositis ossificans
Chest wall mass
Muscle injury
Ossification

ABSTRACT

Myositis ossificans is delineated and distinguished by the generation and deposition of cartilaginous and osseous soft tissues. It generally occurs in the lower extremities and is caused by direct trauma. During the different developmental stages of maturation, the lesion has different radiological appearances that can be confused with sarcomas. Here, we present the case of a 38-year-old woman who presented to the outpatient clinic with a painful mass in the lateral chest wall that had rapidly expanded and increased in size. The patient had no history of trauma. Chest computed tomography revealed an intramuscular mass in the lateral chest wall; postcontrast images demonstrated heterogeneous enhancement and peripheral calcification. The patient was then referred to our center for subsequent assessment and examinations. Pathological examination findings confirmed the diagnosis of myositis ossificans. Surgical resection was performed after obtaining patient consent. The symptoms experienced by the patient were successfully relieved, and no evidence of recurrence was observed during the 2-year follow-up period. Knowledge of the atypical locations of myositis ossificans, calcification patterns at different stages, and radiopathological correlations can help accurately diagnose myositis ossificans and avoid unnecessary medical imaging and interventions.

Introduction

Myositis ossificans (MO) is a non-neoplastic, fibroblastic, and osteoblastic proliferation that occurs most commonly in the muscles [1]. MO has 2 forms: circumscripta (traumatic and idiopathic) and progressive. The progressive form, often referred to as fibrodysplasia ossificans progressiva or MO progressiva, is an extremely rare autosomal dominant disease and develops secondary to a genetic mutation in the ALK2/ACVR1 gene. It is a multifocal disease that requires a complex medical management approach [2]. However, the exact cause of MO remains unclear. Several factors have been reported, with direct trauma being the most common

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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https://doi.org/10.1016/j.radcr.2024.01.089

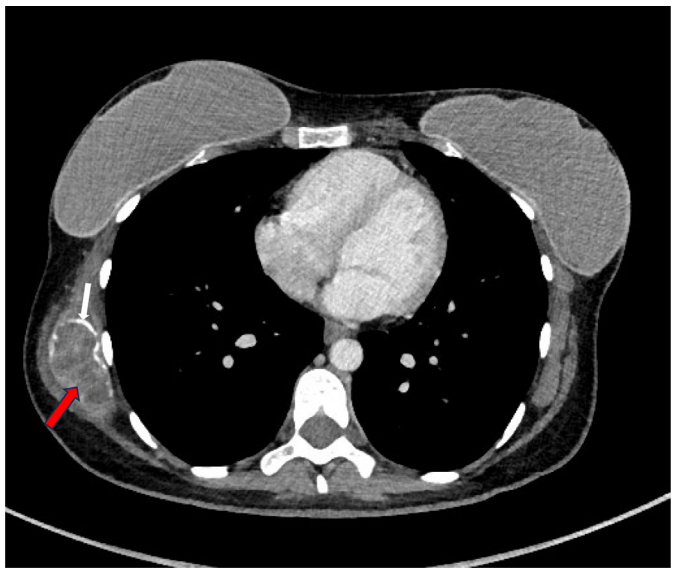

Fig. 1 – Axial computed tomography image of the chest with contrast showing a heterogeneous mass in the right serratus anterior muscle (Red arrow) with peripheral mineralization (White arrow).

contributing factor, accounting for approximately 60% of all cases. Other less common factors include burns, inflammation, neurological pathology, and dysfunction. The prevalence of MO is relatively low, with less than one in a million individuals being affected. MO exhibits a higher prevalence among men than among women and tends to present itself predominantly during the second and third decades of an individual's life. However, it is essential to note that it can emerge at any age, irrespective of sex [3]. MO can originate from various sites; however, approximately 80% of MO are found in the large skeletal muscles of the limbs, with the quadriceps (52%-56% incidence) and brachialis muscles (12%-23% incidence) being the most affected. Other regions such as the pelvis, elbows, and shoulders are susceptible to trauma; however, the exact incidence in these regions remains unknown [3]. Few cases of MO affecting the chest wall have been reported, with only one case reported in the serratus muscle [4]. Patients often have a history of trauma and local tenderness [5], although 40% of patients do not report a history of trauma [6].

The diagnosis of MO of the serratus muscle can be challenging because of its uncommon location and variation in radiological appearance depending on the maturation stage [7]. Moreover, the lack of a history of trauma leads to confusion and misdiagnosis. Here, we present the case of a 38-year-old woman with MO of the serratus anterior muscle.

Case report

A 38-year-old woman presented to our institution with a chief concern of a painful mass in the right lateral chest wall for 4 months that had progressed rapidly in size in the previous month and was associated with severe pain that was partially relieved by painkillers. Although the patient had no history of trauma, she reported a history of bilateral prophylactic mastectomy and breast implantation in April 2018, 3 years prior to the presentation.

Clinical examination revealed an 8-cm rigid mass in the right lateral chest wall in the subscapular region, associated with severe tenderness. Chest computed tomography (CT) revealed an intramuscular mass in the right lateral chest wall with heterogeneous enhancement and a peripheral rim of calcification (Fig. 1). The mass was adjacent to the tip of the scapular body with a clear fat plane and no evident periosteal reaction. Subsequently, chest wall magnetic resonance imaging (MRI) was performed that showed a heterogeneously enhancing mass with T2 hyperintense signal and T1 hypointense signal, with a few foci of T1 hyperintense signal. Muscle edema or adenopathy was not observed (Fig. 2). The results indicated a potential diagnosis of MO. Nevertheless, the patient was recommended to undergo a follow-up radiological assessment to confirm its maturation or alternatively, undergo an ultrasound guided biopsy for histopathological confirmation of the diagnosis. The patient opted for a biopsy to obtain a definitive diagnosis and subsequently underwent an ultrasound-guided core needle biopsy (Fig. 3). Pathological examination findings confirmed the diagnosis of MO. Moreover, to evaluate the stage of MO maturation after the pathological diagnosis is established, a short-term follow-up with CT is recommended. Thereafter, various treatment options, such as simple observation, steroid injection, and surgical excision, were suggested to the patient. After a discussion, the patient opted for surgical resection because of persistent pain.

During surgery, an approximately 4 × 4-cm mass was observed intramuscularly in the serratus anterior muscle. The mass was mobile and unattached to the bone. Following surgical assessment, the mass was excised with a 1-cm margin to ensure complete excision. Examination of the cut surface of the mass revealed a distinct border with a hard bony peripheral shell. Toward the center of the lesion, the

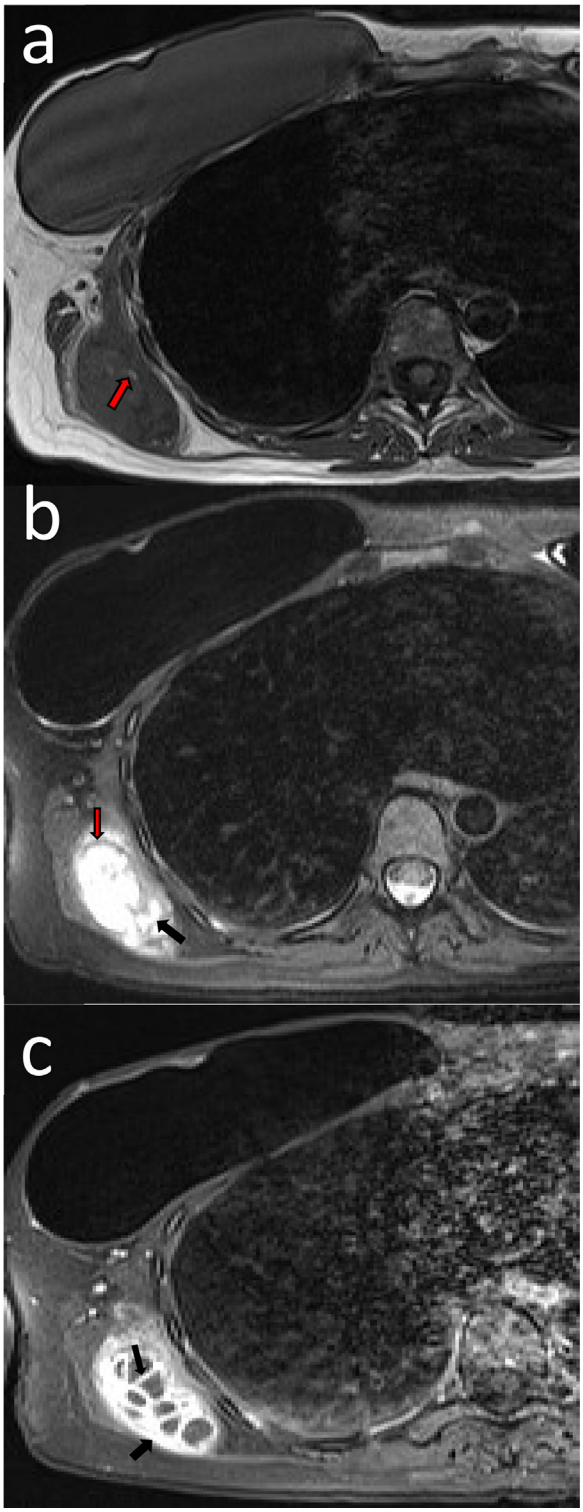

Fig. 2 – (A) Axial T1-weighted magnetic resonance imaging (MRI) image showing T1 hypointense mass with a heterogeneous internal signal containing hyperintense foci, thus suggesting hemorrhage (Red arrow). (B) Axial T2 fat-saturated MRI image showing hyperintense signal of the mass with dark peripheral rim (Red arrow) and internal septations (Black arrow). (C) Axial T1-weighted postcontrast image showing intense peripheral and internal septation enhancement (black arrows).

tissue exhibited a relatively soft consistency, with cystic spaces filled with blood (Fig. 4).

Microscopically, lesions exhibited a zonal pattern. In the inner zone, there was an abundance of proliferating fibroblasts and myofibroblasts, accompanied by vascular spaces. The transition zone showed evidence of immature woven bone formation. Finally, the outer shell was composed of mature lamellar bone. These characteristics are illustrated in Fig. 5.

Fig. 6 depicts the presence of fibroblasts and myofibroblasts in the middle of the lesion, as well as increased vascular proliferation. In addition, immature woven bone was formed within this area.

No signs of recurrence or complications were detected on examination 2 years postoperatively. The chest wall pain subsided completely.

Discussion

MO is a condition in which bone tissue forms within the muscle, typically in response to injury or trauma [1]. The presence of an unexplained soft tissue mass without a clear history of trauma may raise suspicion for sarcoma, particularly considering that a biopsy of the central area within a region of MO can yield immature, undifferentiated tissue resembling a sarcoma [8]. Imaging analysis plays a crucial role in ruling out malignant and infectious etiologies.

Radiography is limited in the evaluation of MO, especially in areas with complex anatomy such as the chest wall or spine. CT is an excellent tool for mineralization characterization and assessment of osseous structural involvement [9,7].

The zoning phenomenon is a valuable imaging tool in differentiating between MO and parosteal osteosarcoma [8]. MO, a benign condition characterized by the formation of heterotopic bone within muscle tissue, typically arises from trauma or repetitive injury [1]. On imaging, MO exhibits a distinct zoning pattern of calcification ([10]). In the early stages, peripheral or eccentric calcifications are observed near the lesion's edges, while more central calcifications may appear as the lesion matures ([10]). In contrast, parosteal osteosarcoma, a malignant bone tumor originating from the bone surface, usually displays central calcifications within the lesion, closer to its middle rather than the periphery. Consequently, the zoning phenomenon aids in distinguishing MO from parosteal osteosarcoma [1].

In the case of MO, MRI often shows a characteristic pattern of low and high signal intensities on T1-weighted and T2-weighted images, respectively, thereby indicating the presence of edema and inflammation in the affected muscle tissue. As the condition progresses and bone tissue begins to form, the affected areas may show regions of high signal intensity on T1-weighted images, thereby indicating the presence of mature bone tissue. MRI can also help differentiate MO from other conditions, such as bone tumors or infections, which present with similar symptoms.

The appearance of MO on MRI varies depending on the stage of ectopic bone maturation. In the early stages of

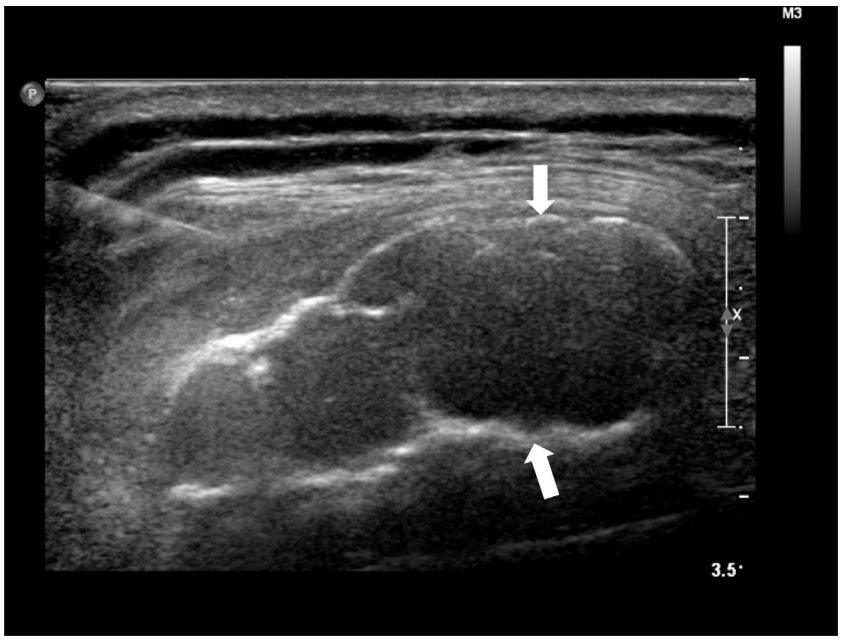

Fig. 3 – Ultrasound-guided biopsy image of the right chest wall mass following the magnetic resonance imaging (MRI) showing uniform and thick peripheral calcifications (white arrows).

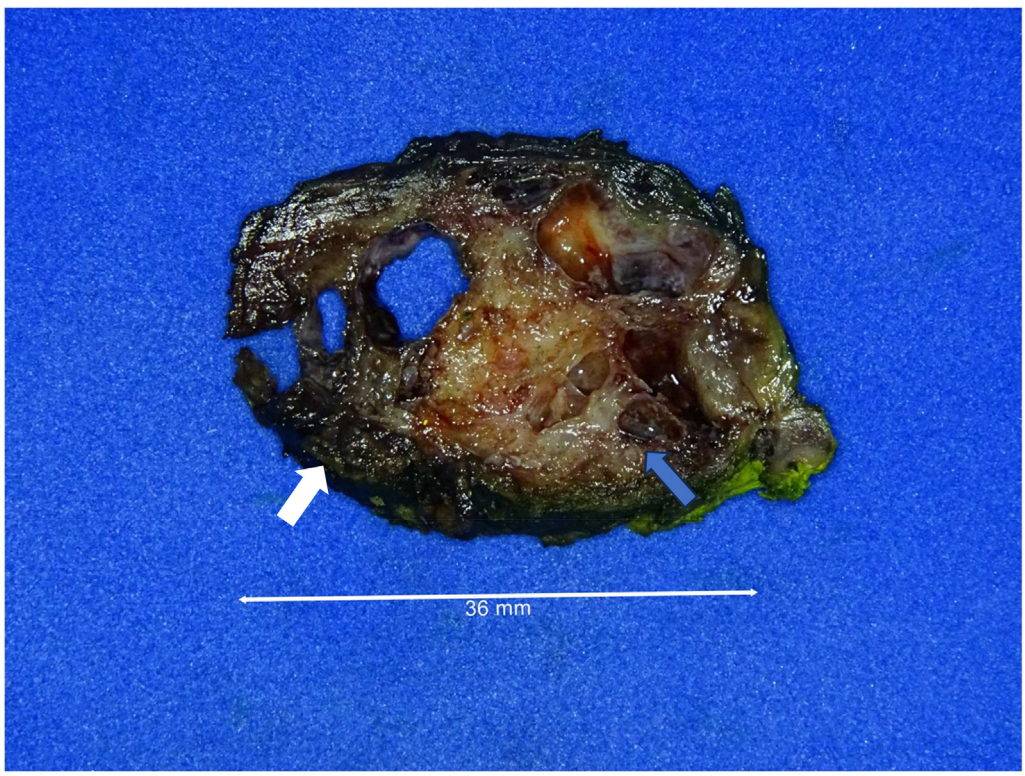

Fig. 4 – Gross specimen: This is a solitary well-circumscribed mass with a peripheral hard bony shell (white arrow). The center of the lesion is relatively soft with cystic spaces filled with blood (Blue Arrow).

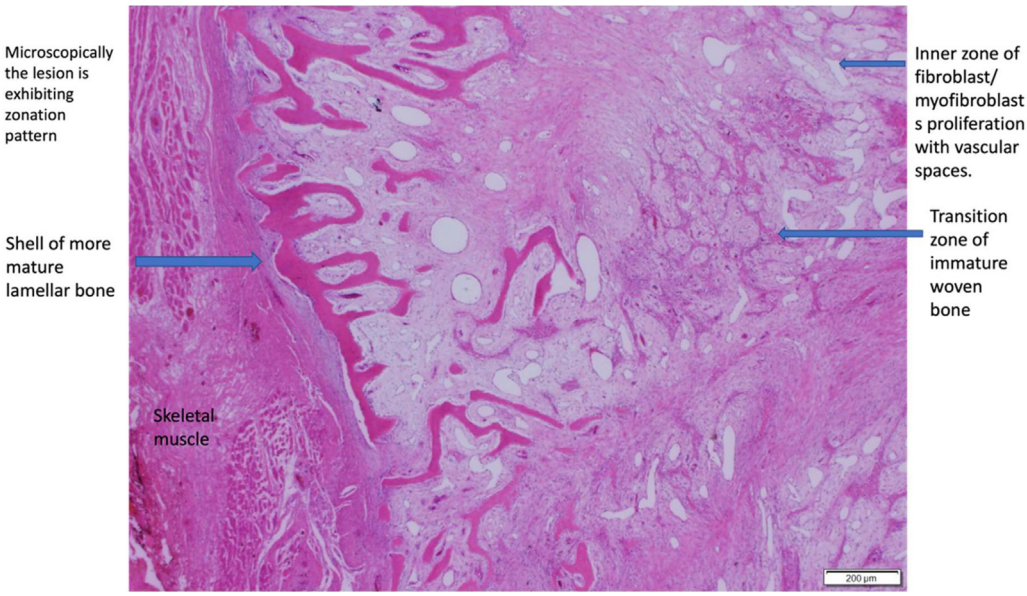

Fig. 5 – Photomicrograph (original magnification, 200x; hematoxylin/eosin stain) presenting a zonation pattern with mature bone at the periphery and fibroblastic/myofibroblastic proliferation in the centre (arrows).

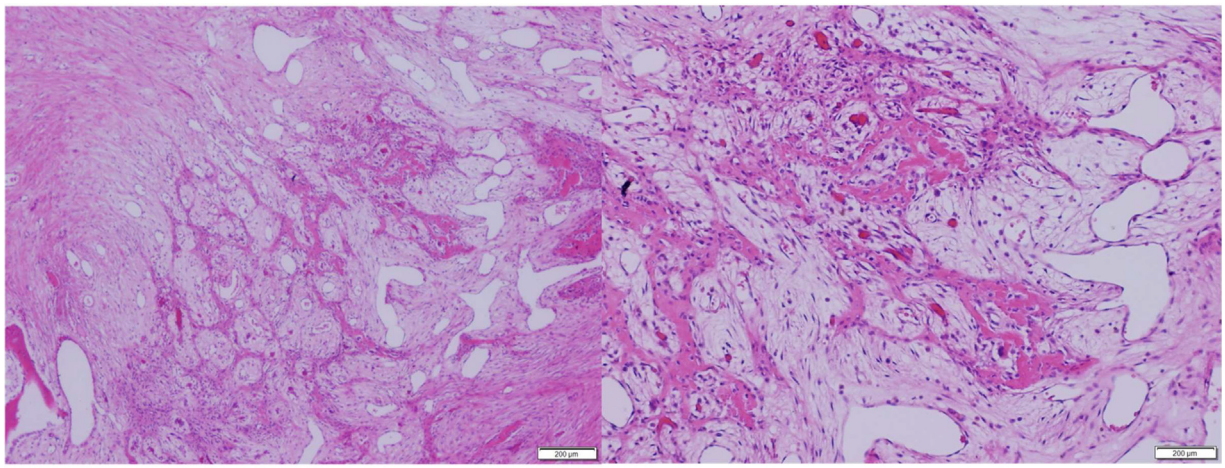

Fig. 6 – Photomicrograph (original magnification, 200x; hematoxylin-eosin stain) of the middle area of the lesion showing fibroblasts/myofibroblasts and vascular proliferation with immature woven bone formation.

MO, which typically occur within the first 2-4 weeks after injury, mineralization appears as a hypointense signal on T1-weighted MRI and as a hyperintense signal on T2-weighted MRI, similar to the signal intensity of muscle tissue. The margins of the lesion may be indistinct, and surrounding edema may be present [7]. As heterotopic bone matures and becomes mineralized, it typically becomes further defined and appears as a heterogeneous signal on T1-weighted MRI with varying degrees of hypointensity and hyperintensity. On T2-weighted MRI, the heterotopic bone may appear as a hypointense signal due to its mineralization; however, there may still be surrounding edema. In the late stages of MO, the ectopic bone becomes relatively organized and may appear as a hypointense signal on both T1-weighted and T2-weighted MRI because of its high degree of mineralization. The margins of the lesion may be well-defined, and there may be evidence of bone marrow within the lesion [7].

Few cases of MO of the chest wall have been reported. In 2015, Wei et al. reported a case of MO in the serratus muscle of the chest wall. The patient presented with a chief concern of a tumor beneath the right clavicle persistent for a duration of 5 months, accompanied by right shoulder discomfort and numbness on the outer surface of the right upper arm that had lasted for 10 days before presentation. The patient reported receiving a continuous intense nape massage for a duration of 2 years before presentation, which the authors suggested might be a cause of trauma. They suggested that the repetitive and forceful manipulation of the serratus anterior muscle below the collarbone, coupled with recurring muscle bleeding and inflammation, gradually led to the formation of adhesions

and subsequent ossification [4]. However, in contrast to this, our patient denied any history of aggressive massage or traumatic incidents.

Our patient reported pain and edema that were persistent for 5 months. Such presentation is typically observed in the initial phases of MO [6]. Peripheral mineralization of the MO lesion as confirmed on MRI findings can often be confused with a tumor capsule; however, the presence of prior CT findings was considerably helpful in assessing mineralization.

Localized MO is rare. In the presence of MO in a typical location of its occurrence, presenting with classic radiological features, the diagnosis is not challenging. However, when MO is present in an atypical location, such as the lateral chest wall, the diagnosis becomes challenging. Our case was unique because of its location and suspicious MRI findings. In our case, the lack of surrounding edema could be attributed to the long symptom duration.

The appearance of MO on MRI can vary depending on numerous factors such as the location and size of the lesion, degree of mineralization, and presence of surrounding edema or inflammation.

Reports of MO at atypical locations and various stages can raise awareness among radiologists. If MO is suspected, CT would help characterize mineralization. Findings of a short-term follow-up CT scan would help radiologists evaluate calcification maturation.

The management of MO is a topic of debate and depends on the severity of symptoms. In many cases, no intervention is required. Symptomatic patients with mild pain or those deemed unsuitable for surgery may be offered conservative treatment, which typically includes a combination of non-steroidal anti-inflammatory drugs and physiotherapy. Surgical intervention may be beneficial for patients with persistent and severe symptoms. The recommended treatment for symptomatic MO is surgical excision; however, it is crucial to wait until complete maturation of MO lesion, as early excision can lead to local recurrence [3].

It is essential to acknowledge the strengths and limitations of this case report and their implications for clinical practice. The strengths of the approach, including detailed clinical information, comprehensive imaging evaluation, and histopathological examination, contribute to our understanding of MO in an atypical location. The case report provides valuable insights into the presentation, diagnosis, and management of MO in this context. However, it is essential to consider the study's limitations, such as the single case design and lack of long-term follow-up data. These limitations highlight the need for further research, larger studies, and comparative analyses to validate the findings and provide more comprehensive guidelines for the diagnosis and management of MO.

Conclusions

Diagnosing MO in atypical locations is challenging. Variations in radiological appearance depending on the stage of maturation and lack of trauma history can cause diagnostic dilemmas for radiologists. Knowledge of the patterns of calcification at various stages of MO, awareness of atypical locations, and proper radiopathological correlations are key for an accurate diagnosis.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Patient consent

Informed consent was obtained from the patient whose images are being published.

Statement of human and animal rights

This article focuses on images; therefore, it did not involve research using human or animal participants.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2024.01.089.

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