Imaging Findings of Plasmacytoma of Both Breasts as a Preceding Manifestation of Multiple Myeloma

Young Mi Park

Department of Radiology, Busan Paik Hospital, Inje University College of Medicine, Gaegeum-dong, Busanjin-gu, Busan 633-165, Republic of Korea

Correspondence should be addressed to Young Mi Park; pymrad@yahoo.co.kr

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1. Introduction

Plasmacytoma is malignant plasma cell proliferative disorder derived from B cells in the bone marrow [1]. Plasmacytoma can be a primary tumor or it can be secondary to disseminated multiple myeloma (MM) and may grow within the axial skeleton or soft tissue [2]. In 2003, the International Myeloma Working Group recognized three distinct groups of plasmacytoma: solitary plasmacytoma of bone, extramedullary plasmacytoma, and multiple solitary plasmacytomas that are either primary or recurrent [3]. Solitary plasmacytoma of bone is the most common form, and it occurs as a lytic lesion within the axial skeleton [4]. Primary extramedullary plasmacytoma is rare, accounting for only 4% of all plasma cell tumors, and can be either solitary or multiple [5]. Extramedullary plasmacytoma most often arises in the upper aerodigestive tract, with a predilection for the head and neck [3, 5–7]. Multiple solitary plasmacytommas occur as multiple sites of disease in soft tissue, bone, or both soft tissue and bone [3].

Breast plasmacytoma is extremely rare. It can occur as a primary isolated tumor or as an extramedullary manifestation in MM. The published data on breast plasmacytommas predominantly include case reports, most of which are focused on the clinical signs or the histopathological characteristics of breast plasmacytoma.

Here, I report the imaging features of bilateral breast plasmacytommas that eventually progressed to MM in a 35-year-old female patient.

2. Case Presentation

In June 2014, a 35-year-old female patient presented with multiple nontender palpable lumps in both breasts and diplopia in her left eye. Thirteen months earlier, she had been diagnosed with primary extramedullary plasmacytoma of the epidural soft tissue at the cervical 6-thoracic 1 spine level and the stomach. At that time, a bone marrow biopsy had shown normocellular bone marrow. A bone marrow examination contained less than 10% (6.2%) plasma cells. There had been no evidence of bony abnormality, end-organ damage (anemia, renal failure, and hypercalcemia), and serum or urine monoclonal protein elevation. The patient had undergone 12 cycles of chemotherapy with melphalan and prednisolone with concurrent radiotherapy of the spinal region. Serial follow-up with magnetic resonance imaging (MRI) and computed tomography (CT) of the cervical spine...
failure and severe metabolic acidosis. In August 2014, the patient died of renal and pulmonary nephropathy occurred due to involvement of the right ureter. The presenting case also showed extremely malignant and rapid progression. The patient initially started with primary extramedullary plasmacytoma rather than extraosseous MM. The patient had received chemotherapy and the disease had been in remission. After about a year, however, relapse and progression to MM occurred. The plasma cell myelomas invaded the right humerus and clavicle as well as both breasts and the orbit. Serum protein electrophoresis showed monoclonal gammopathy at this time. Following this, dissemination of the disease to nearly the entire body occurred in just 3 months.

This patient was unusual in several aspects. Firstly, she was at a relatively young age. MM is a disease of older adults; the median age at diagnosis is 66 years. Only 10%, 2%, and 0.3% of patients are younger than 50, 40, and 30 years, respectively [1, 14]. Secondly, her bone marrow examination results showed normocellular bone marrow and fewer than 10% plasma cells. Approximately 4% of patients may have fewer than 10% bone marrow plasma cells because marrow involvement may be focal, rather than diffuse [8]. Thirdly, both her breasts were entirely invaded by multiple plasma cytomas. Of the breast plasmacytoma cases that have been described, nearly half have been bilateral [15]. The presenting case, however, showed unique image findings: on the final PET-CT scan, multiple masses of myeloma had invaded both entire breasts, forming a huge conglomerated mass.

Breast plasmacytoma is extremely rare with unknown prevalence. Surov et al. [2] reported that the prevalence of breast plasmacytoma at their institution was 1.5% of all identified patients with plasmacytoma and that, in 85% of the patients, involvement of the breast was a secondary event of MM. Primary and secondary plasmacytomas do not show significant differences in radiological characteristics, and they can be misdiagnosed as primary breast carcinoma or even as a benign process [2]. It can present as hyperdense, round or oval, masses with well- or ill-defined margins on mammography. It can also be identified by diffuse infiltration, but microcalcifications are scarce [2]. On ultrasonography, breast plasmacytoma can appear as echo-poor or hypoechoic well-defined masses with hypervascularity, but mixed hypo-to hyperchoic lesions with indistinct margins can also be revealed [2]. The posterior acoustic features are also variable;
Figure 1: Gray scale (a) and color Doppler (b) sonograms of the breast show multiple, circumscribed, markedly hypoechoic, round or oval masses with highly increased vascularity. Mammograms (c) show circumscribed irregular conglomerated hyperdense masses invading both entire breasts. T2-weighted image of breast magnetic resonance imaging (MRI) (d) shows multiple, circumscribed, oval or round masses of high signal intensity (SI) in both breasts. The masses reveal high SI on diffusion-weighted image (e) with a low apparent diffuse coefficient value (not shown) suspicious for malignancy. Early phase of dynamic contrast-enhanced sagittal T1-weighted MRI (f) shows multiple circumscribed masses with strong homogeneous enhancement. Time-intensity curve of dynamic contrast-enhanced MRI (g) shows early strong (780% of the baseline value) and fast/delayed washout enhancement kinetics, suggestive of malignancy. Follow-up positron emission tomography-computed tomography scan (h) reveals massive breast plasmacytomas (SUVmax 6.3), invading both entire breasts. Metastatic lymphadenopathies throughout the whole body and metastatic masses in the abdomen, left cheek, both shoulders, chest wall, right buttock, and both thighs are shown.
Figure 2: Histopathological analysis ((a) HE ×200) of left breast mass shows infiltration of plasmacytoid cells around the ductal breast tissue. The plasmacytoid cells are eccentrically located with slightly enlarged nuclei compared to mature plasma cells ((b) HE ×400). Photomicrographs show a positive reaction for CD 138 ((c) ×200), indicating plasma cell origin, and positive reactions for E-cadherin ((d) ×200), CK5/6 ((e) ×200), and CK7 ((f) ×200) in the entrapped breast ductal tissue, but negative in infiltrated cells, suggesting a nonepithelial origin.

they can show posterior acoustic enhancement or no acoustic transmission and even posterior acoustic shadowing [2].

The patient in this report had similar mammographic and ultrasonographic findings to the previously reported cases. She had multiple lesions in both breasts. The differential diagnosis of multiple bilateral breast masses includes both benign and malignant conditions, such as fibroadenomas, complex cysts, focal fibrosis of the breast, fat necrosis, abscesses, phyllodes tumors, metastasis, lymphoma, and synchronous breast cancers [16]. Malignant multiple bilateral breast masses are very uncommon, but radiologists should consider metastatic or hematological disease when the imaging findings are suspicious. A history of malignancy can help in the differential diagnosis [17, 18].

To date, there are three reports on the MRI findings of breast plasmacytoma [19–21]. According to a case report by Neuhaus and Hess [19], extramedullary plasmacytomas of the breast revealed low/intermediate SI on T1/T2-weighted images and massive homogeneous enhancement with early strong/delayed washout kinetics. On the other hand, another plasmacytoma reported by Kim et al. [21] showed intermediate/low SI on T1-/T2-weighted images. After venous administration of contrast medium, a breast plasmacytoma manifested as a hypervascular mass [20]. In the present case, plasmacytomas revealed high SI on DWI with low ADC values and early strong and fast/delayed washout enhancement kinetics, suggestive of malignancy. These findings suggest that MRI may be more helpful in the differential diagnosis than mammography and ultrasonography.

Extramedullary plasmacytomas can virtually involve whole organs in the body. The few reports on the radiological manifestations of plasmacytomas in other parts of the body...
indicate that extramedullary plasmacytomas are nonspecific and widely variable depending on the site [22]. The differential diagnosis includes extramedullary hematopoiesis, infection, amyloidoma, and a second malignancy. Generally, it is observed as homogeneous soft tissue masses on CT, with a low T2 signal without necrosis and calcification on MRI and with high FDG uptake on FDG-PET. The MRI findings represent high cellularity composed of monoclonal plasma cells [23, 24].

The International Myeloma Working Group recommends urgent MRI or CT when extramedullary involvement is suspected. FDG-PET should be also included [3, 23]. MRI, PET/CT, or CT may be used to evaluate sites of plasma cell myeloma and to monitor the response of these sites to treatment.

In conclusion, breast plasmacytoma in the present report showed multiple circumscribed, oval or round, radiodense, and markedly hypoechoic masses in both breasts. MRI showed strongly enhanced masses with iso/high SI on T1/T2- and diffusion-weighted images and initial fast/delayed washout kinetic curve, suggesting malignancy. When multiple bilateral breast masses are found, breast plasmacytoma should be considered in the differential diagnosis of breast disorders, especially in patients with history of plasma cell malignancy. MRI may be a better option in the differential diagnosis of plasmacytomas than mammography and ultrasonography, which would contribute to a more accurate diagnosis in these patients.

Conflict of Interests

The author declares that she has no conflict of interests.

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