RADIOLOGY FOR THE SURGEON

Musculoskeletal case 44

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A 63-year-old man had a 20-pack-year cigarette-smoking history but stopped smoking 16 years ago. On presentation, his initial chest radiograph showed abnormal shadows in the upper lobe of his left lung. We made a definitive diagnosis of lung cancer (moderately differentiated adenocarcinoma) with transbronchial biopsy. Computed tomography (CT) scans of his chest revealed a 3.2-cm mass in the upper lobe of his left lung, consistent with bronchogenic carcinoma, with left hilar lymphadenopathy and a slightly enlarged lymph node at the aortopulmonary window. His cancer was stage IIIb (T4, N2).

A staging CT/positron emission tomography (PET) scan revealed increased uptake of ^{18}F-fluorodeoxyglucose (FDG) in the primary lesion, the left hilar region and the aortopulmonary window. We found no discrete metastases.

The patient underwent lobectomy and lymph node removal. After surgery, we administered a combination of carboplatin and paclitaxel intravenously once a week for 4 weeks. About 8 months after completing chemotherapy, the patient experienced progressive pain in his left buttock, which prompted recent investigations. An ultrasound revealed a mass, confirmed on CT/PET scan. We were concerned about recurrent adenopathy in the mediastinum. The buttock would be an unusual site of metastasis for a non–small cell lung cancer, so we referred the patient to an oncologist and an orthopedic surgeon.

A magnetic resonance image (MRI) of the patient's pelvis showed a mass in the left gluteus maximus, 5×4 cm in size, that had signal intensity slightly lower than muscle on T_1-weighted images, but equal to or higher than muscle on the T_2-weighted image (Fig. 1).

Given the patient's history of primary lung cancer, what is the chance that the mass is metastatic? What are the MRI features that make muscle metastasis more likely?

Diagnosis

Skeletal muscle metastasis from non–small cell lung cancer

We performed an ultrasound-guided biopsy of the mass and diagnosed metastatic adenocarcinoma, comparing our biopsy findings with earlier findings from a fine-needle aspiration biopsy of the chest mass. The tumour cells were identical.

Skeletal muscle metastases from lung cancer are uncommon. The benign conditions account for most soft tissue masses in pathologic series with an incidence 50–100 times greater than cancer.[1,2] Based on imaging findings, the difference is substantially narrower, with about 70% of lesions being benign and 30% being cancerous.[3,4] Soft tissue metastases are relatively uncommon, even in patients with known cancer. Skeletal muscle is thought to be highly resistant to both primary and metastatic cancer.[5,6] Autopsy series have

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examined the prevalence of skeletal muscle metastases in patients with metastatic neoplasms. Willis[6] found a very low incidence of 0.8% (4 patients in a series of 500). Other authors have detected much higher rates of skeletal muscle metastases: Pearson[7] found an incidence of 16%, and Acinas García and colleagues[8] found an incidence of 17.5%. The relatively high incidence of muscular metastases in the latter 2 studies may be reconciled with the paucity of documentation on this phenomenon in the radiologic literature by noting that many of these lesions are microscopic and asymptomatic.

Various theories have been proposed to explain the rarity of the skeletal metastases, given the fact that skeletal muscles account for a large percentage of total body weight. These theories include variety of blood flow, intermittent muscular contraction, lactic acid metabolism and PH, the presence of diffusible proteases and other inhibitors that may block the enzyme-dependent processes of invasion or tumour growth and relatively low tissue oxygen tension relative to the lungs.[5]

Although solitary muscle metastases are rare, the combination of a muscle mass with a solitary lung mass or unilateral hilar adenopathy is more likely to represent a lung cancer metastasizing to muscle rather than a sarcoma presenting with a solitary lung or hilar metastasis. When patients with sarcomas have exhibited lung metastasis, there has usually been more than one lesion, and it is exceptional for a sarcoma to present with a metastatic hilar mass.[9]

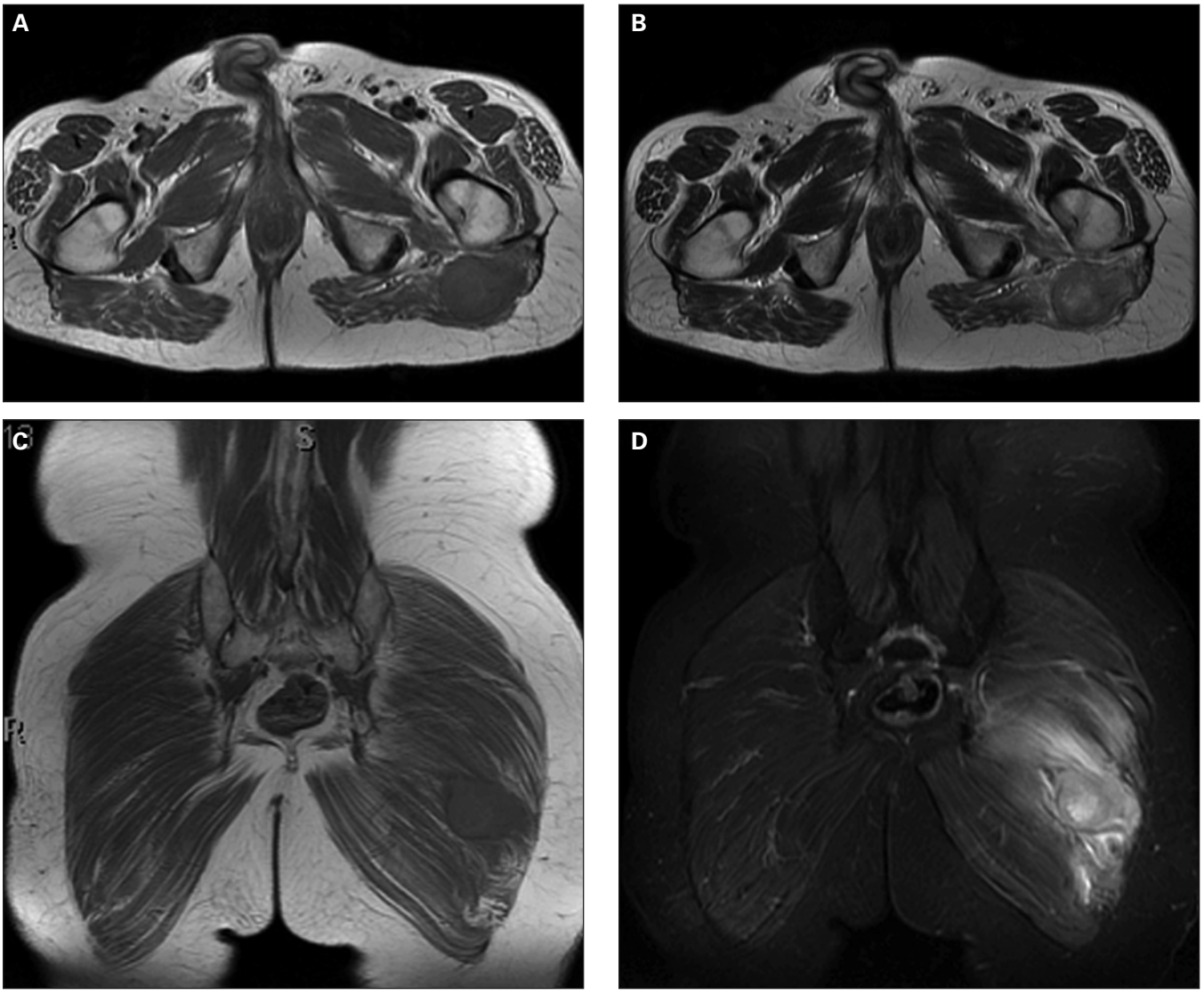

Fig. 1. The signal intensity was slightly lower in the mass in the left gluteus muscle than in the surrounding muscle tissue on T_1-weighted images: (**A**) axial spin echo (SE), T_1 (echo time [TE] 11.9/ repetition time [TR] 717) and (**D**) coronal SE, T_1 (TE 9.4/ TR 883). The signal intensity was equal to or higher in the left gluteus muscle than in the surrounding muscle tissue on the T_2-weighted images: (**B**) axial fast spin echo (FSE), T_2 (TE 80.3/ TR 5850) and (**C**) coronal FSE, short tau inversion recovery (TE 45.5/ TR 4100). The interior of the tumour was heterogeneous. The area around the tumour was represented as a diffuse high signal intensity on T_2-weighted images (**B**,**C**).

Magnetic resonance imaging is ideally suited for evaluation of soft tissue tumours because of its soft tissue contrast and ability to image directly in any plane. Also, it has been proven effective in defining the relation between soft tissue tumours and adjacent neurovascular structures.

We did not administer gadolinium in this patient; the cases reviewed in the literature used gadolinium and almost all showed a similar pattern of enhancement with heterogeneous enhancement of the interior and marked enhancement of the tumour periphery. Our patient's case is one of the few reported cases with peritumoral edema; one of us (P.M.) reported the case of a patient with renal cell carcinoma metastasis to the trapezius,[10] and Suto and colleagues[11] reported the case of a patient with lung carcinoma metastasis to the quadriceps.

The findings of muscle metastases in the gluteus muscle is consistent with other case reports in the literature that have documented exclusive involvement of proximal skeletal musculature by tumour foci, so-called centrifugal metastases. Also, MRI can optimize therapeutic efficacy in that the tumour location within fascial planes of skeletal muscle can be confirmed, allowing accurate placement of the radiation port. Magnetic resonance imaging series may be used to gauge the response to treatment.

The clinical manifestations and the MRI features of metastatic carcinomas in skeletal muscles closely resemble those of soft tissue sarcomas in many respects, but painful masses and the extensive peritumoral enhancement patterns on MRIs are common in the former. Therefore, any painful soft tissue mass occurring in patients with a known history of carcinoma, particularly with extensive peritumoral enhancement associated with central necrosis, is highly suspicious for skeletal muscle metastasis.[4]

In the past, CT was useful for evaluating soft tumours, but it has largely been replaced by MRI because of its imaging advantages, and MRI obviates the need for ionizing radiation and iodinated contrast material. Although MRI has emerged as the most useful diagnostic tool in this setting, consistent differentiation between benign masses and cancer has not been achieved.[12] Thus in most cases, tissue biopsy is necessary for accurate diagnosis.

Competing interests: None declared.

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