

Imaging Findings of Metastatic Disease to the Breast

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The purpose of this study was to evaluate imaging findings of metastatic disease to the breast. We analyzed 15 cases that had been previously examined by radiographic study (comprising a total of 11 mammograms, 13 ultrasounds and 3 chest CT). Primary malignancies included the following: 6 breast cancers, 5 stomach cancers, 2 melanomas, 1 cervical cancer, and 1 lung cancer. Radiologic findings were analyzed and the 15 cases were divided into two groups: hematogeneous and lymphangitic metastasis. Eleven cases were classified as lymphangitic metastasis (73.3%) and 4 cases were hematogeneous metastasis (26.7%). Multiple masses were shown in 13 cases (86.7%), and 12 cases displayed unilateral lesions (80%). There was no evidence of calcification. In the 11 cases with available mammogram, 7 cases (63.6%) revealed multiple masses with well-defined (2 cases, 28.6%) or ill-defined margin (5 cases, 71.4%) and 6 cases (54.5%) showed diffuse increased density and skin thickening. Among the 11 cases that revealed mass lesions on ultrasound, 2 cases showed a well-defined margin (18.2%) and 9 cases showed an ill-defined margin (81.8%). Posterior shadowing of the mass was seen in only 1 case. Four cases (36.3%) showed a minimal echogenic boundary around the mass. Eight cases showed diffuse skin thickening (53.3%). Three cases with chest CT showed multiple masses and/or diffuse skin and trabecular thickening of the breast. In conclusion, the characteristic imaging findings of metastatic disease to the breast are multiple ill-defined masses with a lack of desmoplastic reaction and no calcification, as compared to primary breast carcinoma. The diffuse lesions without evidence of breast mass on mammogram and US could be distinguishable from inflammatory carcinoma of breast origin.

Key Words: Breast neoplasms, breast neoplasms-diagnosis,

Received April 18, 2001
Accepted August 10, 2001

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breast neoplasms-metastases, breast neoplasms-radiography

INTRODUCTION

The breast is a relatively uncommon site for the involvement of metastatic disease from extramammary primary malignancies. In previously reported clinical literature,¹⁻³ the incidence of nonprimary tumors has ranged from 0.5% to 1.3% of all breast malignancies. In contrast to primary breast carcinoma, survival rates have been poor following the discovery of breast metastasis.⁴

Diagnosis and management of metastases to the breast can present difficulties to the radiologist and the clinician. In spite of its rarity, the exact diagnosis of this clinical condition is important, and the correct management of metastases to the breast may help avoiding unnecessary surgery.⁵

The purpose of this study was to evaluate the imaging findings of metastatic disease to the breast in order to aid the accurate diagnosis of this condition.

MATERIALS AND METHODS

In retrospective review of clinical records at our institution, 2,228 patients were found to have suffered from primary and metastatic breast cancer between January 1992 to June 1999. Metastatic disease to the breast, evidenced by the presence of pathologic or clinical proof, was proven in 28 patients. Seventeen of the 28 cases had undergone radiographic study. Among these cases, 2 cases with secondary lymphoma were excluded from this study. The remaining 15 cases that had been examined by radiographic study

were analyzed.

The average age at the time of diagnosis of metastasis to the breast was 41 years (range: 23 - 64 years). All patients were women. Metastases to the breast appeared on average 15 months (range: 0 - 56 months) after the discovery of the primary malignancy. The primary tumors included six contralateral breast cancers, five stomach cancers, two melanomas (calf and foot skin), one cervix cancer and one lung carcinoma. Nine cases of metastatic breast cancer had histologic proof by core needle biopsy (8 cases) or mastectomy (1 case) and 6 cases, which had developed metastasis to the opposite breast following a previous mastectomy for breast carcinoma, were diagnosed with the assistance of reported clinical and radiologic findings. Metastatic disease was present elsewhere in 13 of the patients when the breast lesions were discovered. In 2 patients, the breast was the first metastatic site after the diagnosis of nonmammary primary malignancy.

Both mammogram and ultrasound (US) were performed in 8 cases. Three cases underwent only US, one case had only mammogram and one case had only chest CT. However, two cases had

mammogram, US, and chest CT. The total number of each radiographic study was as follows; mammogram (11 cases), US (13 cases), and chest CT (3 cases).

Two radiologists (S.Y.Chung, K.K.Oh) evaluated the images by consensus. The radiographic findings were analyzed and divided into two groups; hematogeneous and lymphangitic metastasis according to the report by Paulus et al.⁶ Single or multiple nodules of the breast with relatively well-defined margins were classified as hematogeneous metastasis. Marked diffuse skin thickening, denser subcutaneous tissue and glandular stroma, as well as increased trabecular pattern with or without masses of the breast were regarded as indicative of lymphangitic metastasis.

RESULTS

Radiographic findings were analyzed and classified into the two groups of lymphangitic and hematogeneous metastasis (Table 1). Eleven cases were classified as lymphangitic metastasis (6 contralateral breast cancers, 5 stomach cancers)

Table 1. Summary of Imaging Findings of Metastatic Disease to the Breast (n=15)

	Lymphangitic metastasis (n=11)	Hematogeneous metastasis (n=4)	Totals (n=15)
Mammogram and US (n=15)			
Unilateral lesion	10	2	12
Bilateral lesion	1	2	3
Multiple masses	9	4	13
No mass	2	0	2
Mammogram (n=11)			
Multiple masses	4	3	7
- Well-defined margin	0	2	2
- Ill-defined margin	4	1	5
No mass	3	1	4
Diffuse increased density & skin thickening	6	0	6
US (n=13)			
Multiple masses	9	2	11
- Well-defined margin	0	2	2
- Ill-defined margin	9	0	9
No mass	2	0	2
Posterior shadowing	1	0	1
Echogenic boundary	2	2	4
Diffuse skin thickening	11	2	13
Lymphatic dilatation	9	0	9

US, ultrasound.

and 4 cases were hematogeneous metastasis (2 melanomas, 1 lung cancer, 1 cervix cancer).

Unilateral lesions of the breast were found in 6 patients without previous history of breast carcinoma, and bilateral lesions were found in 3 patients. Six patients were previously reported as having had a mastectomy. Thirteen cases showed multiple masses on mammogram, US or chest CT. The 2 remaining cases showed diffuse skin thickening without mass and consisted of 1 case of metastasis of stomach cancer and 1 case of contralateral breast cancer (Fig. 1).

Seven of the 11 cases examined by mammogram showed multiple masses; 2 of these showed a well-defined margin and 5 showed an ill-defined margin. The remaining 4 cases showed diffuse increased density with no visible mass. Two of these 4 cases revealed mass lesions on US. Six cases showed diffuse increased density on

mammogram and all of these cases were lymphangitic metastasis.

Among the 13 cases examined by US, multiple masses were seen in 11 cases; 2 of these cases showed a well-defined margin and 9 showed an ill-defined margin. The 2 cases with a well-defined margin were hematogeneous metastasis. Posterior shadowing of the mass was seen in only 1 case (contralateral breast cancer). On US, 4 cases showed an irregular but minimal echogenic boundary around the mass. Lymphatic dilatation of the skin and breast parenchyma on US were shown in 9 cases and all of these cases were lymphangitic metastasis (Fig. 2). There was no evidence of calcification within the mass, nor spiculation, focal skin thickening, or retraction of the skin and nipple adjacent to the mass. Thirteen cases (86.7%) showed diffuse skin thickening and edema on mammogram, US or chest CT. Axillary

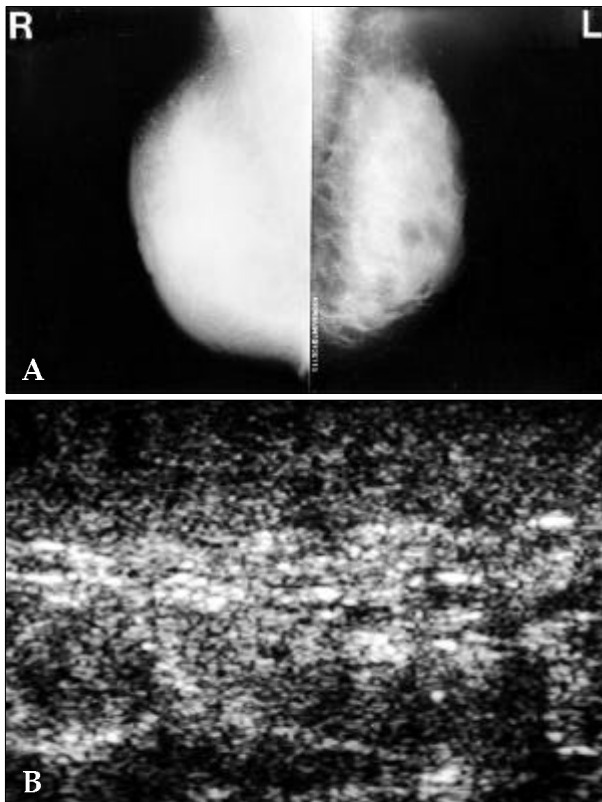


Fig. 1. Lymphangitic metastasis to the breast from stomach cancer in a 23-year-old woman. (A) Mediolateral oblique mammograms demonstrate that the right breast is much denser than the left and its skin is thickened. (B) Ultrasound of the right breast shows diffuse skin thickening and obliteration of subcutaneous fat without evidence of any mass.

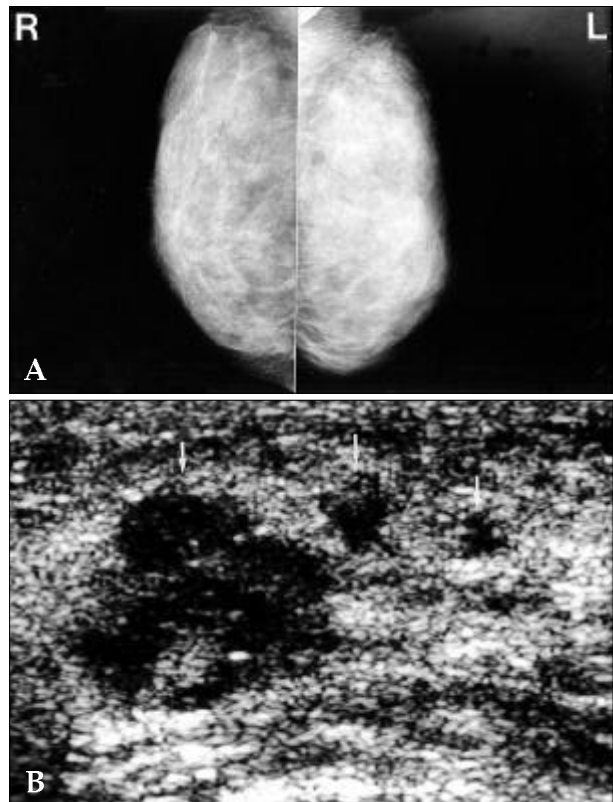


Fig. 2. Lymphangitic metastasis to the breast from stomach cancer in a 37-year old woman. (A) Mediolateral oblique mammogram of the left breast shows diffuse increased parenchymal density. (B) Ultrasound of the left breast shows irregular shaped hypoechoic nodules (arrows) with nonhomogeneous texture, ill-defined margin, and diffuse skin thickening.

node involvement was present in 6 of the 15 cases. In 1 case of melanoma, mammographic evidence of diffuse skin and trabecular thickening was not seen at the time of diagnosis of breast metastasis, although it became evident after 1 month. This finding appears to be due to direct tumor invasion of dermal lymphatics (Fig. 3).

Among the 3 cases examined by chest CT, 1 case (melanoma) showed multiple masses in both breasts. The other 2 cases (both contralateral breast cancer) showed diffuse skin thickening, trabecular thickening and multiple small nodules in the skin and subcutaneous layer on chest CT, suggestive of lymphangitic metastasis (Fig. 4).

DISCUSSION

Metastases to the breast from extramammary malignancies are unusual, and it may be difficult

to make an adequate diagnosis, particularly when a metastatic tumor in the breast is the first manifestation of an unknown extramammary primary tumor.^{7,8} The histologic diagnosis of metastasis to the breast can be more difficult than that of primary breast cancer. Histologically, the tissue is carefully examined for periductal and/or perilobular distribution of malignant tumor cells without identification of intraductal carcinoma and/or lobular carcinoma in situ. It is of the utmost importance to make a histologically correct and type-specific identification of the primary site of metastatic tumor in order to avoid unnecessary major surgery.^{3,5}

Paulus et al.⁶ reported that metastasis to the breast may occur by 2 distinct routes, lymphangitic and hematogeneous, and that the radiographic appearance of these groups was sufficiently distinct. Lymphangitic metastasis to the breast usually occurs when a carcinoma of the breast

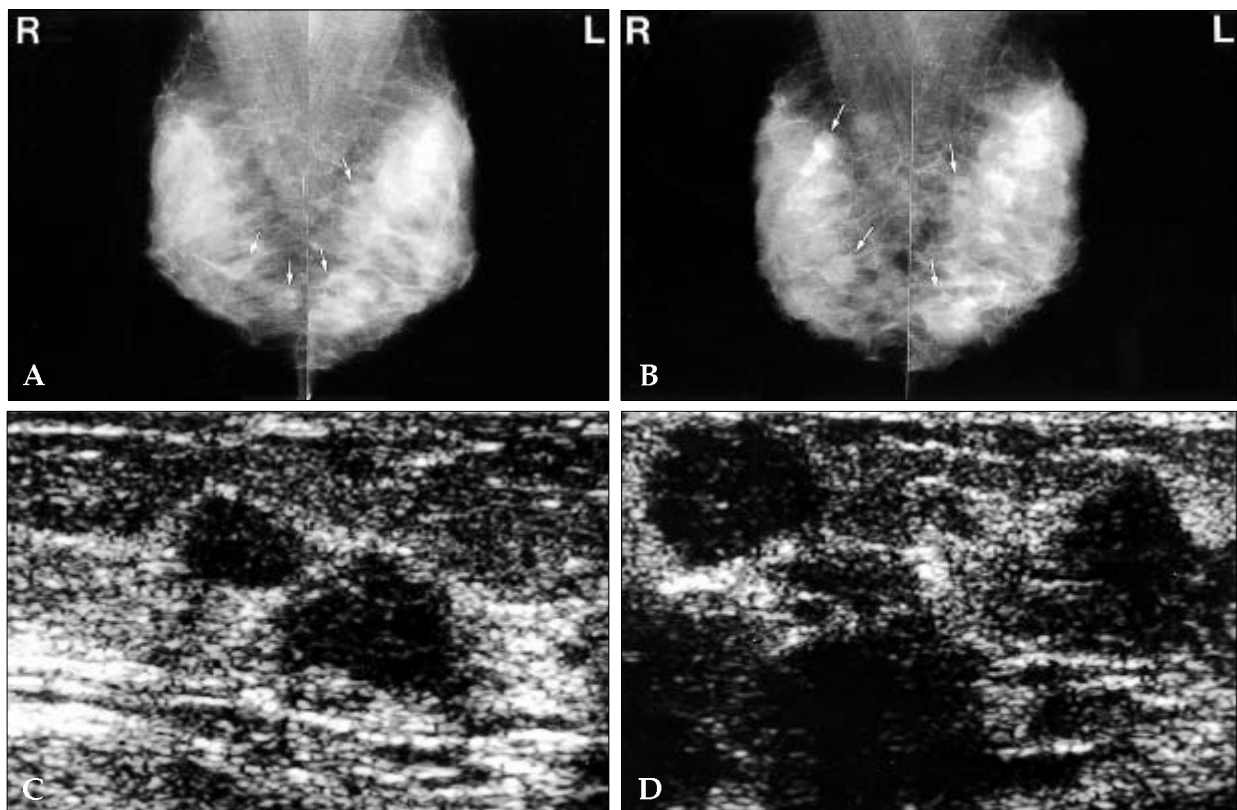


Fig. 3. Hematogeneous metastasis to the breast from calf melanoma in a 40-year-old woman. (A) At the time of diagnosis of breast metastasis, mediolateral oblique mammogram of both breasts shows several irregular shaped, high-density nodules with ill-defined margin (arrows). (B) After 1 month, multiple nodules (arrows) in both breasts grew in size and became more numerous on mammogram. (C) Breast ultrasound obtained at the first examination shows multiple irregular hypoechoic nodules with ill-defined margin. (D) After 1 month, multiple nodules in both breasts increased in size and became more irregular on ultrasound.

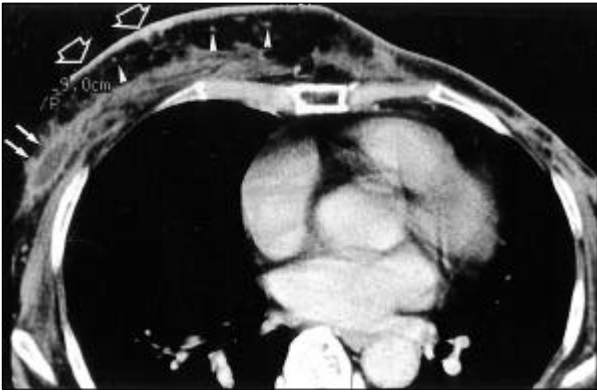


Fig. 4. Lymphangitic metastasis to the contralateral breast following left modified radical mastectomy due to breast cancer in a 63-year-old woman. On chest CT, the right breast shows diffuse skin thickening (open arrows), several tiny nodules (arrow heads) in the subcutaneous layer, and loculated fluid collection of unknown origin (arrows).

spreads across the anterior chest wall (cross-lymphatic metastasis) to the opposite breast. In these cases, skin thickening is often medial in location. Mammographic findings of lymphangitic metastasis reveal skin thickening, denser subcutaneous tissue with a thicker trabecular pattern, and denser and more irregular glandular stroma. The most common radiographic appearance of blood-borne metastasis to the breast is the presence of one or more round, discrete nodules in the breast. A review of the literature,^{3,5,9,10} indicates that melanoma is the most common source of blood-borne metastasis to the breast, followed in decreasing frequency by lung cancer, soft tissue sarcomas, and ovarian cancer. These are followed by smaller numbers of primary tumors in the gastrointestinal and genitourinary tracts.¹¹⁻¹³ A third type of metastatic breast involvement occurs in hematologic malignancies, most often lymphoma, less frequently leukemia, and rarely myeloma. Lymphoma or leukemia may involve the breast primarily, but they are more often part of a widespread process.^{6,14}

In this study, lymphangitic metastasis was found in 11 (6 breast cancers, 5 stomach cancers) of the 15 cases studied and it was more common than hematogeneous metastasis (4 cases). Among the 11 cases of lymphangitic metastasis, 9 cases showed diffuse skin thickening, lymphatic dilatation, subcutaneous fat obliteration and multiple ill-defined nodules, suggestive of advanced

lymphangitic metastasis. These cases can be indistinguishable from inflammatory breast carcinoma.¹⁵⁻¹⁷ However, the remaining 2 cases (stomach cancer and contralateral breast cancer) did not show any mass formation on mammogram or US, and this finding can be suggested as the key finding to be used in differentiating lymphangitic breast metastasis from inflammatory breast carcinoma. Lymphangitic metastasis most commonly occurred from primary carcinoma of the opposite breast. Stomach cancer was the second most common cause of breast metastasis and caused large numbers of breast lymphangitic metastasis in contrast to previous reports. It has been generally reported that the incidence of stomach cancer in Orientals is very high as compared to Caucasians and the metastasis of stomach cancer to the breast seems to occur more frequently in Orientals. The involvement of unilateral breast following ipsilateral axillary node enlargement was seen in 4 of 5 patients with stomach cancers, this may support the theory of involvement by retrograde lymph flow from axilla to breast which has been previously suggested in breast metastasis of ovarian cancer and stomach cancer.^{15,18} However, one case without axillary node enlargement could not be explained by this theory. Additionally, the possibility that the metastases in the breasts and axillary glands may have arisen independently through a different pathway can not be excluded.

In this study, metastatic tumors to the breast tended to have a relatively ill-defined margin rather than a well-defined margin. This finding is contrary to previous reports,^{5,19} which included well-circumscribed lesions. Unilateral lesions were more frequently found than bilateral lesions and this result was in accordance with previous studies.^{3,9} McCrea et al.⁵ reported that multiple lesions and diffuse disease were less common. However, multiple lesions and diffuse disease were more common in this study. This appears to be due to the advanced stage of the disease in this study. Additionally, we observed no spiculated mass, focal skin thickening, or retraction of the skin and nipple adjacent to the mass, suggesting a lack of desmoplastic reaction.²⁰ Several cases have been reported to demonstrate microcalcifications secondary to metastatic ovarian cancer,^{21,22}

but none of the lesions in this study demonstrated such calcifications. The presence of recognizable calcifications in a mass on a mammogram virtually excludes the possibility of metastatic disease to the breast.^{3,5,6,11}

In conclusion, the characteristic imaging findings of metastatic disease to the breast are multiple ill-defined masses with a lack of desmoplastic reaction such as focal skin and nipple retraction or spiculation, and no recognizable calcifications in the mass. In particular, contralateral breast carcinoma and stomach cancer occupied a large proportion of the lymphangitic breast metastasis. The diffuse lesions lacking evidence of breast mass on mammogram and US could be distinguishable from inflammatory breast carcinoma.

REFERENCES

- Abrams HL, Spiro R, Goldstein N. Metastases in carcinoma. *Cancer* 1950;3:74-84.
- Sandison AT. Metastatic tumors in the breast. *Br J Surg* 1959;47:54-8.
- Hajdu SI, Urban JA. Cancers metastatic to the breast. *Cancer* 1972;29:1691-6.
- Silverberg E. Cancer statistics, 1977. *CA Cancer J Clin* 1977;27:26-41.
- McCrea ES, Johnston C, Haney PJ. Metastases to the breast. *AJR* 1983;141:685-90.
- Paulus DD, Libshitz HI. Metastasis to the breast. *Radiol Clin North Am* 1982;20:561-8.
- Cavazzini G, Colpani F, Cantore M, Aitini E, Rabbi C, Taffurelli M, et al. Breast metastasis from gastric signet ring cell carcinoma, mimicking inflammatory carcinoma. A case report. *Tumori* 1993;79:450-3.
- Muttarak M, Nimmonrat A, Chaiwun B. Metastatic carcinoma to the male and female breast. *Australas Radiol* 1998;42:16-9.
- Toombs BD, Kalisher L. Metastatic disease to the breast: Clinical, pathologic, and radiographic features. *AJR* 1977;129:673-6.
- Amichetti M, Perani B, Boi S. Metastases to the breast from extramammary malignancies. *Oncology* 1990;47:257-60.
- Alexander HR, Turnbull AD, Rosen PP. Isolated breast metastases from gastrointestinal carcinomas: report of two cases. *J Surg Oncol* 1989;42:264-6.
- Gupta S, Gupta MK, Gupta R, Mishra RS. Breast metastasis of cervical carcinoma diagnosed by fine needle aspiration cytology. A case report. *Acta Cytol* 1998;42:959-62.
- Harrist TJ, Kalisher L. Breast metastasis: an unusual manifestation of a malignant carcinoid tumor. *Cancer* 1977;40:3102-6.
- Paulus DD. Lymphoma of the breast. *Radiol Clin North Am* 1990;28:833-40.
- Krishnan EU, Philips AK, Randell A, Taylor B, Garg SK. Bilateral metastatic inflammatory carcinoma in the breast from primary ovarian cancer. *Obstet Gynecol* 1980;55 Suppl3:94S-6S.
- Park JM, Kwon JS, Gong G. Metastatic breast carcinoma from gastric cancer: a case report. *J Korean Radiol Soc* 1998;38:1139-41.
- Lee SH, Park JM, Kook SH, Han BK, Moon WK. Metastatic tumors to the breast: mammographic and ultrasonographic findings. *J Ultrasound Med* 2000;19:257-62.
- Kim SH, Cha ES, Park JM, Kim HH, Kim JY, Park YH, et al. Radiologic findings of metastatic tumors to the breast. *J Korean Radiol Soc* 1999;41:601-6.
- Bohman LG, Bassett LW, Gold RH, Voet R. Breast metastases from extramammary malignancies. *Radiology* 1982;144:309-12.
- Yang WT, Metreweli C. Sonography of nonmammary malignancies of the breast. *Am J Roentgenol* 1999;172:343-8.
- Moncada R, Cooper RA, Garces M, Badrinath K. Calcified metastases from malignant ovarian neoplasm. Review of the literature. *Radiology* 1974;113:31-5.
- Royen PM, Ziter FM Jr. Ovarian carcinoma metastatic to the breast. *Br J Radiol* 1974;47:356-7.