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Case report

Intramuscular metastasis from gastric cancer

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Abstract
Skeletal muscle is an uncommon site of hematogenous metastasis of gastric carcinoma. We report here a rare case of gastric carcinoma with multiple intramuscular metastases. Our patient had advanced gastric carcinoma and complained of left gluteal induration with tenderness. Because magnetic resonance imaging (MRI) revealed that the gluteal tumor showed iso-signal intensity on T1-weighted images and high signal intensity on T2-weighted images, with reticulated texture around the tumor, and the patient had advanced gastric carcinoma, we speculated that the tumor was an intramuscular metastatic tumor from primary gastric carcinoma. There were also multiple intramuscular metastatic lesions in both gluteal muscles on the MRI findings that were not detected by physical examination. Therefore, the patient underwent total gastrectomy with combined resection of spleen, with subsequent chemotherapy. Three months after the operation, we excised the gluteal tumor to alleviate the gluteal pain. Histological examinations confirmed that the gluteal tumor was a metastasis from primary gastric carcinoma.

Key words Gastric cancer · Intramuscular metastasis · Magnetic resonance imaging

Introduction

The most common metastatic sites of gastric carcinoma are liver, lungs, lymph nodes, and peritoneum. Metastasis to skeletal muscle from gastric carcinoma is extremely uncommon, although the skeletal muscle mass of the human body accounts for a large percentage of the total body weight, nearly 50%, and receives an abundant blood supply. At present, the reasons for the rarity of intramuscular metastasis remain unclear. Some reasons have been considered to be the high tissue pressure, the accumulation of lactic acid, local changes in pH, and oxygenation [1].

We had a patient who had advanced gastric carcinoma, with a left gluteal tumor. We suspected from the magnetic resonance imaging (MRI) characteristic findings that the gluteal tumor was a metastasis from primary gastric carcinoma. MRI was also helpful in defining the extent of metastasis for the excision of the gluteal tumor. We report here this patient with intramuscular metastasis from advanced gastric carcinoma, focussing on the diagnosis by MRI. This report is the twelfth documented instance of gastric carcinoma metastasis to skeletal muscles. The purpose of this report was to document this unusual intramuscular metastasis from gastric carcinoma, and to provide a review of the literature.

Case report

A 64-year-old Japanese woman presented with a 2-month history of general fatigue, right hypochondralgia, and left gluteal tenderness. She was examined at a local hospital. Upper gastrointestinal radiological studies and endoscopic studies suggested advanced gastric carcinoma with central ulceration at the lesser curvature, extending from the antrum to the body of the stomach. According to the general rules of the Japanese Gastric Cancer Association (JGCA) [2], the tumor was classified macroscopically as type 3, and gastric biopsies revealed poorly differentiated adenocarcinoma (Fig. 1).

The patient was referred to our hospital on September 27, 1999, for further treatment of the gastric carcinoma. The results of her blood laboratory tests were all within normal limits. On physical examination, a mass measuring approximately 8 cm long × 4 cm wide was palpable in the left gluteus maximus muscle. The tumor was nonfluctuant, consistent, and mobile in the subcutaneous tissue. The range of motion of the left hip joint

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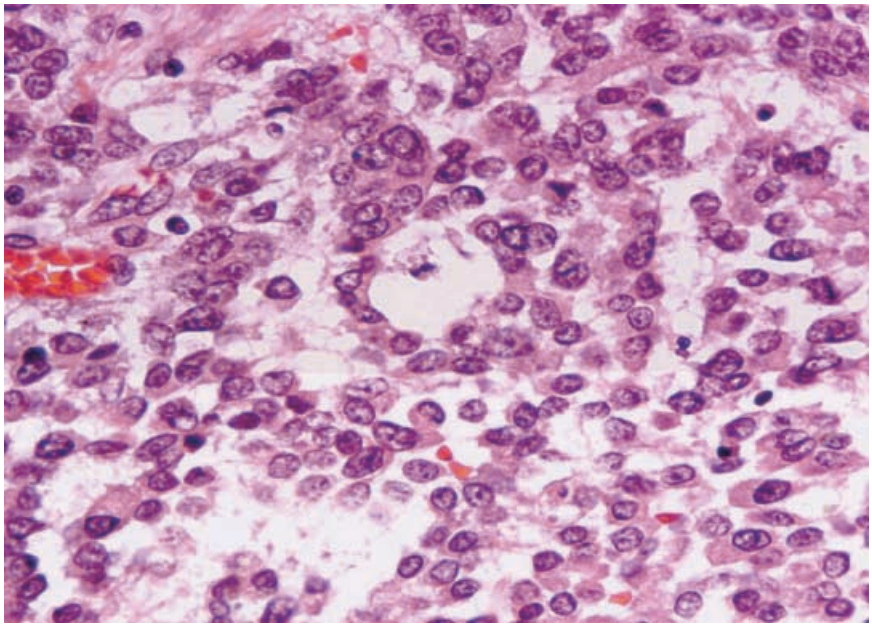

Fig. 1. Microscopic appearance of gastric biopsy specimen, showing poorly differentiated adenocarcinoma (solid type). H&E, ×400

was almost normal. MRI showed that the tumor in the left gluteus maximus muscle was well-defined, and it revealed iso-signal intensity on T_1-weighted images (Fig. 2A) and heterogeneous high signal intensity on T_2-weighted images, compared with the surrounding muscles (Fig. 2B). The extensive reticulated texture with low signal intensity in the T_1-weighted image and high signal intensity with T_2-weighted image was found in the peritumoral area (Fig. 2A,B). A small mass with the same MRI patterns as the main mass was found in the left adductor magnus muscle (Fig. 2C). A few small nodules, with the same MRI intensity patterns as the left gluteal tumor, were also detected in both gluteal maximus muscles on an other plane (Fig. 2D). We speculated, from these findings and the clinical history of this patient, that the gluteal mass was a metastasis from primary gastric cancer, rather than being a primary soft-tissue tumor, as a possible diagnosis.

The patient underwent total gastrectomy with combined resection of the spleen for advanced gastric carcinoma on October 28, 1999, as she was reluctant to have excision of the left gluteal mass. The resected tumor was classified macroscopically as type 3, according to the general rules of the JGCA, and the size of the tumor was 12 × 9 cm (Fig. 3). Histological examination of the resected specimen revealed that the tumor was poorly differentiated adenocarcinoma (solid type) mixed with signet-ring cell carcinoma penetrating the serosa, with no regional lymph node metastasis; tumor vascular invasion was rarely observed.

Three months after the operation, as the patient suffered severe gluteal pain and the size of the gluteal mass had increased, she requested that excision of the gluteal mass be performed. Open needle biopsies were performed, and the mass was histologically diagnosed to be consistent with the previously resected primary gastric carcinoma (Fig. 4). She underwent tumor excision on the same day: February 29, 2000. After the excision, she had marked relief from the pain. Subsequently she received chemotherapy, with the systemic administration of 5-fluorouracil (5-FU). However, this chemotherapy was not effective, and multiple metastatic nodules rapidly developed in the entire abdominal wall, the left thigh, and both gluteal muscles at the end of May 2000. She died of progressive gastric carcinoma, without lung or liver metastasis, on November 4, 2000.

Discussion

Twelve cases of intramuscular metastases from gastric carcinoma, including our case (Table 1) have been reported in the literature since 1970, as far as we could determine from our search [3–13]. In these previous reports, there was no difference according to sex, and the mean age of the patients was 57.7 years (range, 47–72 years). Metastases developed in multiple skeletal muscles in some patients [4,12], including our patient. In our patient, the metastatic pattern of gastric carcinoma was unusual, as multiple metastases developed, but not in liver and lungs. The mechanisms of the metastases to skeletal muscles could not be explained in our patient.

In the diagnosis of intramuscular metastasis, computed tomography (CT), MRI, ultrasonograghy, and gallium scintigraphy have been employed to date. Of these investigations, MRI is the most useful, not only for

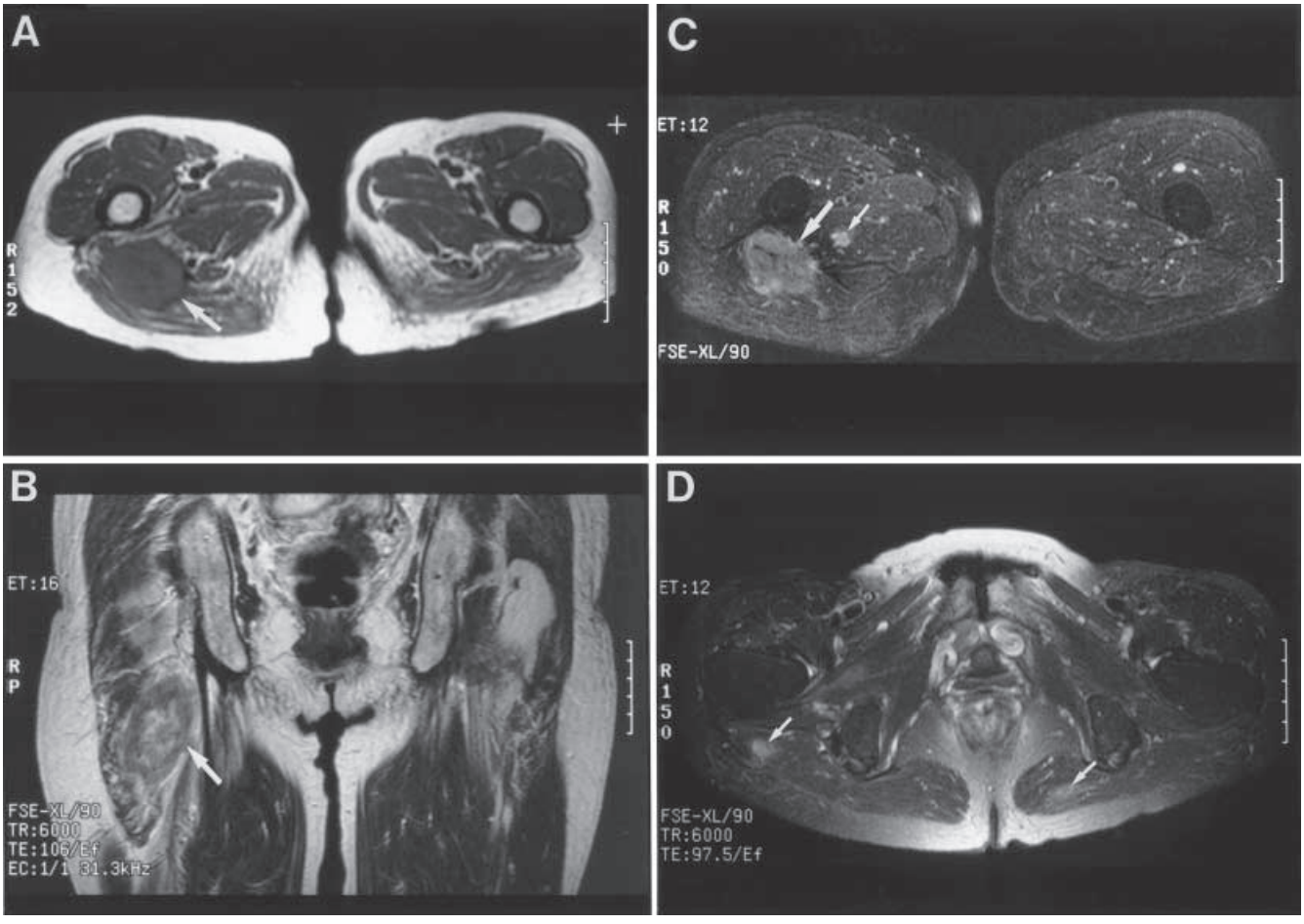

Fig. 2A–D. Magnetic resonance imaging (MRI), showing intramuscular metastasis in the gluteus maximus muscle. MRI revealed iso-signal intensity (*arrow*) on the T_1-weighted axial image **A** (repetition time [TR]/echo time [TE]: 600/14) and high signal intensity (*arrow*) on the T_2-weighted coronal image **B** (TR/TE: 6000/106) compared with surrounding muscles. **C** On fat-suppression T_2-weighted image (TR/TE: 6000/97.5), a small mass (*small arrow*) was revealed in the left adductor magnus muscle. **D** Two intramuscular nodules (*arrows*) were found in both gluteal maximus muscles on T_2-weighted axial image (TR/TE: 6000/106)

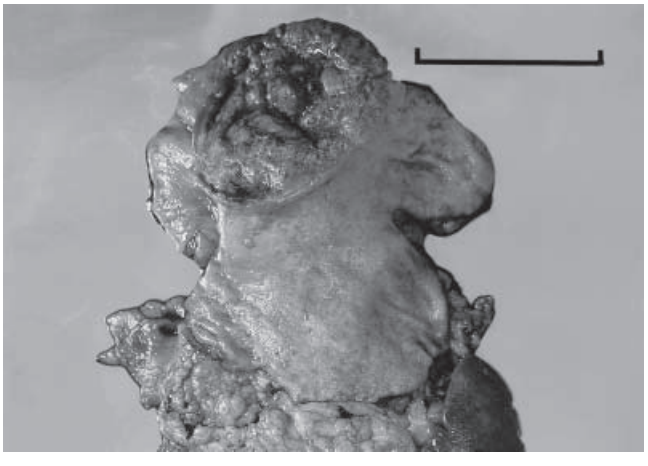

Fig. 3. Macroscopic appearance of the primary gastric carcinoma, of type 3, measuring 12 × 9 cm at the lesser curvature, extending from the antrum to the body of the stomach. *Bar* 10 cm

the differential diagnosis of metastatic tumors, primary soft-tissue sarcoma, hematoma, and abscess but also in delineating the extent of the involved muscle, because of its excellent contrast to the surrounding muscle and observations on multiplanar sections [3,8,14,15]. Additionally, MRI is accurate in evaluating tumor invasion to the adjacent bone and vessels. Unenhanced CT scans show intramuscular metastatic masses as iso-density lesions compared with surrounding muscles, and the sensitivity of CT is much poorer than that of MRI. Contrast enhanced CT may provide more information than unenhanced CT [3,14]. However, CT is particularly useful in detecting the calcification of lesions, which is sometimes caused by mucinous adenocarcinoma [12,13]. In such cases, CT scans are useful in detecting metastatic lesions with ossification. In addition, some interesting reports have recently described the MRI appearances of intramuscular metastases [7,14,15]. Intramuscular

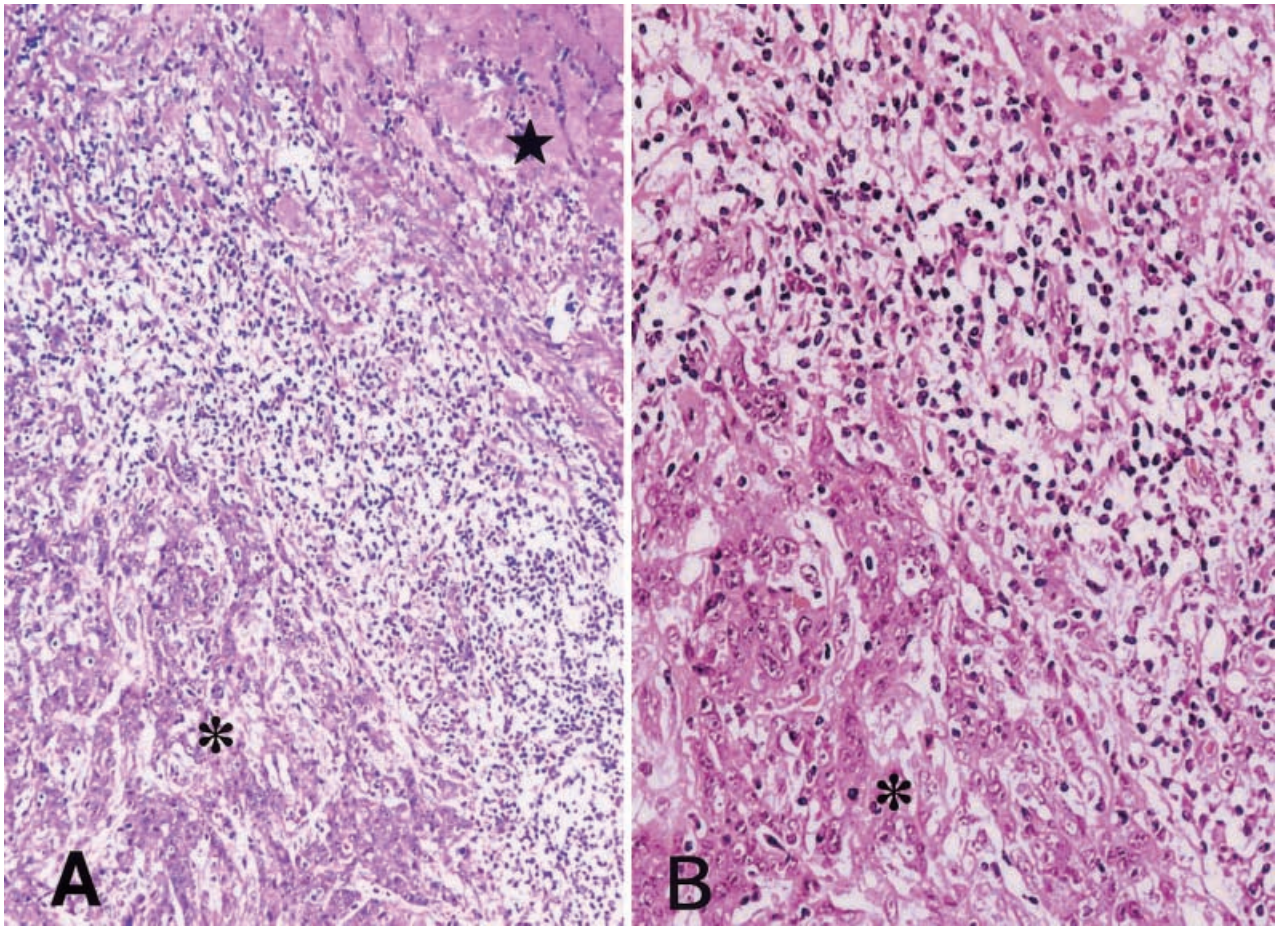

Fig. 4A,B. Microscopic appearance of the metastatic adenocarcinoma in the gluteus maximus muscle from the primary gastric carcinoma. There was peritumoral edema with inflammatory cell infiltration. *Asterisks*, Metastatic tumor; *star*, skeletal muscle. **A** H&E ×100; **B** H&E, ×200

Table 1. Reported cases of intramuscular metastasis from gastric carcinoma

Author	Year	Age (years)	Sex	Muscle site of metastasis
Sudo et al. [3]	1993	61	M	Trapezius m.
Porlie et al. [4]	1990	65	M	Sartorius m., Rectus femoris m.
Narvaez et al. [5]	1998	49	M	Psoas m.
Traves and Barruch [6]	1979	52	M	Psoas m.
Pestalozzi and von Hochstetter [7]	1998	72	F	Gastrocnemius m.
Amano and Kumazaki [8]	1996	57	M	Gastrocnemius m.
Toillon et al. [9]	1994	58	M	Gastrocnemius m.
Van Gelderen [10]	1993	47	F	Extraocular m.
Arnold et al. [11]	1989	59	F	Extraocular m.
Rosenbaum et al. [12]	1984	54	M	Upper arm m., Femoral m.
Obley et al. [13]	1983	54	M	Paraspinal m.
Our patient		64	F	Gluteus maximus m., Adductor magnus m.

metastases have been described as showing low-iso signal intensity on T_1-weighted images and high signal intensity on T_2-weighted images compared with surrounding muscle. Other features of intramuscular metastases include muscle enlargement, reticulated texture, and peritumoral edema, and intratumoral patterns such as hemorrhage and central necrosis. Histological findings in our patient revealed large amounts of inflammatory cells infiltrated to the metastatic carcinoma, with the formation of peritumoral edema (Fig. 4); these findings were related to the characteristic MRI findings. In our patient, a possible differential diagnosis

from intramuscular metastasis could be malignant fibrous histiocytoma, in consideration of the MRI findings, this patient's age, and the tumor site. Although nonhemorrhagic soft-tissue sarcoma shows the same T_1- and T_2-weighted image patterns as intramuscular metastatic carcinoma, it usually has less necrosis, peritumoral edema, and lobulation, which is usually distinguished from intramuscular metastases [3,8,15,16]. However, these appearances are not always compatible with soft-tissue sarcoma. Biopsy, in addition to MRI, should be performed for the final diagnosis of intramuscular tumor.

The optimal treatment of intramuscular metastasis is not known. There are several reports, including our report, of surgical excision, or radiation therapy, or systemic chemotherapy for intramuscular metastasis from primary gastric cancer [3,4,7,12,13]. The clinical complaints were alleviated by these therapies in some patients, including our patient [4,12]. However, these therapies were not effective for prolonging the survival of the patients. From these previous reports, we believe that intramuscular metastasis is considered to be a sign of partial systemic hematogenous metastasis and the terminal stage in the progress of gastric carcinoma. The findings in our patient, together with those in the other patients, suggest that clinically undetectable metastatic lesions were already present at the initial diagnosis of the intramuscular metastasis. We must be careful to treat patients with multiple metastases, as a recent study has suggested that a postoperative increase in dormant tumor angiogenesis may promote tumor growth [16]. Further clinical studies are needed to establish a standard therapy for intramuscular metastasis from gastric carcinoma.

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