Early Imaging Findings of Non-traumatic Myositis Ossificans in Shoulder: a case report

CHING-CHIEH CHANG1  HONG-JEN CHIOU1,2,3  HUNG-TA WU1,2  CHING-LAN WU1  CHENG-YEN CHANG1,2

Department of Radiology1, Taipei Veterans General Hospital, Taipei, Taiwan
School of Medicine2, National Yang-Ming University, Taipei, Taiwan
School of Medicine3, National Defense Medical Center, Taipei, Taiwan

ABSTRACT

Myositis ossificans is a benign ossifying process in the musculature presenting a typical zonal pattern of mineralization. It is difficult for diagnosis at early stage because of atypical imaging finding. CT scan examination is more sensitive than radiography for detection of ossification. However, MR imaging presentation of the early lesion is non-specific, which makes it difficult to distinguish from a sarcoma since no ossification can be detected. We present a case of early myositis ossificans in posterior shoulder proven by biopsy.

CASE REPORT

A 13-year-old girl complained of a persistent but endurable pain over the left shoulder having lasted for 2 months. Except for gradual swelling of left shoulder noted by her family, she had no other discomfort or any associated symptoms such as weight loss, anorexia or fevers. There was no traumatic history over her shoulder joint, either.

She visited our hospital for evaluation. The left shoulder was full in range of motion. Results of cell counts and laboratory examinations were all within normal limit. Left shoulder radiograph, taken at the same day of the orthopedic appointment, (Fig. 1) showed soft-tissue density mass in the left axillary region without calcification or ossification.

Since the possibilities of differential diagnoses such as sarcoma, and inflammatory mass such as myositis ossificans, TB or infection with myositis could not be excluded, ultrasound and MRI exams were arranged concomitantly. MR examination done 11 days later showed a heterogeneous mass lesion about 2.9 x 2.9 cm in diameter which involved the infraspinatus and teres minor muscles of the left shoulder. The mass showed isointense to mildly hyper-intense on T2-weighted images (Fig. 2a-2c), isointense on T1-weighted images (Fig. 2d), and marked enhancement after administration of contrast medium (Fig. 2e, 2f). Some sparse foci in the mass showed hypointense on T2-weighted images and no enhancement after contrast administration (Fig. 2a, 2e), which were considered to be early ossifications compatible with the findings from the follow-up radiograph taken 20 weeks later (not shown) and MR imaging obtained 21 weeks later (not shown). Prominent edema at the surrounding soft tissue and muscles was also noted on T2-weighted images, as along with the enlargement of left axillary lymph nodes (not shown). The glenohumeral joint was intact.

The ultrasound study (Fig. 3a, 3b) done 18 days later
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found a heterogeneous echogenic mass lesion in the posterior aspect of left shoulder within the infraspinatus muscle that showed rim or sheet-like echogenic plaques at the periphery with intense acoustic shadowing and increased color flow signal.

Under the impression of calcified or ossified mass, the patient was actually subjected to ultrasound-guided core needle biopsy. The pathological diagnosis showed mature bony tissue with active osteoblastic rimming, chondroid tissue, granulation tissue and fibrosis in layers, compatible with myositis ossificans. The specimen examined showed no evidence of malignancy.

After discussion with the clinician, the patient decided to receive conservative treatment. The mass of left posterior shoulder showed ossification in the follow-up radiographs taken 8 weeks (Fig. 4) and 20 weeks later (not shown), respectively, with zonal appearance of mineralization, compatible with myositis ossificans.

DISCUSSION

Myositis ossificans is a benign ossifying process that is generally solitary and well-circumscribed, and is found most commonly in the musculature [2]. It is synonymous with pseudomalignant osseous tumor of soft tissue, extraosseous localized nonneoplastic bone and cartilage formation, myositis ossificans circumscripta, pseudomalignant myositis ossificans, and heterotopic ossification [3].

The etiology and potential predisposing factors of myositis ossificans remain unclear [4]. Patients are usually young adults [1]. The most frequent symptoms and signs at the early stage are progressive pain and tenderness on a soft-tissue mass that is incidentally found [1] with variable and non-specific clinical presentations and cannot exclude the possibility of a tumor or an infection.

A history of trauma is often inapparent [3]. Therefore, it serves little purpose to distinguish between traumatic and non-traumatic forms of myositis ossificans because both forms are morphologically identical and are assuredly secondary to some kind of injury [2].

The conventional radiography may show normal result except for a localized and slightly increased density in soft tissue [5]. By the third to fourth week, as the osteoid becomes mineralized, floccular calcification can be noted within the mass [6].

On ultrasound, myositis ossificans may show a well-circumscribed, homogeneous or heterogeneous hypoechoic mass with scattered internal calcifications at the very earliest stage. At subacute stage, diffuse echogenic plaques are found with a posterior acoustic shadowing as a result of the differentiation of fibroblasts into osteoblasts to secrete an osteoid matrix at the periphery of the initial myxoid zone, giving a pseudo-osteosarcomatous appearance. In the late phase, also called the maturation phase, bone production can be observed at the periphery of the lesion. Patterns of calcification suggestive of myositis ossificans include peripheral rim-like calcification, and sheet-like or lamellar calcification [6, 7]. Ultrasound may be the most sensitive imaging modality to early depict the zone phenomenon in myositis ossificans [4].

On T1-weighted images of MRI, the lesion may show iso- to hyperintense relative to normal skeletal muscle. On T2-weighted images, it appears as an inhomogenous focal mass with extensively diffuse surrounding edema. A low signal intensity rim corresponding to the peripheral ossification may be present. If no ossification is detected at the periphery, the non-specific appearances of the lesion would make it difficult to distinguish the early-staged lesion from a sarcoma. After Gadolinium contrast administration, rim or diffuse enhancement can be seen on post-contrast enhanced T1-weighted images. [3-6].

The differential diagnosis of early-staged myositis ossificans includes focal myositis, abscess, rhabdomyolysis, hematoma, and the most importantly, soft-tissue sarcoma.
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Figure 2. The MR imaging (arranged 11 days later). T2-weighted images with fat suppression of left shoulder in axial a. coronal b. and sagittal c. views showed a heterogeneous mass lesion (white arrow) with iso- to mildly hyperintensity involving the infraspinatus and teres minor muscles. Some sparse foci (black arrowheads in 2a, 2c, 2e, 2f) in the mass showed hypointense on T2-weighted images with no enhancement after contrast administration, which were considered as early ossifications. Prominent edema at the surrounding soft tissue and muscles was also noted. The mass was isointense on T1-weighted images d. and showed marked enhancement after administration of contrast material e. f.

- a. axial view of T2WI with fat suppression
- b. coronal view of T2WI with fat suppression
- c. sagittal view of T2WI with fat suppression
- d. axial view of T1WI
- e. axial view of T1WI with contrast administration
- f. sagittal view of T1WI with contrast administration

Focal myositis resembles the early-staged myositis ossificans on medical imaging, except that it develops no calcification in the disease course [5]. Abscess, rhabdomyolysis and hematoma can have surrounding edema [6].

When the degree of mineralization is minimal, synovial sarcoma, rhabdomyosarcoma and malignant fibrous histiocytoma should be considered, as they may show calcifications [6] that are often centrally located. A continuous or non-continuous low signal intensity rim on T2-weighted images in myositis ossificans may help in differential diagnosis [5]. As mineralization increases, the possibility of extraskeletal and juxtacortical osteosarcoma has to be taken into account. Osteosarcoma show denser calcification in the central area, while myositis ossificans has pronounced calcification at the periphery [8].

Determining the pattern of mineralization with peripheral mature ossification is essential in establishing the radiographic diagnosis of myositis ossificans to differentiate it from other mineralized lesions, especially extraskeletal and juxtacortical osteosarcoma [1]. When the typical zonal phenomenon is present at intermediate and late stage of myositis ossificans, there is no difficulty in differentiating myositis ossificans from other disorders [5].

It may be difficult for diagnosis of early myositis ossificans if the symptoms, history and imaging findings are not typical. In the case lack of typical imaging features
Needle biopsy might be necessary for differential diagnosis [6]. The physicians should keep aware of the sometimes misleading histological picture which resembles a malignant lesion in early myositis ossificans, or if the biopsy specimen is sampled from the center of the lesion alone without showing the typical zonal pattern [8].

CT scan is more sensitive than radiography in detecting ossification [3]. Enlarged muscle group with normal attenuation is seen, with or without faint calcification within the lesion at early stage [5]. In our case, in addition, the clinical symptoms and history were inapparent. CT scan was therefore not performed for the risk of radiation hazard in this still very young girl.

The typical zonal pattern was not seen in the image studies of our case, which made it not specific enough to eliminate the need for biopsy to differentiate myositis ossificans from malignancy. Besides, the biopsy, if done in delay, might run the risk of missing a true sarcoma to allow tumor dissemination. Thus, biopsy was done.

In summary, it is critically important to take advantage of the imaging studies to identify the zonal phenomenon of myositis ossificans as early as possible. Once the zonal phenomenon is identified, the biopsy is not necessary. If this is not the case of myositis ossificans, the histologic confirmation should be performed.

**Figure 3.** Ultrasound (arranged 18 days later) a. b. revealed a heterogeneous echogenic mass lesion in the posterior aspect of left shoulder, with rim or sheet-like echogenic plaques at the periphery with intense acoustic shadowing (a, white arrows) and increased color flow signal (b, black arrows).

**Figure 4.** Follow-up left shoulder radiograph 8 weeks later showed zonal appearance of mineralization (black arrow), compatible with myositis ossificans.
REFERENCES