

# Rotator Cuff Metastases: A Report of Two Cases with Literature Review

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## Abstract

**Context:** Distant metastases of primary malignancies to the skeletal muscle tissue are a very rare event. Distant metastases that affect the rotator cuff are even rarer, and only a few of cases have been reported so far. **Case Report:** The present article reports two cases that presented to our hospital with the complaint of shoulder pain and had a soft tissue mass affecting the muscles of the rotator cuff and invading the neighboring bone compartments. One of the patients developed mucoepidermoid cancer metastasis of the submandibular gland, and the other was found to have a malignant epithelial tumor metastasized from the lower lobe of the right lung, whose primary origin could not be diagnosed until the imaging examinations were employed. Ultrasound and magnetic resonance imaging findings are presented in this paper. **Conclusion:** Metastases to the muscle tissues could be misdiagnosed as primary sarcomas. Because the therapy regiments and prognoses are fairly different for these two entities, the possibility of a metastasis to the muscle tissue must be considered as a differential diagnosis for case of painful soft tissue mass. Ultrasound is very useful in detection of the lesion and acts as a very important tool during guidance for biopsy. Magnetic resonance imaging, however, is a very valuable asset in the evaluation of the borders of the soft tissue mass and its invasive effect on the bony tissues. Particularly when the features such as lobulated contours, peripheral edema, and intratumoral necrosis exist, the possibility of metastases must be considered.

**Key words:** Imaging, Metastasis, Rotator cuff

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## Introduction

Metastases of malignant tumors to the muscle tissues of the skeletal system are a very rare issue. It was reported in the literature that muscle tissue metastases accounted for less than 1%.<sup>[1]</sup> Distant metastases to the rotator cuff are even rarer, only a few of cases have been reported so far.<sup>[2-4]</sup> To the best of our knowledge, no mucoepidermoid cancer that metastasized from the submandibular gland has been reported in literature.

In this article, we reported two cases. One had a mucoepidermoid cancer of the submandibular gland, and metastasized to the rotator cuff, while the other patient was initially diagnosed as a rotator cuff metastasis but whose metastasis from the lung was diagnosed by subsequent imaging techniques.

## Case Presentation

### Case One

A 58-year-old male patient with “shoulder pain” presented in the outpatients clinic of our hospital for the physical therapy and rehabilitation. While inquiring, we learned that the pain had started about 6 months ago and worsened during night, and it did not respond to nonsteroid anti-inflammatory therapy. The patient’s visual analogue score was 10. Personal data had a history of an operation on the submandibular gland 4 years ago due to mucoepidermoid cancer. On

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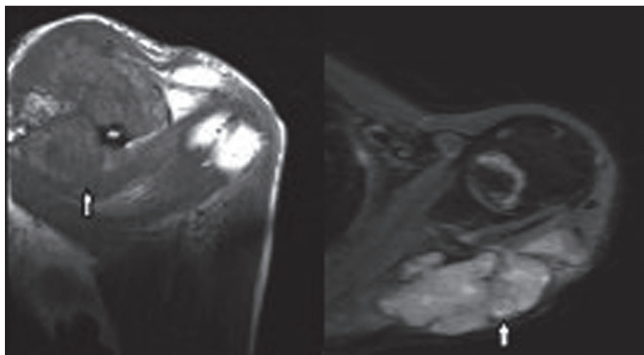
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physical examination, the posterior shoulder became thick and the range of motion (ROM) was substantially restricted. An anteroposterior-shoulder X-ray showed a nonspecific density increase in the subacromial space. Magnetic resonance imaging (MRI) showed a mass located between the trapezius and supraspinatus muscles. These muscles were cranially and anteriorly pushed, and the mass invaded the infraspinatus, teres minor, and deltoid muscles [Figure 1 and 2]. Intravenous (iv) contrast material was not utilized due to the allergic history of patient. The patient was transferred to the Department of Oncology and underwent radiotherapy and chemotherapy, after metastatic mucoepidermoid cancer was diagnosed [Figure 3].

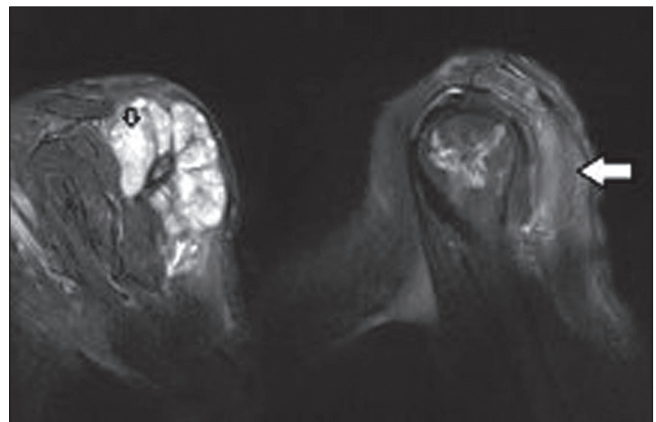
### Case Two

A 64-year-old male patient with “shoulder pain” presented the Department of Physical Therapy and Rehabilitation of our hospital. The patient had a pain history for 4 months and emphasized that the pain used to worsen in the nighttime. His history record did

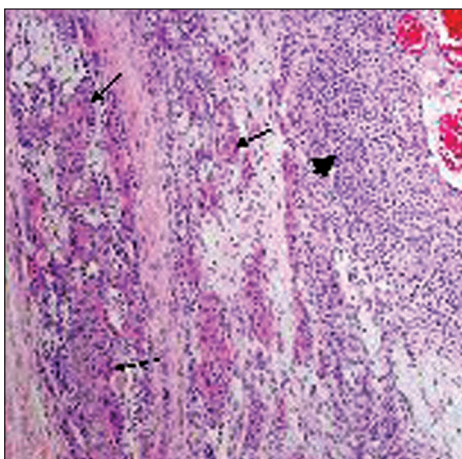
not show anything particular, except diabetes mellitus and hypertension. On physical examination, ROM was substantially restricted. His visual analogue score was 10. No prominent pathological feature was detected on the anteroposterior-shoulder X-ray film. An initial ultrasound (US) examination was scheduled in order to evaluate the situation of his rotator cuff compartment. US revealed a mass lesion invading the supraspinatus muscle and extending inferiorly [Figure 4]. MRI showed a mass lesion at the infraspinatus tendon invading the supraspinatus muscle cranially with some peripheral areas of edema [Figure 5]. The invasion in the scapula with a pulsion in the subscapularis muscle was detected. IV contrast material was not utilized because the patient refused it. Malignant epithelial tumor was diagnosed from the pathological histology through the US-guided percutaneous biopsy [Figure 6]. A mass lesion in the right lung was coincidentally detected by the computed tomography (CT) in search for a primary tumor. The patient was subsequently transferred to the Department of Oncology for chemotherapy and radiotherapy.



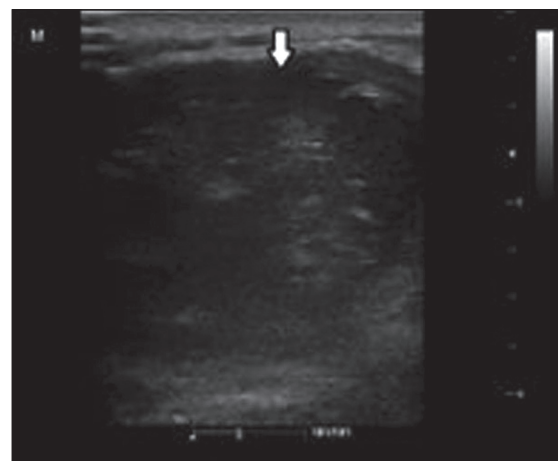
**Figure 1:** Tumoral lesion located in the infraspinatus muscle, as seen on these coronal T1-weighted and axial fat-suppressed T1-weighted sequences (arrows)



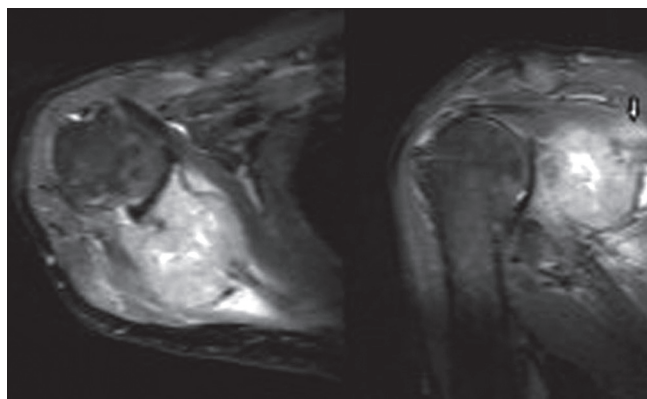
**Figure 2:** These sagittal T2-weighted images demonstrate high-signal intensity necrotic areas (small arrow) and peritumoral hyperintense edematous regions in the deltoid muscle (large arrow)



**Figure 3:** Microscopic appearance of high-grade mucoepidermoid carcinoma including squamous cells (arrows), intermediate cells (arrowhead), and necrosis (Hematoxylin and Eosine, ×100)



**Figure 4:** A hypoechoic mass lesion invading the supraspinatus muscle is seen on ultrasound



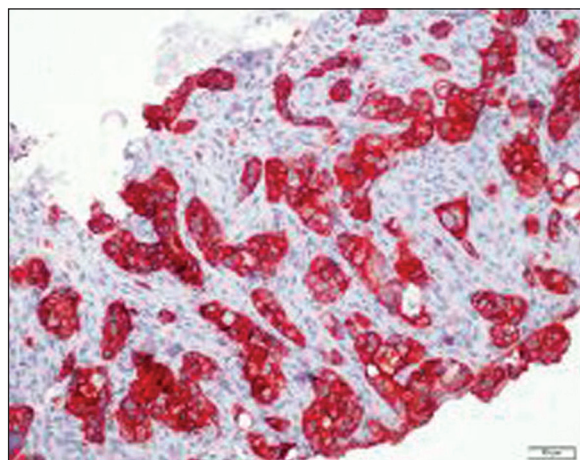
**Figure 5:** A hyperintense mass lesion located in the infraspinatus muscle and infiltrating the scapula and the supraspinatus muscle is seen on these axial and coronal fat-suppressed T1-weighted images (arrow)

## Discussion

The muscle tissues of the skeletal system constitute an important part of the body mass and receive a rather rich flow of blood. However, muscle tissues are very rare locations of metastases.<sup>[5,6]</sup> Literature has pointed out that a ratio of metastases to the muscle tissues is less than 1%.<sup>[1,5,7]</sup> In these metastases, the most frequent locations are the lower extremity muscles.<sup>[7]</sup> The most frequently metastasizing tumors to the skeletal muscle tissues are the cancers from the lungs, gastrointestinal system, kidney, and breast,<sup>[1,8,9]</sup> although any malignancy can metastasize to the muscle tissue.

Metastasis to the rotator cuff, on the other hand, is a very rare. A few of cases metastasizing to the rotator cuff from the lung, duodenum, and tongue was reported in the literature.<sup>[2-4,10,11]</sup> A study by Damron *et al.*<sup>[12]</sup> showed that the metastases to the shoulder were detected in 11 of 118 patients with soft tissue metastases. The primary lesions responsible for these metastases were of renal origin in 3 and breast origin in another 3 patients, while in 1 patient, the metastasis occurred from the lungs and in another patient from colon. A primary lesion could not be detected in the remaining 1 patient. Unfortunately, the study did not emphasize which of these patients had rotator cuff metastases.<sup>[12]</sup> Distant metastasis from a submandibular primary tumor, on the other hand, has not been reported in the literature, to our knowledge.

Sridhar *et al.*<sup>[13]</sup> concluded three possible reasons for the rarity of skeletal muscle tissue metastasis: 1) the high permeability of the tumor cell and the difficulty of producing an implant, due to a big variety of blood flow in the muscle; 2) the physical destruction of tumor cells due to muscle motion; and 3) the suppressing effect of increased lactate levels on tumor proliferation. The last two etiological factors may explain why the muscles of the rotator cuff, which are more profoundly



**Figure 6:** Intense and diffuse immunoreactivity for CK7 in tumor cells

used in comparison with the other muscles of the body, constitute such a rare location for metastases.

It is reported that the skeletal muscle metastases are more painful in comparison with primary sarcomas.<sup>[1]</sup> In our patient, the primary complaint was pain; both patients had a visual analogue score of 10. Pain is usually encountered during the later stages of malignant diseases in cases with a known primary malignancy and is a sign of poor prognosis.<sup>[8]</sup> Pain may appear with rotator cuff metastasis, as shown in our second case.

The imaging findings of soft tissue metastases are usually nonspecific. A density increase may be seen in a conventional radiogram. Calcification has been reported in some gastric, pancreatic, and colon metastases.<sup>[12]</sup> In our first case, a nonspecific density increase was observed in the subacromial region.

On non-enhanced CT images, an enlargement of the affected muscle may be the sole finding, due to the isodensity of the mass lesion and its neighboring soft tissue compartments.<sup>[1]</sup> In such a case, a comparison with the reciprocal symmetry may be mandatory.<sup>[14]</sup> Contrast material is indicated for the demonstration of the presence and dissemination of the lesion.<sup>[5,15]</sup>

Most muscle metastases are hypoechoic at ultrasonography<sup>[15]</sup>, as shown in our second case. MRI, on the other hand, is the choice of modality in the imaging of soft tissue metastases. Lesions are usually characterized by iso- or hypointense on T1-weighted and hyperintense on T2-weighted sequences in comparison with the neighboring muscle tissues.<sup>[15,16]</sup> The lesion with hyperintense character on T1 weighted sequences may also be seen.<sup>[15]</sup> The lesions must be differentiated from the primary sarcomas, hematomas, and abscesses, because these pathological entities may resemble certain imaging similarities with these lesions.<sup>[8]</sup> It has been reported that,

as a difference from primary sarcomas, these lesions may present with the increased lobulations, peripheral edema, and intratumoral necrosis.<sup>[7,14]</sup> A study by Tuoheti *et al.*<sup>[7]</sup> reported that peritumoral edema and intratumoral necrosis were present in 92% of the patients. In our patients, edematous and millimetric necrotic areas appeared in the periphery of the lesions with lobulated contours.

Soft tissue sarcoma, abscess, and hematoma should be considered when the differential diagnosis of muscle metastasis was made. Hematomas have a characteristic MRI appearance of blood products, but hemorrhage may occur within soft tissue sarcoma and metastatic lesion. Serial MRI can be helpful in differentiating primary hemorrhagic tumors from or secondary hemorrhagic tumors. Lobulation, necrosis, and peritumoral edema seen in MRI are more common in muscle metastases than primary sarcomas. Needle biopsy may be mandatory for the definite diagnosis.<sup>[7,12,14]</sup>

The therapy includes chemotherapy, radiotherapy, and resection in certain selected cases.<sup>[7, 8]</sup> For the cases scheduled for a surgery, the IV contrast injection is mandatory to define lesion borders.

In conclusion, metastases to the rotator cuff are very rare and must be differentiated from primary sarcomas because their therapies and prognoses are quite different. Even though it is usually nonspecific in the imaging findings, any painful mass causing an enlargement of the muscular tissue in a patient with a known primary malignancy must be carefully evaluated for the possibility of a muscle metastasis. Features, such as lobulated contours, intratumoral necrosis, and peripheral edema, may help in differentiating muscle metastases from primary lesions.

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