Metastasis to the Skeletal Muscle from a Malignant Phyllodes Tumor of the Breast: A Case Report

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We report radiological findings of ultrasonography (US), 18F-fluorodeoxyglucose (FDG) positron emission tomography (PET) computed tomography (CT), and magnetic resonance (MR) imaging for a rare case of skeletal muscle metastasis from an underlying known malignant phyllodes tumor. To our knowledge, there has been no previous published report of imaging findings of skeletal muscle metastasis from a sarcoma such as malignant phyllodes tumor.

Index words : Muscle, skeletal
Neoplasms
Phyllodes tumor
Magnetic resonance (MR)

Introduction

Malignant phyllodes tumors are relatively rare, accounting for 0.3 to 0.9% of all tumors of the breast. This tumor metastasizes approximately 20% of the cases depending upon the histologic behavior (1). The most common site of metastasis is the lung (1). Of all possible organs, metastasis to the skeletal muscle is relatively unusual. Moreover, imaging findings of metastasis to the skeletal muscle for patients with sarcoma such as phyllodes tumors like our case have not been published in the radiology literature, to the best of our knowledge. All the previous articles were more focused on muscle metastasis from carcinoma rather than from sarcoma (2–4). Accordingly, the purpose of this article was to present the radiological findings of metastasis of a sarcoma to the skeletal muscle that we observed in a patient with malignant phyllodes tumor, including ultrasonography (US), 18F-fluorodeoxyglucose (FDG) positron emission tomography (PET)-computed tomography (CT), and magnetic resonance (MR) imaging.

Case Report

A 44-year-old female diagnosed malignant phyllodes tumor was referred and admitted to the Department of Thoracic and Cardiovascular Surgery at our institution for further evaluation and management of the masses found in the chest and the left thigh on a routine follow-

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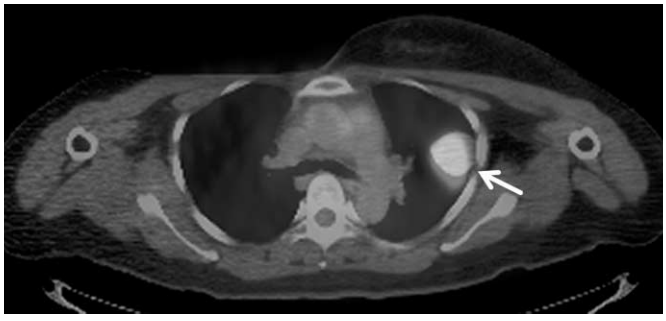
up 18F-FDG PET-CT images (Fig. 1a and b). Three years ago, the patient underwent right mastectomy and subsequent chemotherapy for management of a malignant phyllodes tumor at another hospital. Physical examination revealed a non-tender palpable mass on the lateral aspect of her left upper thigh.

We performed a CT (Somatom Sensation 64; Siemens Medical Solutions, Forchheim,Germany) scan for the chest and MR (1.5T, Achieva, Philips Healthcare, Best, The Netherlands) scan for the thigh to further evaluate the masses detected on the 18F-FDG PET-CT scan. Contrast-enhanced CT scans for the chest revealed an approximately 3 × 2.5 × 2.5-cm sized well-defined soft tissue mass in the left upper lobe of the lung (Fig. 1c). A subsequent MR images of the left thigh showed an approximately 6 × 2 × 5-cm sized multi-lobulated mass in the vastus lateralis muscle. On T2 weighted images (T2WI) (TR, 3500 msec; TE, 100 msec), the mass demonstrated relatively homogeneous high signal intensity and the muscle belly adjacent to the mass demonstrated a subtly increased but not profuse signal intensity, which was suggestive relatively scanty muscular edema (Fig. 2a). On T1-weighted images (T1WI) (TR, 435 msec; TE, 10 msec), the mass showed iso- or slightly higher signal intensity compared to the signal intensity of the surrounding muscle (Fig. 2b). On contrast enhanced fat-suppressed T1WI (TR: 435 msec, TE: 10 msec), the mass demonstrated diffuse and relatively homogeneous enhancement. Subtle enhancement with an obscured margin was visualized around the mass at the corresponding area where edematous change was seen on T2WI (Fig. 2c, d).

Based on the medical record and findings of MR images and PET-CT, the radiological impression was metastasis of the malignant phyllodes tumor to the lung and skeletal muscle. US-guided core biopsy for the intramuscular mass was performed for pathologic confirmation. A concurrent sonographic examination of the thigh revealed a heterogeneous hypoechoic mass (Fig. 2e) demonstrating scanty vascular signals on Doppler US (not shown). Pathologic findings of the muscle specimens showed hyperplasia of malignant mesenchymal cells, tumor giant cells, and mitosis (Fig 3). Desmin and myoglobin, which indicate the possibility of a primary



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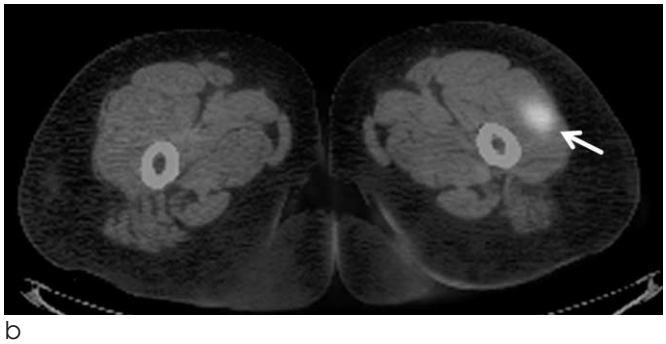

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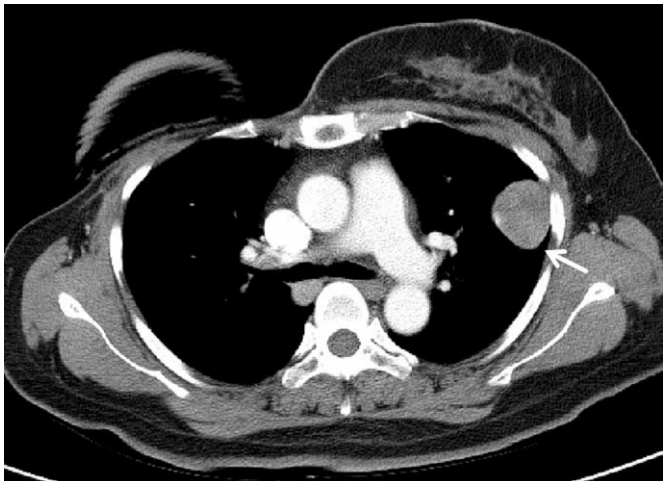

c

Fig. 1. 18F-fluorodeoxyglucose (FDG) PET-CT (PET-CT) scan and chest CT images.
a. Axial PET/CT scan shows intense FDG uptake by a mass in the upper lobe of the left lung (arrow).
b. Axial PET/CT scan shows intense FDG uptake by a mass in the left vastus lateralis muscle (arrow).
c. Axial contrast-enhanced CT scan shows an approximately 3.2 × 2.6-cm sized well-enhanced mass with a clear margin in the left upper lobe of the lung (arrow).

muscle tumor such as rhabdomyosarcoma, were not found by immunohistochemical staining (not shown). Although the pathologic features could not be compared with those of the primary malignant phyllodes tumor which was only available at the previous hospital where the patient received the initial diagnosis, we ultimately concluded that the diagnosis was metastasis from the malignant phyllodes tumor of the breast putting together all the available medical, radiologic, and pathologic findings.

Discussion

Skeletal muscle metastasis rarely occurs because of a high resistance to metastasis of the skeletal muscle due to environmental factors such as contractile activity, local changes in pH, oxygenation, the accumulation of lactic acid, and local temperature (5). Despite these factors, hematogenous metastases to the skeletal muscle have been occasionally reported in patients with carci-

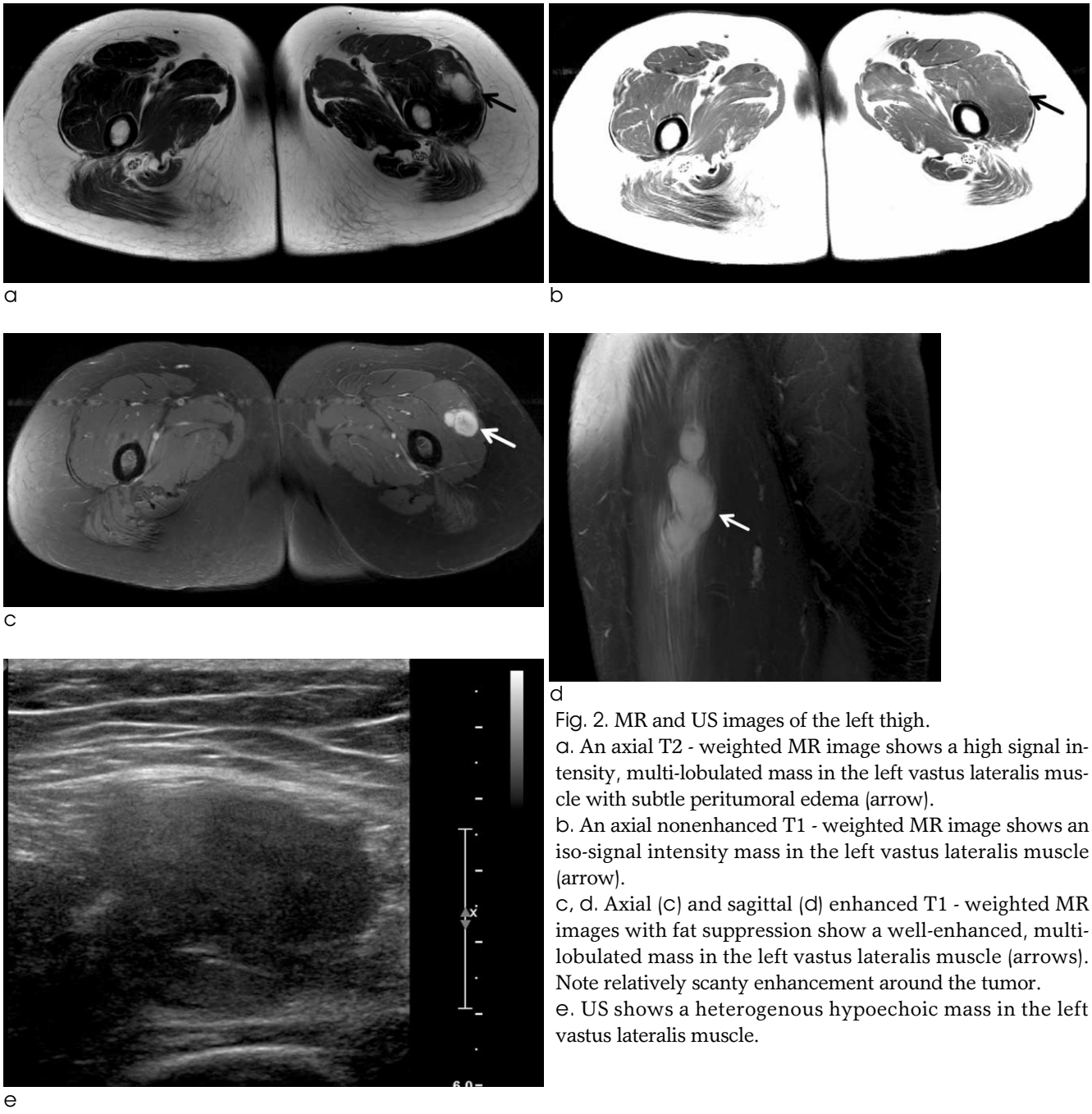

Fig. 2. MR and US images of the left thigh.
a. An axial T2 - weighted MR image shows a high signal intensity, multi-lobulated mass in the left vastus lateralis muscle with subtle peritumoral edema (arrow).
b. An axial nonenhanced T1 - weighted MR image shows an iso-signal intensity mass in the left vastus lateralis muscle (arrow).
c, d. Axial (c) and sagittal (d) enhanced T1 - weighted MR images with fat suppression show a well-enhanced, multilobulated mass in the left vastus lateralis muscle (arrows). Note relatively scanty enhancement around the tumor.
e. US shows a heterogenous hypoechoic mass in the left vastus lateralis muscle.

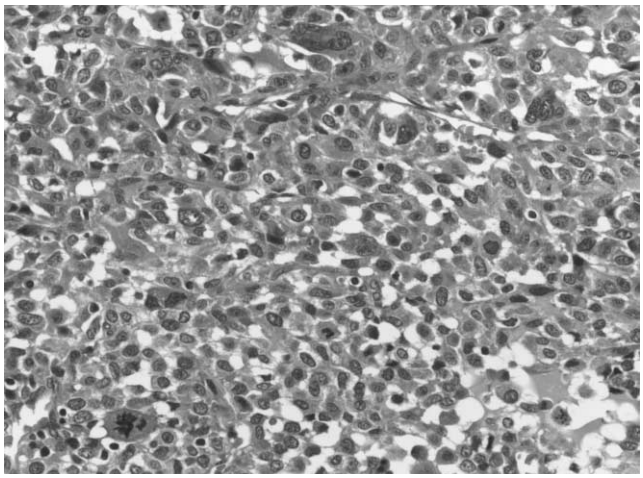

Fig. 3. Photomicroscopic findings show hyperplasia of malignant mesenchymal cells, tumor giant cells, and mitosis (H & E ×400, muscle biopsy specimen).

noma, leukemia, and lymphoma (4). The most common primary lesion that can show metastasis to the skeletal muscle is carcinoma of the lung. The most common location of the skeletal muscle metastases among the body portion is the lower extremity like our case (1). MR imaging features of metastatic tumors involving the skeletal muscles have been scrutinized in a number of articles. All the articles have been on the MR imaging findings for skeletal muscle metastasis from carcinoma, and the reported findings included heterogeneous signal intensity, large areas of necrosis, peritumoral edema, and heterogeneous enhancement. However, the report that demonstrates the pathognomonic MRI findings allowing discrimination between primary sarcoma and metastatic tumor to the skeletal muscle has hardly been identified (2–4).

Metastases of malignant phyllodes tumors occur through hematogenous spread. The most common site where the tumor metastasizes is the lung, but metastases have also been reported in other organs such as bone, brain, gastrointestinal tract, uterus, spleen, thyroid, and heart (4, 6, 7). To the best of our knowledge, our report is the first one covering imaging findings of a skeletal muscle metastasis from a malignant phyllodes tumor. The imaging findings of the skeletal muscle mass of the current case were also non-specific as are those of other soft tissue tumors, but we noted that the MR images of the skeletal muscle metastasis of our case showed relatively less prominent peritumoral edema, less peritumoral enhancement on intravenous gadolinium compound-enhanced images, and relatively homogenous tumor enhancement without salient necrosis compared with the previously reported metastatic muscle tumors from 'carcinomas'. We speculate that these imaging characteristics represent discernible imaging features compared with the usual imaging findings of skeletal muscle metastasis from 'carcinomas' (4, 8).

Phyllodes tumor is generally considered a sarcoma rather than a carcinoma, because mesenchymal cells play a primary role in the biological behavior of the mass. We thought that a metastatic sarcoma might resemble a primary sarcoma of the skeletal muscle. Nonhemorrhagic primary soft tissue sarcomas have uniform high signal intensity on T2WI with less central necrosis and peritumoral edema/enhancement on MRI, whereas large, multinodular, hypervascular soft tissue sarcomas may have central areas of hemorrhage, necrosis, calcification, and possibly peritumoral edema (8). Accordingly, we speculated that the relative lack of peritumoral edema/enhancement of the metastatic muscle tumor in our patient was due to the innate character of an uncomplicated sarcoma in contrast to carcinoma. Wiliams et al. described three cases of metastatic carcinoma involving muscle that showed extensive peritumoral edema. The masses of the two cases of their series showed central necrosis but the remaining one did not show central necrosis or any other internal complication. The fact that one of the three metastatic muscle tumors exhibited prominent peritumoral edema without significant internal necrosis and/or hemorrhage suggests that uncomplicated metastasis from a carcinoma can cause profound peritumoral edema, whereas a primary sarcoma usually does not (8). However a study conducted by Tuoheti et al. showed a disputable result. They reported that 11 out of 12 cases of muscle metastasis from carcinoma displayed severe peritumoral edema with associated central necrosis, while the remaining one case did not show peritumoral edema. Unfortunately, the authors did not include a detailed description of the MRI findings of this exceptional case on whether it demonstrated internal complications such as hemorrhage or necrosis (4).

In conclusion, we suggest that a relative lack of peritumoral edema on T2WI with relatively scanty peritumoral enhancement on gadolinium-enhanced T1WI could be characteristic of metastatic sarcoma to the skeletal muscle, such as from malignant phyllodes tu-

mor of the breast, in contrast to metastatic carcinoma. However, comparison of MR imaging findings between metastatic sarcoma and carcinoma involving muscles, enrolling much more cases, is necessary to further prove our findings.

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골격근육에 전이된 악성 유방 엽상종양의 영상소견: 증례 보고

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저자들은 육종의 일종으로 분류되는 유방의 악성 엽상종양이 골격근으로 전이된, 현재까지 영상소견으로는 보고된 사례가 없는, 드문 증례의 초음파, 양전자방출 단층촬영, 전산화 단층 촬영, 자기공명영상 소견을 보고하고자 한다.

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