CASE REPORT

Solitary Plasmacytoma of the Sternum Detected Incidentally by MR Imaging of the Cervical Spine

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We incidentally detected a case of solitary plasmacytoma of the sternum by magnetic resonance (MR) imaging of the cervical spine. At detection, the patient had no symptoms, the lesion was localized in the bone marrow of the sternum, and there were no findings of bone destruction. The lesion showed high contrast on diffusion-weighted images, gradually enlarged over 3 years, and was confirmed as a solitary plasmacytoma at open biopsy 3 years after detection. Radiologists should pay attention to incidental findings in the upper part of the sternum at MR imaging examination of the cervical spine.

Keywords: *plasmacytoma, sternal tumor, MRI*

Introduction

A solitary plasmacytoma of the bone occurs infrequently, when a neoplastic mass of plasma cells arises at a single site of bone or soft tissue.^{1–3} Several cases affecting the sternum have been reported.^{4–7} However, to the best of our knowledge, in most of these, the tumor broke through the cortex of the sternum and spread into adjacent soft tissue of the anterior chest wall, and patients then complained of pain of the anterior chest wall.

We present a case of solitary plasmacytoma of the sternum detected incidentally at MR imaging examination of the cervical spine.

Case Report

A 63-year-old woman presented with neck pain and numbness of her upper limbs. Her past history included a cholecystectomy for cholecystolithiasis at age 50 and a total gastrectomy for gastric cancer at age 59. MR imaging of the cervical spine for suspicion of cervical spondylosis demonstrated an area of abnormal signal intensity in the manubrium sterni (Fig. 1). Bone scintigraphy following MR imaging showed no abnormal uptake (not shown).

At the same time as the MRI, carcinoma of the rectum was found. The sternal lesion was not interpreted as a bone metastasis because of the negative result of the bone scintigraphy. We obtained informed consent that treatment for the carcinoma of the rectum should have priority, and the patient underwent a low anterior resection.

About one year later, follow-up MR imaging revealed an obvious area of hyperintensity on sagittal short-tau inversion recovery (STIR) images (Fig. 2A), and diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) also clearly depicted the lesion (Fig. 2B, C). Although the size of the lesion remained unchanged from the first examination, we suspected a primary malignant bone tumor, especially solitary plasmacytoma, based on these MR imaging findings. However, results were negative for plasma interleukin-2 receptor and urinary Bence-Jones protein.

The patient was referred to a bone tumor expert but did not visit the outpatient clinic because she was asymptomatic. Approximately 3 years after initial presentation, she complained of anterior chest pain and underwent MR imaging of the thoracic cage (Fig. 3), which showed a lesion that was obviously enlarged from the previous study. Computed tomographic (CT) examination showed expansion of the bone marrow of the manubrium sterni and a partially deformed cortex (Fig. 4). Open biopsy

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Fig. 1. At first examination, magnetic resonance (MR) imaging of the cervical spine was performed for suspicion of cervical spondylosis. **A:** T₁-weighted sagittal image shows area of low intensity in the manubrium sterni (arrow). **B:** Short-tau inversion recovery (STIR) sagittal image shows area of high intensity in the same region (white arrow).

Fig. 2 Eleven months after the first examination, magnetic resonance (MR) imaging of the cervical spine and thoracic cage were performed. **A:** Short-tau inversion recovery (STIR) sagittal image shows an area of high intensity (white arrow). **B:** Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) coronal image shows an area of high intensity in the manubrium sterni (arrow). **C:** DWIBS sagittal image also shows an area of high intensity in the same region (arrow).

confirmed plasmacytoma (Fig. 5). Whole-body F-18-deoxyfluoroglucose (FDG) positron emission tomography (PET) and PET-CT disclosed no other lesions. After radiotherapy with a total dose of 45 Gy, the anterior chest pain disappeared. Two years after radiotherapy, the sternal lesion was unchanged on MR imaging, and serum IgA and M-protein tended to be increased. However, there was no obvious development of multiple myeloma.

Discussion

Because MR imaging of the cervical spine also depicts the surrounding structures, such as the upper part of the sternum, part of the thyroid gland, and muscle and subcutaneous soft tissues, it can be used to detect sternal abnormalities, space-occupying lesions in the thyroid gland, and tumors of the soft tissue in the neck. Sternal abnormalities can arise from trauma, degenerative and inflammatory conditions, and neoplasms. Most neoplasms of the sternum are metastases,² with primary sternal ne-

Fig. 3. Thirty-four months after the first examination, the patient underwent magnetic resonance (MR) imaging of the thoracic cage for anterior chest pain. **A:** T₁-weighted coronal image shows an area of low intensity expanding the cortex bone (arrow). **B:** Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) coronal image shows an area of high intensity in the manubrium sterni. **C:** DWIBS sagittal image shows an area of high intensity in the same region. The area is obviously larger than in Fig. 2 (arrows).

Fig. 4. Also 34 months after the first examination, computed tomography (CT) of the thoracic cage was added. **A:** Original axial image shows bone marrow of the manubrium sterni expanded and partially deformed cortex (white arrow). **B:** Sagittal reconstructed image also shows bone marrow of the manubrium sterni expanded and partially deformed cortex (white arrow).

Fig. 5. Histological findings. **A:** Hematoxylin-and-eosin staining showed proliferation of round cells with abundant cytoplasm and eccentric nuclei with coarse chromatin, thus indicating plasmacytoma. **B:** Positive CD 138 staining on the cell surface revealed plasma cell nature of the tumor cells.

oplasms relatively uncommon; however, primary tumors are much more frequently malignant than benign, and most are chondrosarcomas.² In a series of 11,087 Dahlin bone tumors at the Mayo Clinic,⁸ Restrepo² reported only 66 (0.6%) primary malignant tumors of the sternum, which included 22 (33%) chondrosarcomas and 20 (30%) myelomas that included plasmacytomas.

Solitary plasmacytoma of bone usually occurs in bones characteristically affected by multiple myeloma; Bateille⁹ reports the spine, pelvis, and ribs as the most commonly affected sites. Radiographically, solitary plasmacytoma of the bone appears multicystic, multilocular, and trabeculated. It may be expansile and may break through the cortex of the bone to spread into adjacent soft tissue structures.⁴⁻⁷ On MR imaging, lesions usually appear as intermedullary zones with low intermediate signal on T₁-weighted images (T₁WI), from slightly high to high signal on T₂-weighted images (T₂WI), and with high signal on fat suppression T₂WI or STIR.¹⁻³

Metastatic disease is the most common differential diagnosis,^{1,8,10} and non-Hodgkin lymphoma, Langerhans histiocytosis, and osteomyelitis are possibilities.¹ In our case, negative bone scintigraphy suggested a low possibility of metastatic disease.

Although literature review^{1-3,8-16} indicates solitary plasmacytoma of the sternum to be rare, it should be considered in the differential diagnosis when MR imaging detects signal abnormalities of the sternum.

Several reports describe cases of solitary plasmacytoma of the sternum,⁴⁻⁷ but few appear to discuss MR imaging findings. Moreover, most of these reported tumors were detected in advanced stages, in which they had broken through the cortex of the sternum and spread into the adjacent soft tissue of the anterior chest wall, so patients complained of pain and swelling in the anterior chest wall. In contrast, we detected our patient's lesion incidentally by MR imaging at an early stage, when the patient had no symptoms. On MR imaging, the mass was localized within the bone marrow of the sternum and gradually enlarged over 3 years. Our patient was diagnosed and treated much earlier than patients in the previous reports, whose final diagnosis and treatment took place after the tumor had enlarged and symptoms had appeared.

In our case, after we histologically confirmed the diagnosis of plasmacytoma, we performed FDG-PET combined with whole body CT, which confirmed the lesion as solitary. Our case was consistent with the criteria of the International Myeloma

Working Group (IMWG) diagnostic criteria of solitary plasmacytoma of the bone¹⁷: no M-protein in serum and/or urine; single area of bone destruction due to clonal plasma cells; bone marrow not consistent with multiple myeloma (plasma cells < 5%); normal skeletal survey (and MR imaging of the spine and pelvis if done); and no related organ or tissue impairment.

Radiotherapy is the recommended standard for solitary plasmacytoma of the bone, with response rates as high as 94% reported.¹⁸ In patients with solitary plasmacytoma of the bone, the most common pattern of progression consists of new bone lesions, rising myeloma protein level, and development of marrow plasmacytosis. The median time to progression is 2 to 3 years, but multiple myeloma has developed in a few patients as long as 15 years after radiotherapy.¹⁹ Therefore, long-term careful observation is necessary.

In summary, we incidentally detected a solitary plasmacytoma of the sternum at MR imaging of the cervical spine. The mass was localized in the bone marrow, and the patient had no symptoms. MR imaging has proved useful in detecting abnormalities of the bone marrow, such as plasmacytoma and multiple myeloma, at early stages. Radiologists should pay attention to incidental findings in the extraspinal region in MR imaging examination of the cervical spine. Malignant tumor should be considered if abnormal signal is detected in the upper part of the sternum, and plasmacytoma is one differential diagnosis.

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