Case Report

Rapid progression of carcinoma en cuirasse breast dermal metastases on ^{18}F-fludeoxyglucose positron emission tomography–computed tomography

ABSTRACT

Cancer in the dermis of the breast has a poor prognosis. The breast dermis can become malignantly involved primarily in inflammatory breast cancer, through the direct extension of locally advanced breast cancer, or metastatically from an underlying breast mass or a distant primary malignancy (e.g., gastric adenocarcinoma). Breast dermal metastases have the shortest median survival among them. Breast dermal metastases are classified into eight clinicohistopathologic groups, one of which is carcinoma en cuirasse. We present a case of a 52-year-old female with a history of invasive ductal carcinoma, Stage IIIC (pT2N3a), treated with lumpectomy, axillary node dissection, and chemoradiation therapy that recurred as carcinoma en cuirasse breast dermal metastases. Through ^{18}F-fludeoxyglucose positron emission tomography–computed tomography (^{18}F-FDG PET-CT) and clinical images, the case illustrates the rapid progression and devastating consequences of carcinoma en cuirasse breast dermal metastases over a 4-month period despite optimal therapy. Furthermore, the case emphasizes the sensitivity of ^{18}F-FDG PET-CT to detect pathology in the breast dermis. Finally, the case highlights the crucial role that nuclear medicine physicians play in helping clinical colleagues differentiate between the various breast dermal malignant manifestations and benign mastitis, a common confounder in postradiation patients.

Keywords: ^{18}F-fludeoxyglucose positron emission tomography–computed tomography, breast dermal metastases, carcinoma en cuirasse, inflammatory breast cancer, locally advanced breast cancer

Disclaimer: The views expressed in this manuscript are those of the author and do not reflect the official policy of the Department of Navy, Department of Defense, or U.S. Government.

CASE REPORT

A 52-year-old female with a 4.6 cm left breast invasive ductal carcinoma (no special type) was treated with a lumpectomy and axillary lymph node dissection. Pathologic analysis of surgical specimens revealed wide negative surgical margins on the primary mass, and 19 of 25 lymph nodes were metastatically involved, overall consistent with Stage IIIC (pT2N3a) disease. No left breast dermal involvement was initially present. Subsequently, she received adjuvant chemotherapy with Adriamycin, Cytoxan, and paclitaxel and 66 Gy of radiation to the left breast and axilla.

Colin Raymond Young, Mallini Harigopal[1], Darko Pucar

Departments of Radiology and [1]Pathology, Yale New Haven Hospital, New Haven, CT, USA

Address for correspondence: Dr. Colin Raymond Young, Department of Radiology, Yale New Haven Hospital, 20 York Street, New Haven, CT 06510, USA.
E-mail: c.young@yale.edu

Submitted: 18-May-2019, **Accepted:** 01-Jul-2019, **Published:** 07-Nov-2019

Access this article online	
Website: www.wjnm.org	Quick Response Code
DOI: 10.4103/wjnm.WJNM_37_19	

How to cite this article: Young CR, Harigopal M, Pucar D. Rapid progression of carcinoma en cuirasse breast dermal metastases on ^{18}F-fludeoxyglucose positron emission tomography–computed tomography. World J Nucl Med 2020;19:65-8.

About 1 year later, she represented with fibrosis of the left breast [Figure 1a, white short arrows], and palpable right axillary adenopathy. While biopsy of the right axillary adenopathy indicated recurrent malignancy, the left breast fibrosis was initially clinically favored to represent radiation mastitis, partially attributable to initial punch biopsy results. However, an ^{18}F-fludeoxyglucose positron emission tomography–computed tomography (^{18}F-FDG PET-CT)

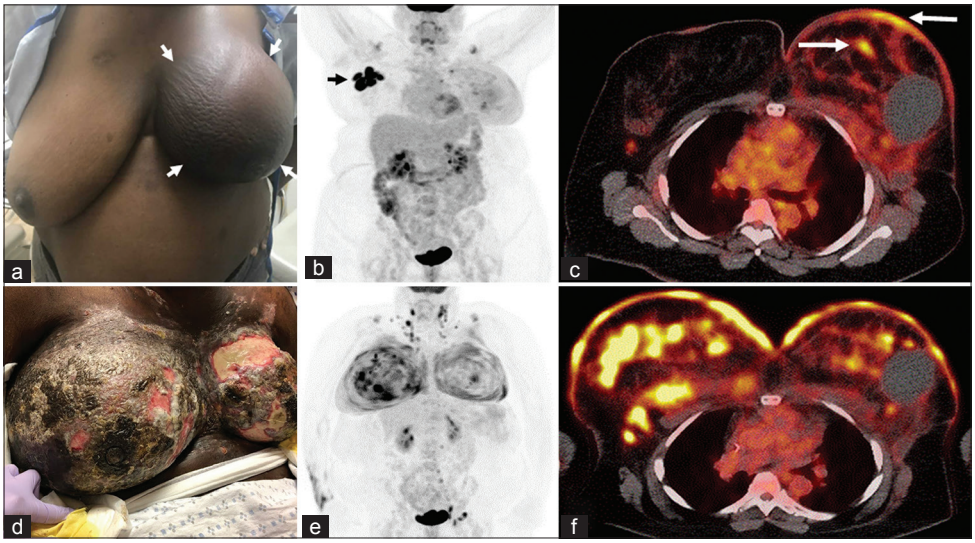

Figure 1: (a-c) Pre-salvage chemotherapy (d-f) Post-salvage chemotherapy

Table 1: Differentiating malignant lesions of the breast dermis

Category	Inflammatory breast cancer (IBC)	Non-IBC locally advanced breast cancer	Breast dermal metastases
Clinical presentation	Breast erythema and edema (peau d'orange)[1] Often no palpable mass[1] Involves >1/3 of the breast[1] T4d, at least Stage IIIb[1] Younger age at diagnosis (average: 58 years old) than LABC[2] 20%–40% risk of distant metastases at diagnosis[2]	Definition[1-3] Tumors >5 cm in size (T3) with regional adenopathy (N1) or Tumors of any size with direct extension to the chest wall (T4a) or skin (T4b) or both (T4c) regardless of adenopathy or Presence of regional adenopathy: Clinically fixed or matted axillary lymph nodes (N2) or any infraclavicular, supraclavicular, or internal mammary adenopathy (N3) regardless of tumor stage At least Stage IIIa[1] 10% risk of distant metastases at diagnosis[2]	Eight clinicohistopathologic morphologies[4] Nodular type Inflammatory Telangiectatic Alopecia neoplastica Carcinoma of the inframammary crease Metastatic carcinoma of the eyelid Paget's disease Carcinoma en cuirasse Usually from underlying breast cancer Rarely originates from another organ (e.g. stomach)
Skin finding development relative to the initial disease presentation	<3 months[1,2]	>3 months[1,2]	Usually seen as recurrence of disease[5] Rarely may be initial presentation[5]
Continuity with underlying mass	Continuous	Continuous	Discontinuous
Molecular characteristics	More proliferative subtypes (40% HER2+and 50% triple−)[2] >60% mutated p53 tumor suppressor gene[2] Overexpression of RhoC and loss of WISP3 → Increased tumor invasion and metastases [2] High VEGF → Stimulator of tumor angiogenesis[2] E-cadherin and dysfunctional MUC-1 overexpression → Embolus formation and increased metastases[2]	More favorable subtypes (more ER+and HER2−subtypes)[2] 30% mutated p53 tumor suppressor gene[2]	Activation of pleiotrophin and caveolin-1 → Induces tumor growth, angiogenesis, and potential to invade into adjacent spaces[6,7] Loss on chromosome 1p → Inactivation of tumor suppressor genes[8] Decrease in BigH3 and α-catenin → Less cell differentiation and adhesion[9,10]
Median survival	2.9 years[11]	6.4 years[11]	13.8 months[12]

IBC: Inflammatory breast cancer; LABC: Locally advanced breast cancer; VEGF: Vascular endothelial growth factor; MUC-1: Mucin 1, cell surface associated; WISP3: WNT1 inducible signaling pathway protein 3; HER2+: Human epidermal growth factor receptor 2 positive; WISP3: WNT1 [wingless-related MMTV integration site 1] inducible signaling pathway protein 3; RhoC: Ras homolog gene family, member C

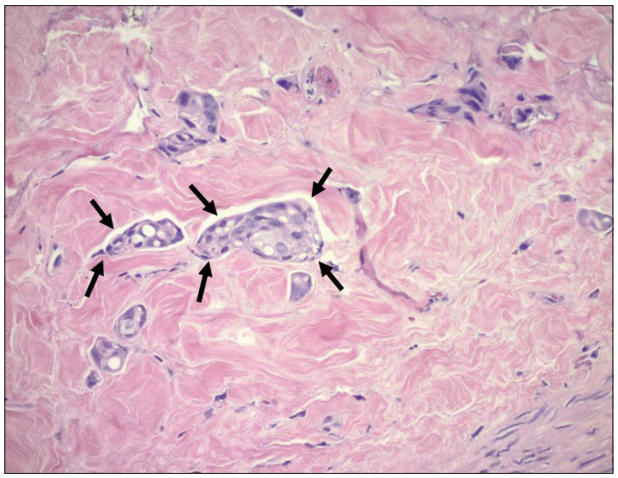

Figure 2: Postsalvage chemotherapy biopsy

demonstrated an intense hypermetabolic activity associated with the right axillary adenopathy [Figure 1b, black arrows] and broad areas of moderate hypermetabolic activity throughout the left breast dermis and parenchyma [Figure 1c, white arrows]. This indicated that the changes in the left breast represented a site of aggressive recurrence as opposed to benign inflammation. This was confirmed with a repeat punch biopsy. The skin changes in the left breast were subsequently identified as carcinoma en cuirasse breast dermal metastases. Despite aggressive salvage chemotherapy with paclitaxel and carboplatin, an ^{18}F-FDG PET-CT scan performed 4 months later revealed the progression of metastatic disease with spread to the right breast, with clinical images showing widespread cutaneous ulcerations and excoriations [Figure 1d-f]. Metastatic spread to the right breast dermis was confirmed by punch biopsy which demonstrated invasion of lymphovascular spaces by tumor emboli [Figure 2, black short arrows] in a background of fibrous connective tissue.

DISCUSSION

Cancer in the dermis of the breast has a poor prognosis. The breast dermis can become malignantly involved primarily in inflammatory breast cancer, through direct extension of locally advanced breast cancer, or metastatically from an underlying breast mass or a distant primary malignancy (e.g., gastric adenocarcinoma). Table 1 describes the differences between these entities. Dermal metastases have the shortest median survival.[11,12] Dermal metastases from underlying breast cancer occur infrequently, with an estimated incidence between 0.6% and 10%.[13] First described by Velpeau in 1838, carcinoma en cuirasse is a particularly aggressive clinicohistopathologic variant of breast dermal metastases with a contractile fibrous texture resembling the metallic chest plate in antique Spanish cavalry armor.[14] Carcinoma en cuirasse accounts for approximately 3% of dermal metastases from underlying breast cancer.[15] Carcinoma en cuirasse is rarely the presenting feature of underlying breast cancer but rather tends to occur later in the course of the disease development or as a sign of recurrence.[13,15] It is also known as scirrhous carcinoma, pachydermia, or Acarcine eburnee.[16] While others have presented ^{18}F-FDG PET-CT images of this entity,[16,17] this case report represents the first depiction of the rapid progression and devastating consequences. Furthermore, the case emphasizes the sensitivity of ^{18}F-FDG PET-CT to detect pathology in the breast dermis. Finally, the case highlights the crucial role that nuclear medicine physicians play in helping clinical colleagues differentiate between various breast dermal malignant manifestations and benign mastitis, a common confounder in postradiation patients. Physicians interpreting ^{18}F-FDG PET-CT images must routinely scrutinize the breast dermis for thickening or hypermetabolism. Such findings warrant recommending direct physical examination with tissue sampling as indicated.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Giuliano AE, Connolly JL, Edge SB, Mittendorf EA, Rugo HS, Solin LJ, *et al.* Breast cancer-major changes in the American Joint Committee on Cancer eighth edition cancer staging manual. CA Cancer J Clin 2017;67:290-303.
2. Yeh ED, Jacene HA, Bellon JR, Nakhlis F, Birdwell RL, Georgian-Smith D, *et al*. What radiologists need to know about diagnosis and treatment of inflammatory breast cancer: A multidisciplinary approach. Radiographics 2013;33:2003-17.
3. Garg PK, Prakash G. Current definition of locally advanced breast cancer. Curr Oncol 2015;22:e409-10.
4. Schwartz RA. Histopathologic aspects of cutaneous metastatic disease. J Am Acad Dermatol 1995;33:649-57.
5. Afiya S, Singh J. Carcinoma en cuirasse with zosteriform metastasis-a rare presentation of breast carcinoma. J Med Surg Pathol 2017;1:1-3.
6. Perez-Pinera P, Chang Y, Deuel TF. Pleiotrophin, a multifunctional tumor promoter through induction of tumor angiogenesis, remodeling of the tumor microenvironment, and activation of stromal fibroblasts. Cell Cycle 2007;6:2877-83.
7. Hayashi K, Matsuda S, Machida K, Yamamoto T, Fukuda Y, Nimura Y, *et al*. Invasion activating caveolin-1 mutation in human scirrhous breast cancers. Cancer Res 2001;61:2361-4.
8. Tsukamoto K, Ito N, Yoshimoto M, Kasumi F, Akiyama F, Sakamoto G, *et al.* Allelic loss on chromosome 1p is associated with progression and lymph node metastasis of primary breast carcinoma. Cancer 1998;82:317-22.
9. Calaf GM, Echiburú-Chau C, Zhao YL, Hei TK. BigH3 protein expression as a marker for breast cancer. Int J Mol Med 2008;21:561-8.
10. Ochiai A, Akimoto S, Shimoyama Y, Nagafuchi A, Tsukita S, Hirohashi S, *et al*. Frequent loss of alpha catenin expression in scirrhous carcinomas with scattered cell growth. Jpn J Cancer Res 1994;85:266-73.

11. Hance KW, Anderson WF, Devesa SS, Young HA, Levine PH. Trends in inflammatory breast carcinoma incidence and survival: The surveillance, epidemiology, and end results program at the national cancer institute. J Natl Cancer Inst 2005;97:966-75.
12. Schoenlaub P, Sarraux A, Grosshans E, Heid E, Cribier B. Survival after cutaneous metastasis: A study of 200 cases. Ann Dermatol Venereol 2001;128:1310-5.
13. Mahore SD, Bothale KA, Patrikar AD, Joshi AM. Carcinoma en cuirasse: A rare presentation of breast cancer. Indian J Pathol Microbiol 2010;53:351-8.
14. Savatard L. Cancer en cuirasse. Br J Dermatol Syph 1943;55:31-9.
15. Mordenti C, Peris KM, Fargnoli C, Cerroni L, Chimenti S. Cutaneous metastatic breast carcinoma. Acta Dermatovenerol 2000;9:143-8.
16. Tung L, Stone EC, Bhasin M, Sheth S, Nelson M, Sheth PA, *et al*. Breast carcinoma en cuirasse as a natural progression of untreated breast cancer. Case Stud Surg 2015;2:46-8.
17. Win AZ, Aparici CM. Carcinoma en cuirasse from recurrent breast cancer seen on FDG-PET/CT. J Clin Imaging Sci 2015;5:35.