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Radiation-Induced Pleomorphic Dermal Sarcoma of the Chest Wall 25 Years After Breast Cancer Radiotherapy: A Case Report and Literature Review

Shamim Alikhail ¹, Saban Secmeler ², Saleha Alikhail ³, Saule Umurzakova ⁴

1. Oncology, Altınbaş University, Medical Park Bahçelievler Hospital, Istanbul, TUR 2. Medical Oncology, Şanlıurfa Training and Research Hospital, Şanlıurfa, TUR 3. Orthopedics and Traumatology, Medical Park Bahçelievler Hospital, Istanbul, TUR 4. Nuclear Medicine, Medical Park Bahçelievler Hospital, Istanbul, TUR

Corresponding author: Shamim Alikhail, ali.shamim.k@gmail.com

Abstract

Radiation-induced sarcoma (RIS) is a rare but aggressive long-term complication of radiotherapy. It typically develops within previously irradiated tissues after a prolonged latency period and is associated with poor prognosis because of its locally invasive behavior and high recurrence rates. Breast cancer survivors who receive adjuvant radiotherapy remain at risk for secondary malignancies, including sarcomas arising within the radiation field.

We report the case of a 78-year-old woman who developed a progressively enlarging chest wall mass 25 years after mastectomy and adjuvant radiotherapy for breast cancer. Initial clinical and radiological findings raised concern for local recurrence; however, histopathological examination with immunohistochemistry confirmed a high-grade pleomorphic dermal sarcoma arising within the previously irradiated field. The patient initially received gemcitabine and docetaxel chemotherapy, but follow-up fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) demonstrated disease progression. She subsequently underwent extensive chest wall resection with pulmonary resection and prosthetic reconstruction, followed by palliative radiotherapy for metastatic disease.

This case highlights the importance of maintaining a high index of suspicion for RIS in patients presenting with new lesions decades after radiotherapy, as early biopsy with histopathological and immunohistochemical evaluation is essential for accurate diagnosis and appropriate management.

Categories: Radiology, Radiation Oncology, Oncology

Keywords: breast cancer, mastectomy, radiation-induced sarcoma, radiotherapy (rt), secondary malignancy

Introduction

Breast cancer remains the most frequently diagnosed malignancy among women worldwide, with approximately 2.3 million new cases annually. Advances in surgery, chemotherapy, endocrine therapy, targeted therapy, and radiotherapy have significantly improved survival, leading to a growing population of long-term breast cancer survivors [1]. Consequently, increasing attention has been directed toward the late complications of cancer treatment, including radiation-induced secondary malignancies [2].

Radiation-induced sarcoma (RIS) is a rare but well-recognized late adverse effect of radiotherapy, accounting for less than 1% of all soft tissue sarcomas. Although uncommon, RIS carries a poor prognosis because of its aggressive biological behavior, high local recurrence rates, and limited therapeutic options. The incidence following breast irradiation has been estimated to range between 0.03% and 0.2%, with a typical latency period of 5-15 years, although substantially longer intervals have been reported [3,4].

The diagnosis of RIS remains challenging because patients often present with masses that clinically and radiologically resemble recurrent breast carcinoma. Histopathological examination with immunohistochemistry is therefore essential to differentiate these entities and guide appropriate management. Surgical excision with negative margins remains the cornerstone of treatment, while chemotherapy and re-irradiation have more limited roles depending on disease extent [3,4].

We present an unusual case of pleomorphic dermal sarcoma developing 25 years after adjuvant radiotherapy for breast cancer, emphasizing the prolonged latency, diagnostic challenges, and importance of considering radiation-induced malignancy in the differential diagnosis of new chest wall lesions arising within previously irradiated fields.

Case Presentation

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A 78-year-old woman with no known chronic comorbidities had a history of left breast carcinoma treated in 2000 with mastectomy and adjuvant radiotherapy, followed by chemotherapy (CMF regimen) and radiation therapy. She was reported to have a local recurrence in 2022, although a prior biopsy did not confirm malignancy.

Twenty-five years after treatment for left breast carcinoma, the patient presented with a progressively enlarging mass in the left mastectomy bed. Physical examination demonstrated a large inflammatory mass involving the inferior left chest wall with elevation of the overlying skin, raising concern for local recurrence. An incisional biopsy was subsequently performed.

Pathological evaluation

Incisional biopsy of the left chest wall mass revealed a malignant spindle-cell neoplasm. Immunohistochemical analysis demonstrated diffuse positivity for smooth muscle actin (SMA) and focal CD10 expression, while pancytokeratin, S100, CD34, and desmin were negative. These findings excluded recurrent breast carcinoma and supported the diagnosis of pleomorphic dermal sarcoma arising within the previously irradiated field. Final histopathological examination of the resection specimen confirmed a high-grade pleomorphic sarcoma (pleomorphic dermal sarcoma type) measuring $8.5 \times 6.5 \times 5.5$ cm with areas of necrosis.

Following histopathological confirmation of pleomorphic dermal sarcoma, the patient was started on systemic chemotherapy with gemcitabine (1,400 mg on days 1 and 8) and docetaxel (80 mg on day 8) administered in a two-week cycle regimen. Follow-up fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) performed after completion of chemotherapy demonstrated metabolic disease progression, indicating an inadequate therapeutic response (Figure 1).

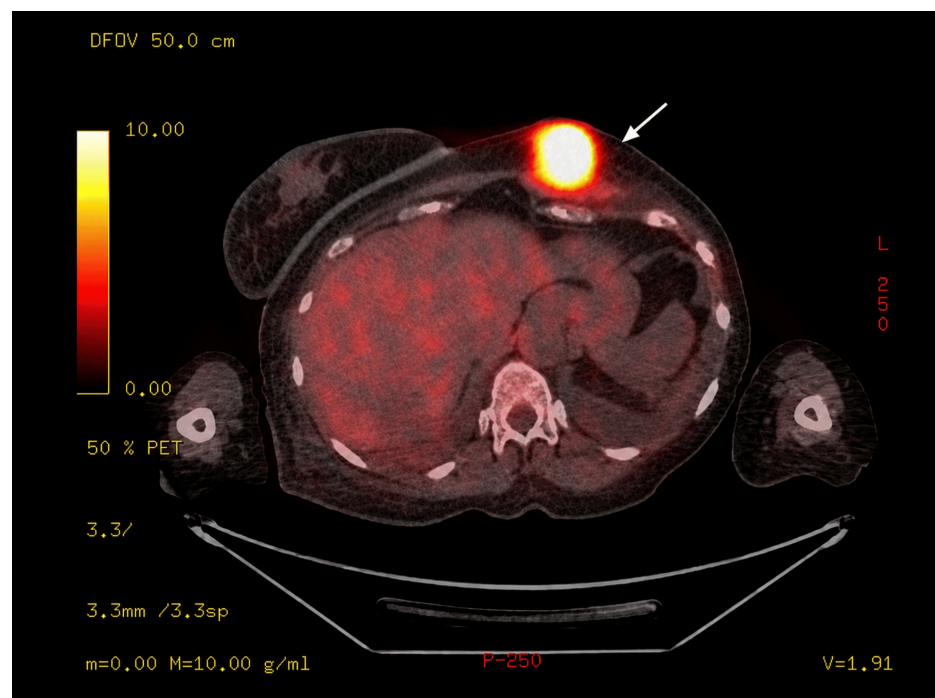


FIGURE 1: Axial fused ^{18}F -FDG PET/CT image

Axial fused ^{18}F -FDG PET/CT image acquired using a Discovery IQ 16-slice PET/CT scanner (GE Healthcare, Milwaukee, WI, USA) following institutional imaging protocols, showing an intensely ^{18}F -FDG-avid left anterior chest wall mass (arrow) within the previous mastectomy bed, consistent with metabolically active pleomorphic dermal sarcoma and demonstrating disease progression following gemcitabine-docetaxel chemotherapy.

FDG PET/CT: fluorodeoxyglucose positron emission tomography/computed tomography

Due to evidence of disease progression, the patient underwent chest wall resection with pulmonary resection and prosthetic reconstruction. The postoperative course was complicated by pneumonia, pleural effusion, and surgical site infection requiring broad-spectrum antibiotics and drainage.

Follow-up PET/CT demonstrated progressive metastatic disease with pleural effusion, mediastinal involvement, and additional metastatic lesions (Figure 2). In view of continued progression despite systemic

therapy, the disease was considered chemotherapy-refractory.

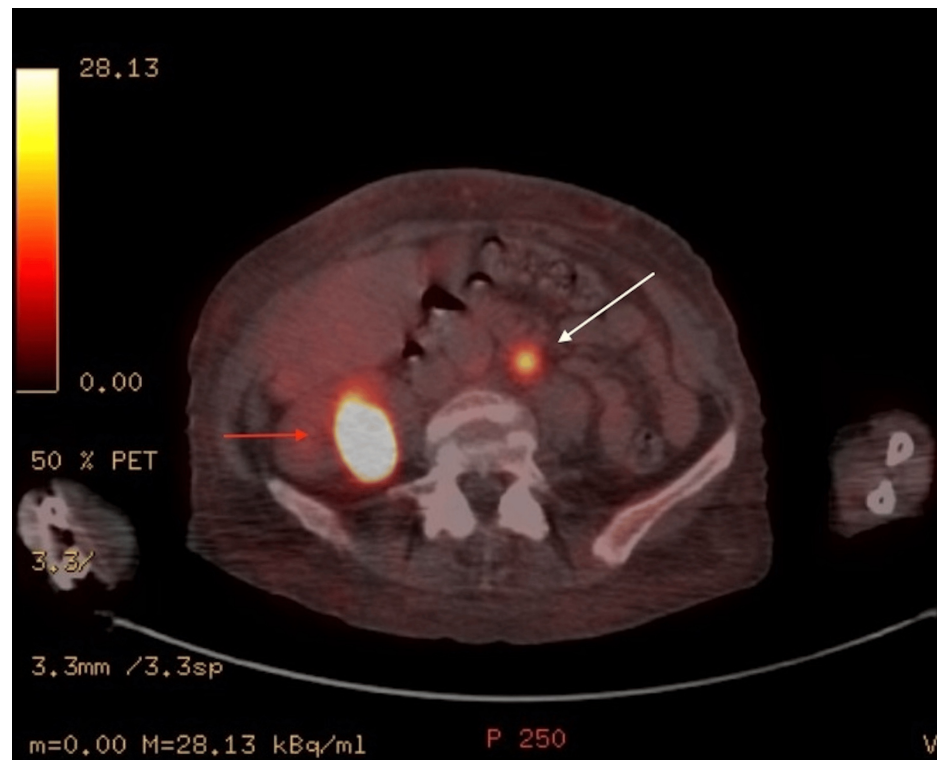


FIGURE 2: Axial fused 18F-FDG PET/CT image

Axial fused ^{18}F -FDG PET/CT image obtained during follow-up demonstrates a hypermetabolic para-aortic lymph node metastasis (white arrow). The intense FDG uptake in the right kidney (red arrow) represents physiological renal excretion of the radiotracer.

FDG PET/CT: fluorodeoxyglucose positron emission tomography/computed tomography

Palliative management

Following disease progression, the patient received palliative radiotherapy to symptomatic metastatic sites, consisting of 25 Gy in five fractions to the L3 vertebra followed by 20 Gy in five fractions to the left femur. Both treatment courses were delivered using intensity-modulated radiotherapy (IMRT) with daily cone-beam computed tomography (CBCT)-guided image guidance (IGRT). Supportive and symptomatic care was continued throughout treatment.

Discussion

RIS is a rare but well-established late complication of radiotherapy, accounting for less than 1% of all soft tissue sarcomas [2-4]. With improving long-term survival in breast cancer patients, the absolute number of patients at risk for secondary malignancies is increasing. RIS is defined as a sarcoma arising within a previously irradiated field after a latency period, with histological confirmation distinct from the primary malignancy [2-4].

In this case, the diagnosis fulfills the modified Cahan criteria for RIS. The patient had a clear history of adjuvant radiotherapy for breast carcinoma in 2000, and the tumor developed within the previously irradiated chest wall. The latency period of 25 years is substantially longer than the commonly reported interval of 5-15 years; however, similar delayed presentations have been described in isolated case reports [3,5]. Histopathology confirmed a high-grade pleomorphic sarcoma with immunohistochemical exclusion of epithelial, melanocytic, vascular, and myogenic differentiation, effectively ruling out metaplastic carcinoma and other spindle-cell mimics.

Although the latency period in our patient was unusually prolonged, the most important clinical challenge was the initial resemblance to recurrent breast carcinoma. Functional imaging demonstrated progressive metabolically active disease but could not reliably distinguish recurrent breast carcinoma from RIS. Similar diagnostic uncertainty has been described in previous reports, where RIS were frequently mistaken for local recurrence because of their nonspecific clinical and radiological features. This highlights the limitations of

imaging alone and reinforces the importance of early biopsy with comprehensive histopathological and immunohistochemical evaluation to establish the correct diagnosis and guide appropriate management [3,5].

Management of RIS remains challenging and is primarily surgical, with complete resection and negative margins representing the mainstay of treatment [3,6]. However, prior irradiation and locally advanced disease often limit curative options. Despite systemic chemotherapy with gemcitabine and docetaxel, the disease demonstrated progression, necessitating extensive surgical intervention and ultimately palliative radiotherapy for metastatic involvement.

This case underscores the importance of maintaining a high index of suspicion for radiation-induced malignancies in any new or atypical lesion arising within a previously irradiated field, even decades after initial treatment.

Conclusions

Pleomorphic dermal sarcoma is a rare but aggressive late complication of breast cancer radiotherapy that may develop even decades after treatment. This case highlights the importance of considering RIS in the differential diagnosis of new chest wall lesions arising within previously irradiated fields, particularly when clinical and radiological findings suggest local recurrence. Early biopsy with histopathological and immunohistochemical evaluation is essential for establishing an accurate diagnosis and guiding appropriate management.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Shamim Alikhail, Saban Secmeler, Saleha Alikhail

Acquisition, analysis, or interpretation of data: Shamim Alikhail, Saule Umurzakova

Drafting of the manuscript: Shamim Alikhail, Saban Secmeler, Saleha Alikhail, Saule Umurzakova

Critical review of the manuscript for important intellectual content: Shamim Alikhail, Saban Secmeler, Saleha Alikhail

Supervision: Saban Secmeler, Saleha Alikhail, Saule Umurzakova

Disclosures

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The authors acknowledge the use of Claude during manuscript preparation to cross-check text for originality and ensure compliance with copyright and anti-plagiarism standards. The final manuscript was fully reviewed and verified by the authors, who maintain ultimate responsibility for the originality and integrity of the content. Histopathological examination and immunohistochemical analysis were performed at an external laboratory in Istinye Hospital. Despite our efforts, we were unable to obtain the original photomicrographs for inclusion in the manuscript. The diagnosis was established based on the official histopathology report and immunohistochemical findings provided by the reporting pathology department, which are summarized in the manuscript.

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