Occult Primary Breast Cancer Presenting with Ipsilateral Nodal Metastatic Disease

Mark Andrew Rowley Jr MD*, Ethan Nussio BS, Rashad Daker MD

University of Tennessee Medical Center, Knoxville, USA

***Correspondence:** Mark Andrew Rowley Jr, MD, University of Tennessee Medical-Center, 1924 Alcoa Highway Knoxville, Tennessee, United States, 37920,

mrowley@utmck.edu

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ABSTRACT

Occult primary breast cancer is a rare form of breast cancer that may present as axillary lymphadenopathy. When axillary lymphadenopathy is identified, further workup including biopsy and imaging should be done to rule out malignancy. Treatment for occult breast cancer typically involves axillary lymph node dissection and ipsilateral mastectomy, with a favorable prognosis. We present the case of a 66-year-old female with a past medical history of hemochromatosis who underwent magnetic resonance imaging of the abdomen to assess for iron deposition and was found to have right axillary lymphadenopathy. Breast imaging did not reveal a source for her lymphadenopathy but lymph node biopsy revealed metastatic carcinoma compatible with primary breast cancer. She was treated with multiple rounds of chemotherapy and received targeted axillary lymph node dissection to monitor treatment response. Pathology of the lymph node specimen from this biopsy revealed complete therapeutic response and no further evidence of malignancy. Our goal with this case report is to explore the recommended workup and treatment for occult primary breast cancer.

CASE REPORT

CASE REPORT

A 66-year-old female with a past medical history of hypertension and hemochromatosis presented to her hematologist for a follow-up for monitoring of her hemochromatosis. She was diagnosed with hemochromatosis in 2017 which was confirmed by a liver biopsy. Her regular follow-up visits included laboratory testing (metabolic panels and iron studies) as well as phlebotomy when her hemoglobin level was above 11. At this time, the patient felt well and reported no symptoms. The patient's physician had been recommending magnetic resonance imaging (MRI) of the abdomen with and without contrast to monitor her degree of iron deposition, but the patient had been declining due to anxiety and claustrophobia for over a year. However, she agreed to undergo an open MRI with a prescription for lorazepam. The MRI abdomen revealed moderate hepatic steatosis and no evidence of hemochromatosis. The reporting radiologist also noted several large, enhancing right axillary lymph nodes, suspicious for underlying breast cancer (Figure 1) and advised further evaluation. Six months prior the patient had a routine, bilateral screening mammogram. An irregular mass was noted in the left breast for which she underwent an ultrasound guided biopsy. The final diagnosis for the mass in the left breast was benign fibroglandular tissue with stromal fibrosis, negative for neoplasm. However, no suspicious masses or abnormalities were noted in the right breast. She had no personal history of cancer. Her mother had breast cancer at

age 52.

For further evaluation of the axillary lymphadenopathy, she underwent a diagnostic mammogram with ultrasound of the right breast, which revealed multiple level II suspicious lymph nodes (Figure 2). The interpreting radiologist graded the findings as a breast imaging-reporting and data system (BI-RADS) grade 4 and recommended ultrasound-guided biopsy of the lymph nodes. No mammographic correlate was visualized due to the depth of the lymph nodes. No suspicious abnormalities were noted within the right breast on mammography (Figure 3) and no contralateral axillary lymphadenopathy was visualized. Ultrasound-guided biopsy of the right axillary lymph nodes returned with a diagnosis of metastatic carcinoma, compatible with breast primary. Immunohistochemistry results were estrogen receptor (ER) negative, progesterone receptor (PR) negative, Ki-67 40%, and human epidermal growth factor receptor (HER2) positive. In search of the primary lesion, a bilateral breast MRI was performed. This study did not find any suspicious lesions within the right breast (Figure 4). The patient's medical oncology physician proceeded with a positron emission tomography (PET) scan in hopes of identifying the source of the lymph node metastasis. The PET scan noted bulky hypermetabolic right axillary and supraclavicular lymphadenopathy, but no primary lesion. At this time, the patient continued to report feeling well without symptoms. The decision was made to proceed with neoadjuvant chemotherapy, consisting of docetaxel, carboplatin, and a subcutaneous combination of trastuzumab and pertuzumab (Phesgo) with prophylactic pegfilgrastim. After 3 cycles of chemotherapy, a repeat ultrasound of the right breast and axillary lymph nodes was performed to evaluate her response. Ultrasound revealed a positive interval response, with a decrease in size and cortical thickening of the axillary lymph nodes (Figure 5). The patient completed six rounds of chemotherapy, which she tolerated well without significant side effects. A bilateral breast MRI following completion of chemotherapy was significant for complete resolution of the adenopathy in the right axilla. Given the patient's robust response to chemotherapy, she was taken to the operating room for right axillary sentinel lymph node biopsy and targeted axillary lymph node dissection. Pathologic specimens from the operating room demonstrated no residual disease, compatible with a complete response to neoadjuvant chemotherapy. Given her thorough response to chemotherapy, the tumor board did not feel she should undergo any further operations. She began adjuvant radiotherapy for six weeks and maintenance of trastuzumab and pertuzumab for one year. Six weeks following surgery, she underwent a repeat PET scan for continued monitoring of treatment response. This post-treatment PET scan is compared to her pre-treatment PET scan in (Figure 6), as well as pre and post-treatment maximum intensity projections in (Figure 7). To date, she continues to tolerate maintenance chemotherapy and remains clinically stable with no evidence of recurrence.

DISCUSSION

Etiology and Demographics

Occult breast cancer is a rare form of newly diagnosed breast cancers, with an incidence of only 0.1-1% [1,2]. The most common presentation for occult breast cancer is the presence of axillary lymphadenopathy, which is generally a benign finding but warrants further workup including biopsy to rule out underlying malignancy [3]. The patient discussed in this case did not report palpable adenopathy. Her enlarged axillary lymph nodes were found incidentally during a follow-up scan for her hemochromatosis. Significant risk factors for occult breast cancer include late parity and a family history of breast cancer [4]. Our patient's mother did have breast cancer at the age of 52, prompting concern about the possibility of occult breast cancer among her physicians. Given that occult breast cancer is such a rare entity, it is important to further elucidate its diagnosis, treatment, and clinical course.

Clinical & Imaging Findings

The first step in diagnosis of unexplained axillary lymphadenopathy is biopsy. If pathologic examination of the biopsy reveals primary breast carcinoma, dedicated breast imaging is warranted, beginning with mammography [5]. Immunohistochemical markers of the biopsy specimen should also be performed, especially for ER, PR, and HER2. Elevated levels of ER/PR will support the diagnosis of a breast cancer primary [5]. The presence of cytokeratin (CK) 7 and absence of CK20 also support the diagnosis of primary carcinoma of the breast [3].

If diagnostic mammogram and ultrasound do not reveal a primary lesion in the breast, then MRI is recommended [5,6]. MRI boasts a higher sensitivity in detecting a primary lesion compared to mammography and ultrasound, identifying a primary source in 72% of patients with occult breast cancer [7,8]. The downside of MRI for detecting occult lesions is its high false-positive rate, estimated to be approximately 30% [9,10]. An MRI was performed for the patient in this study following her biopsy to search for a primary lesion. The MRI revealed no suspicious findings consistent with a primary lesion. The utility of PET scans in detecting primary lesions has not been thoroughly investigated, but some studies suggest they may be useful. In one case study, a 54-year-old woman was diagnosed with occult breast cancer but no lesion was seen on mammography or MRI. However, a nodule was identified using PET [11]. PET possesses a higher specificity (91.2% vs 86.3%) than MRI, but a lower sensitivity (41% vs 53%) [12]. Therefore, PET should not be performed in place of MRI, but may be useful as a supplement if no primary tumor can be identified with MRI. In the case of our patient, a PET scan was attempted following MRI but no lesion was detected.

Treatment & prognosis

In general, occult breast cancer carries a prognosis similar to other forms of breast cancer. A study performed at the European

Institute of Oncology of 80 patients with occult breast cancer and 80 patients with small invasive breast cancers (pT1) matched for year of surgery, age, nodal status, and biological features found no significant difference in the 5-year disease-free and overall survival between the two groups [13]. The prognostic factors that determine a patient's outcome are immunohistochemical markers and extensive nodal involvement. Therefore, the decision to pursue chemotherapy depends on the molecular makeup of the occult breast cancer. In another study of 36 patients with occult breast cancer, 25 patients received neoadjuvant chemotherapy and 80% of these patients achieved complete resolution in the axilla [14]. Our patient's occult cancer was positive for expression of HER-2, which resulted in her chemotherapy regimen including trastuzumab and pertuzumab. In regards to systemic therapy, patients with axillary metastasis from occult breast cancer are treated identically to patients with similar nodal stages and proven breast primaries [15].

It is standard practice for all patients with occult breast cancer to undergo axillary lymph node dissection, but the management of the ipsilateral breast is unclear. Observation of the ipsilateral breast without surgery is not generally recommended. One meta-analysis of the Surveillance, Epidemiology, and End Results (SEER) database found a significantly higher 10-year survival for patients who underwent lymph node dissection and ipsilateral breast surgery (breast conserving or mastectomy) compared to those with lymph node dissection only (65% versus 59%, respectively) [1]. A more recent meta-analysis of the SEER database confirms these results. Breast surgery (breast conserving or mastectomy) along with radiation therapy, compared to simple axillary lymph node dissection, improves patient prognosis, likely due to increasing local control of the breast [16]. In that study, patients who underwent axillary lymph node dissection, radiation therapy, and breast surgery had the lowest mortality rate. The role of radiation therapy is believed to control local recurrence. However, the radiation therapy doses were not available in the studies included in the aforementioned meta-analysis, so the specifics of radiation therapy dose and schedule warrants further study. For patients who achieve complete response following targeted axillary lymph node dissection and neoadjuvant chemotherapy, ipsilateral breast surgery may be unnecessary. In a study of 114 patients with occult breast cancer, targeted axillary dissection resulted in a 5-year disease-free survival rate of 74.5% and overall survival rate of 88.5%. A total of 22.8% of patients underwent neoadjuvant treatment and complete pathological response was achieved in 38.5% [17]. Our patient's case supports these results, as she had complete response following targeted axillary dissection and neoadjuvant chemotherapy, and no further surgery was pursued.

Differential diagnoses

While occult primary breast cancer can present with axillary lymphadenopathy, so can other entities. The most frequent diagnosis is nonspecific benign lymphadenopathy. Other causes include lymphomas, metastatic disease from non-breast primary site, sarcoidosis, and Human immunodeficiency virus (HIV)-related lymphadenopathy. While occult primary breast cancer can evade diagnostic imaging, the entities in the listed differential usually present with axillary lymphadenopathy and concrete masses on ultrasound and with enhancement on MRI.

TEACHING POINT

Occult primary breast cancer is a rare form of breast cancer that can present as isolated axillary lymphadenopathy with no identifiable primary lesions on diagnostic imaging. Biopsy of isolated axillary lymphadenopathy may reveal histological evidence of breast cancer and can then guide further steps in management. Analysis of the SEER database reveals a higher survival rate for patients who underwent chemotherapy and breast surgery in comparison to those who underwent axillary dissection alone. Therefore, it is imperative to recognize the shortcomings of imaging in diagnosing occult breast cancer and the changes in suggested management of patients with this condition.

QUESTIONS

Question 1: which of the following can present with axillary lymphadenopathy?

a. Sarcoidosis
b. HIV
c. Primary occult breast cancer
d. Reactive lymphadenopathy associated with a breast abscess
e. All of the above (applies).

Explanation:

a. Sarcoidosis is an autoimmune disease that can present with axillary lymphadenopathy. [For example, in a study of 76 cases of lymphadenopathy, the most frequent diagnosis was nonspecific benign lymphadenopathy, followed by metastatic breast and chronic lymphocytic leukemia or well-differentiated lymphocytic lymphoma. Other causes included collagen vascular disease, lymphomas other than well-differentiated lymphocytic lymphoma, metastatic disease from non-breast primary site, metastatic disease from unknown primary site, sarcoidosis. HIV-related lymphadenopathy, and reactive lymphadenopathy associated with a breast abscess]

b. HIV is an infectious process that can lead to enlarged lymph nodes and axillary lymphadenopathy. [For example, in a study of 76 cases of lymphadenopathy, the most frequent diagnosis was nonspecific benign lymphadenopathy, followed by metastatic breast and chronic lymphocytic leukemia or well-differentiated lymphocytic lymphoma. Other causes included collagen vascular disease, lymphomas other than well-differentiated lymphocytic lymphoma, metastatic disease from non-breast primary site, metastatic disease from unknown primary site, sarcoidosis. HIV-related lymphadenopathy, and reactive lymphadenopathy associated with a breast abscess]

c. Primary occult breast cancer most commonly presents with axillary lymphadenopathy. [For example, in a study of 76 cases of lymphadenopathy, the most frequent diagnosis was nonspecific benign lymphadenopathy, followed by metastatic breast and chronic lymphocytic leukemia or well-differentiated lymphocytic lymphoma. Other causes included collagen vascular

disease, lymphomas other than well-differentiated lymphocytic lymphoma, metastatic disease from non-breast primary site, metastatic disease from unknown primary site, sarcoidosis. HIV-related lymphadenopathy, and reactive lymphadenopathy associated with a breast abscess]

d. Breast abscesses can can cause an inflammatory reaction leading to axillary lymphadenopathy. [For example, in a study of 76 cases of lymphadenopathy, the most frequent diagnosis was nonspecific benign lymphadenopathy, followed by metastatic breast and chronic lymphocytic leukemia or well-differentiated lymphocytic lymphoma. Other causes included collagen vascular disease, lymphomas other than well-differentiated lymphocytic lymphoma, metastatic disease from non-breast primary site, metastatic disease from unknown primary site, sarcoidosis. HIV-related lymphadenopathy, and reactive lymphadenopathy associated with a breast abscess]

e. All the conditions listed above can lead to axillary lymphadenopathy, therefore the correct answer is all of the above. [For example, in a study of 76 cases of lymphadenopathy, the most frequent diagnosis was nonspecific benign lymphadenopathy, followed by metastatic breast and chronic lymphocytic leukemia or well-differentiated lymphocytic lymphoma. Other causes included collagen vascular disease, lymphomas other than well-differentiated lymphocytic lymphoma, metastatic disease from non-breast primary site, metastatic disease from unknown primary site, sarcoidosis. HIV-related lymphadenopathy, and reactive lymphadenopathy associated with a breast abscess]

Question 2: Which of the following is the recommended workup for occult breast cancer?

a. Mammogram only
b. Biopsy only
c. Lymph node dissection
d. MRI only
e. Mammogram, MRI, and biopsy (applies).

Explanation:

a. Mammography is not the most sensitive diagnostic method for detecting occult breast cancer, identifying an occult lesion in only about 20% of cases. [Mammography identifies an occult lesion in only about 20% of cases [6]].

b. Performing a biopsy by itself would be ill-advised without an imaging method to show where a suspicious mass or area of lymphadenopathy may be for testing with a biopsy. [Although axillary lymphadenopathy is generally a benign finding, it requires further workup including biopsy and dedicated breast imaging [3].]

c. Lymph node dissection may be used for diagnosis and achieving regional control of the occult cancer but would not be considered a complete workup. [All patients should undergo lymph node dissection for both diagnosis and achieving regional control.]

d. MRI is known to be sensitive and has been studied to reveal a primary breast lesion in about 75% of women who have negative mammography. However, it would fail to provide tumor characterizations that one can learn from biopsy. [MRI is sensitive and has revealed a primary breast lesion in about 75% of women who have negative mammography [7,8]].

e. Mammogram followed by MRI and a biopsy would provide the most comprehensive workup out of the answer choices listed and result in the most helpful workup. [The standard approach to imaging for patients with concern of occult breast cancer first includes diagnostic mammography followed by MRI if mammogram is negative].

Question 3: Which of the following are potential treatment options for occult breast cancer?

a. Reassurance and follow-up in 6 months
b. Reassurance and observation
c. Antibiotics
d. Lymph node dissection, chemotherapy, and mastectomy (applies)
e. Corticosteroids

Explanation:

a. Reassurance and follow-up in 6 months would be ill-advised as this would give the occult breast cancer a chance to grow and result in a poor prognosis. [At the time of lymph node dissection, patients typically undergo ipsilateral mastectomy which can possibly identify the primary tumor and has a lower likelihood of tumor recurrence and improved disease-free survival compared to no local breast treatment [10]. The use of adjuvant systemic therapy has not been fully elucidated in the treatment of occult breast cancer. However, it has been suggested that patients with occult breast cancer who receive neoadjuvant chemotherapy have a survival benefit [11].]

b. Reassurance and observation would be ill-advised for similar reasons to answer choice a. [At the time of lymph node dissection, patients typically undergo ipsilateral mastectomy which can possibly identify the primary tumor and has a lower likelihood of tumor recurrence and improved disease-free survival compared to no local breast treatment [10]. The use of adjuvant systemic therapy has not been fully elucidated in the treatment of occult breast cancer. However, it has been suggested that patients with occult breast cancer who receive neoadjuvant chemotherapy have a survival benefit [11].]

c. Antibiotics are used to treat infection but in the case of occult breast cancer would fail to provide effective treatment. [At the time of lymph node dissection, patients typically undergo ipsilateral mastectomy which can possibly identify the primary tumor and has a lower likelihood of tumor recurrence and improved disease-free survival compared to no local breast treatment [10]. The use of adjuvant systemic therapy has not been fully elucidated in the treatment of occult breast cancer. However, it has been suggested that patients with occult breast cancer who receive neoadjuvant chemotherapy have a survival benefit [11].]

d. Lymph node dissection, chemotherapy, and mastectomy are all potential treatment methods for the treatment of occult breast cancer depending on the stage and grade. [At the time of lymph node dissection, patients typically undergo ipsilateral mastectomy which can possibly identify the primary tumor and has a lower likelihood of tumor recurrence and improved disease-free survival compared to no local breast treatment [10]. The use of adjuvant systemic therapy has not been fully elucidated in the treatment of occult breast cancer. However, it has been suggested that patients with occult breast cancer who

receive neoadjuvant chemotherapy have a survival benefit [11].]

e. Corticosteroids are used to manage autoimmune and other inflammatory conditions. It would not provide effective treatment for breast cancer. [At the time of lymph node dissection, patients typically undergo ipsilateral mastectomy which can possibly identify the primary tumor and has a lower likelihood of tumor recurrence and improved disease-free survival compared to no local breast treatment [10]. The use of adjuvant systemic therapy has not been fully elucidated in the treatment of occult breast cancer. However, it has been suggested that patients with occult breast cancer who receive neoadjuvant chemotherapy have a survival benefit [11].]

Question 4: Which of the following tumor markers are suggestive of breast cancer?

a. Absent CK7
b. Present CK20
c. Absence of progesterone
d. Absence of estrogen
e. Presence of progesterone, presence of estrogen, and presence of CK7 (applies)

Explanation:

a. Presence rather than absence of CK7 is suggestive of breast cancer. [The presence of CK7, absence of CK20, and positive staining of ER and PR are all suggestive of a breast cancer diagnosis [4].]

b. Absence rather than presence of CK20 is suggestive of breast cancer. [The presence of CK7, absence of CK20, and positive staining of ER and PR are all suggestive of a breast cancer diagnosis [4].]

c. While the absence of progesterone doesn't rule out a diagnosis of breast cancer it is less suggestive than the presence of progesterone. [The presence of CK7, absence of CK20, and positive staining of ER and PR are all suggestive of a breast cancer diagnosis [4].]

d. While the absence of progesterone doesn't rule out a diagnosis of breast cancer it is less suggestive than the presence of progesterone. [The presence of CK7, absence of CK20, and positive staining of ER and PR are all suggestive of a breast cancer diagnosis [4].]

e. Presence of progesterone, estrogen, and CK7 is the tumor marker combination that would be most suggestive of breast cancer and is the correct answer. [The presence of CK7, absence of CK20, and positive staining of ER and PR are all suggestive of a breast cancer diagnosis [4].]

Question 5: What percent of breast cancer is found to be of the occult primary form?

a. 10%
b. 90%
c. 30%
d. 50%
e. <1% (applies)

Explanation:

a. Occult primary breast cancer is a rare form of breast cancer making up less than 10% of breast cancer. [Occult primary breast cancer is a rare form of breast cancer, accounting for less than 1% of breast cancers [1]].

b. 90% is incorrect for similar reasons to answer choice a. [Occult primary breast cancer is a rare form of breast cancer, accounting for less than 1% of breast cancers [1]].

c. 30% is incorrect for similar reasons to answer choice a. [Occult primary breast cancer is a rare form of breast cancer, accounting for less than 1% of breast cancers [1]].

d. 50% is incorrect for similar reasons to answer choice a. [Occult primary breast cancer is a rare form of breast cancer, accounting for less than 1% of breast cancers [1]].

e. <1% of breast cancers are accounted for by occult primary breast cancer, making it a rare diagnosis. [Occult primary breast cancer is a rare form of breast cancer, accounting for less than 1% of breast cancers [1]].

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FIGURES

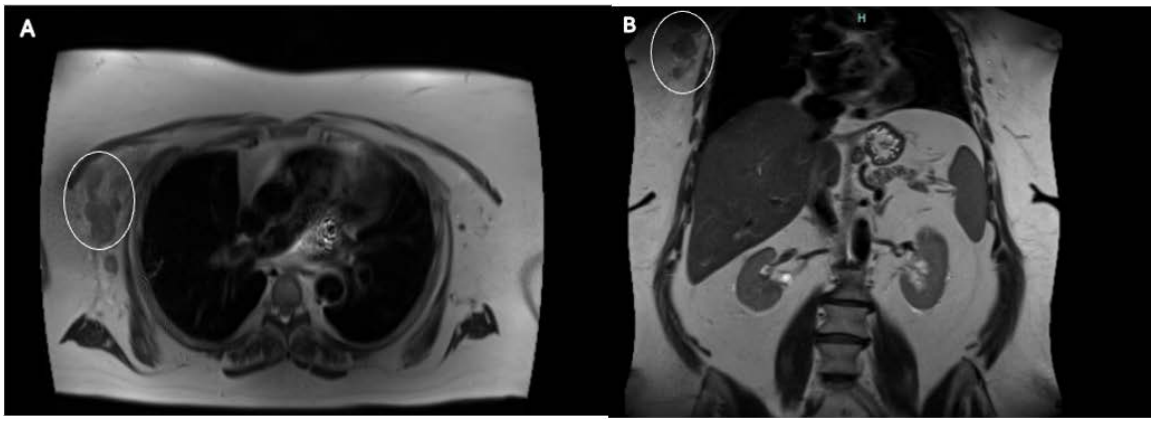

Figure 1: 66-year-old female with incidental right axillary lymphadenopathy found during routine abdominal MR surveillance for hemochromatosis. Findings: Several asymmetric large, enhancing right axillary lymph nodes suspicious for underlying malignancy, with primary breast cancer considered (white circle), which were not visualized on screening mammography six months prior. Technique: Axial (A) and coronal (B) T2 MRI of the abdomen without and without contrast (15 cc MultiHance).

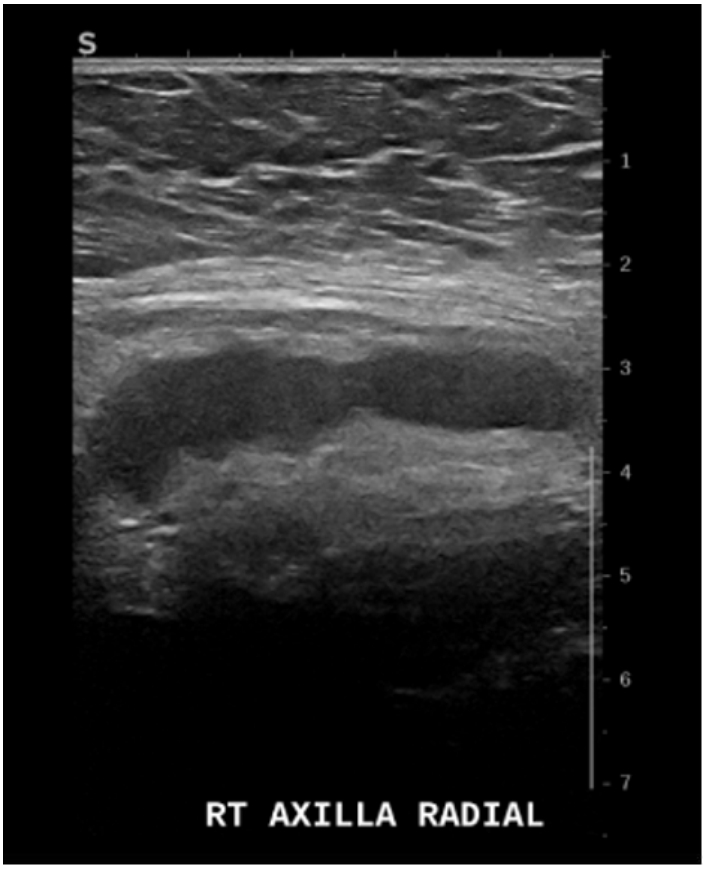

Figure 2: Diagnostic ultrasound following incidental finding of right axillary lymphadenopathy on MRI of the abdomen. Findings: Multiple level II lymph nodes (BI-RADS category 4), correlating with previous MRI findings. Biopsy of these lymph nodes was recommended for pathology and cytology. Technique: Diagnostic targeted greyscale right axillary ultrasound performed in a dedicated Breast Center.

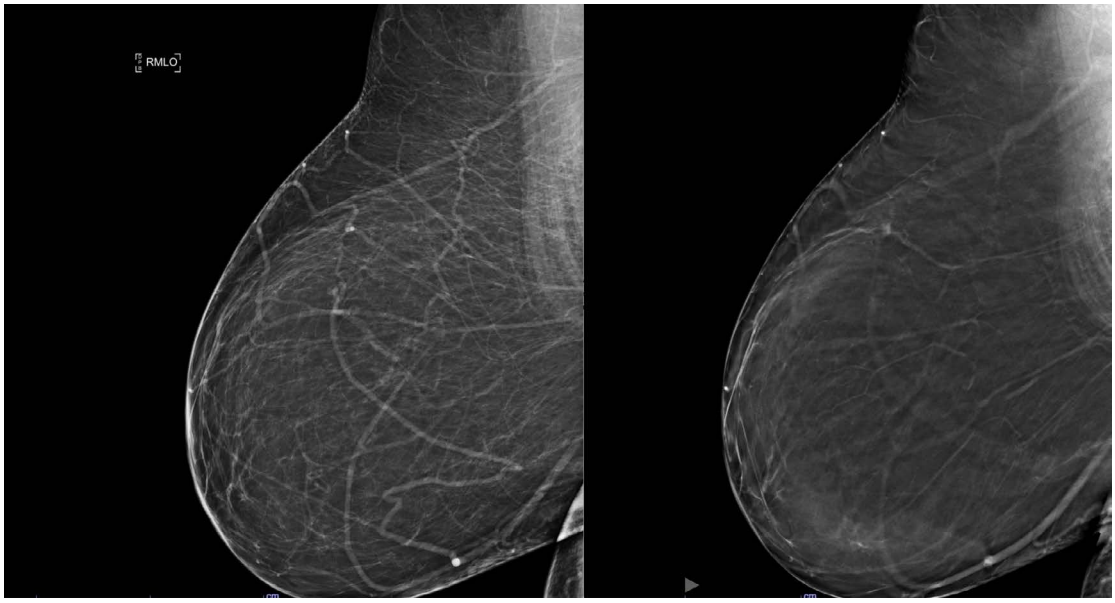

Figure 3: Right breast mammogram for a 66-year-old female found to have right axillary lymphadenopathy. Findings: No masses, calcifications, or other abnormalities were visualized within the right breast. No mammographic correlate of right axillary lymph nodes given depth of the lymph nodes. Technique: Diagnostic mammogram with right mediolateral oblique (left) and right mediolateral oblique with tomosynthesis (right).

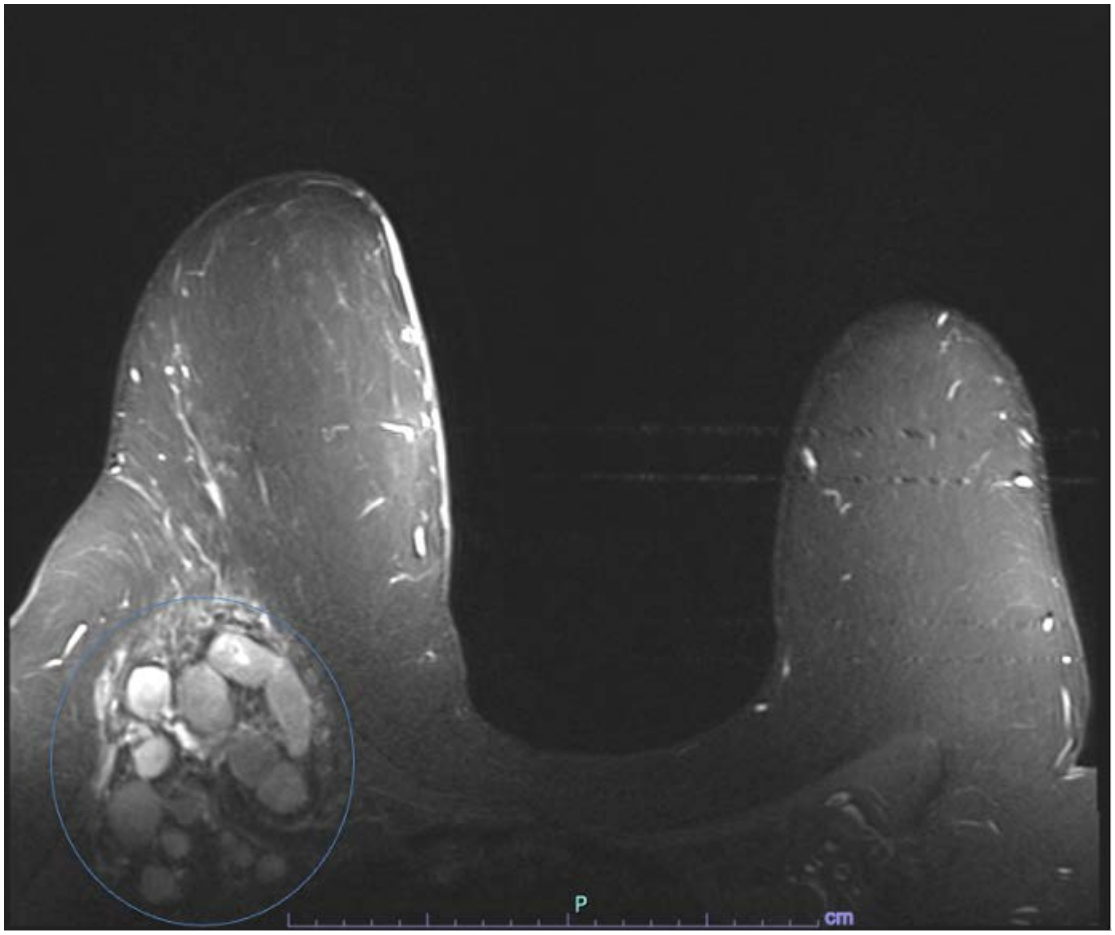

Figure 4: A 66-year-old female underwent bilateral breast MRI following biopsy proven right axillary lymph node, positive for metastatic invasive lobular carcinoma, to assess for site of primary breast malignancy. Findings: Bulky right axillary lymphadenopathy (blue circle) representing biopsy-proven metastatic breast carcinoma without suspicious finding in the right breast. Technique: Bilateral breast MRI (axial) using a 3T magnet performed with a dedicated 16 channel Sentinel breast coil. She received 0.1Mm/kg Multihance IV contrast 20 cc with a contrast delay of 20 seconds.

Figure 5: Right axillary ultrasound following three cycles of chemotherapy to monitor therapeutic response. Findings: Decrease in size and cortical thickening of right axillary lymph nodes, with overall normalization of right axillary lymph nodes. Technique: Diagnostic targeted greyscale ultrasound of the right axilla.

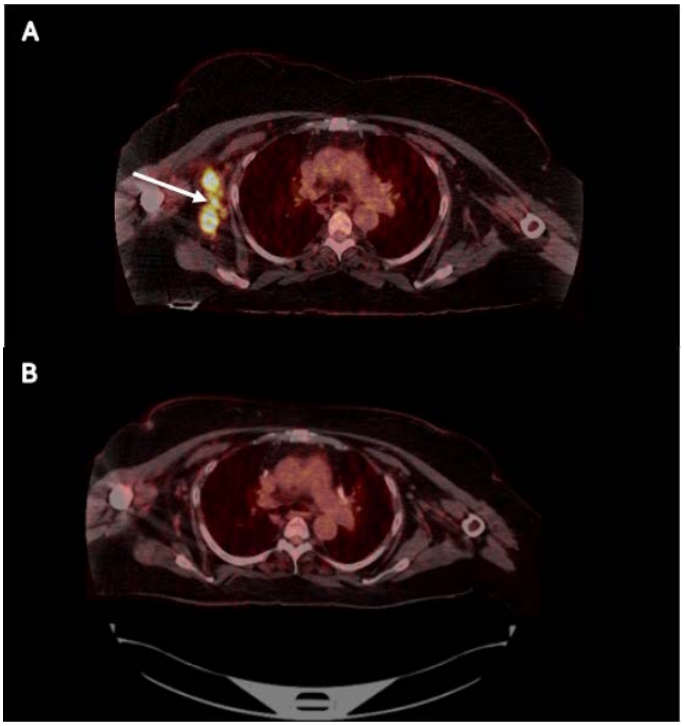

Figure 6: Pre (A) and post-treatment (B) PET scans following six cycles of chemotherapy, axillary dissection, and radiation therapy. Findings: Resolution of axillary lymphadenopathy (white arrow) between images A and B, the largest axillary lymph node in image A measured 2.1x3cm. Technique: axial fused PET scans over CT. Images were obtained from the base of the skull to mid-thigh 60 minutes after administration of the radiotracer, F-18 FDG. CT images were obtained without IV contrast for attenuation correction and localization.

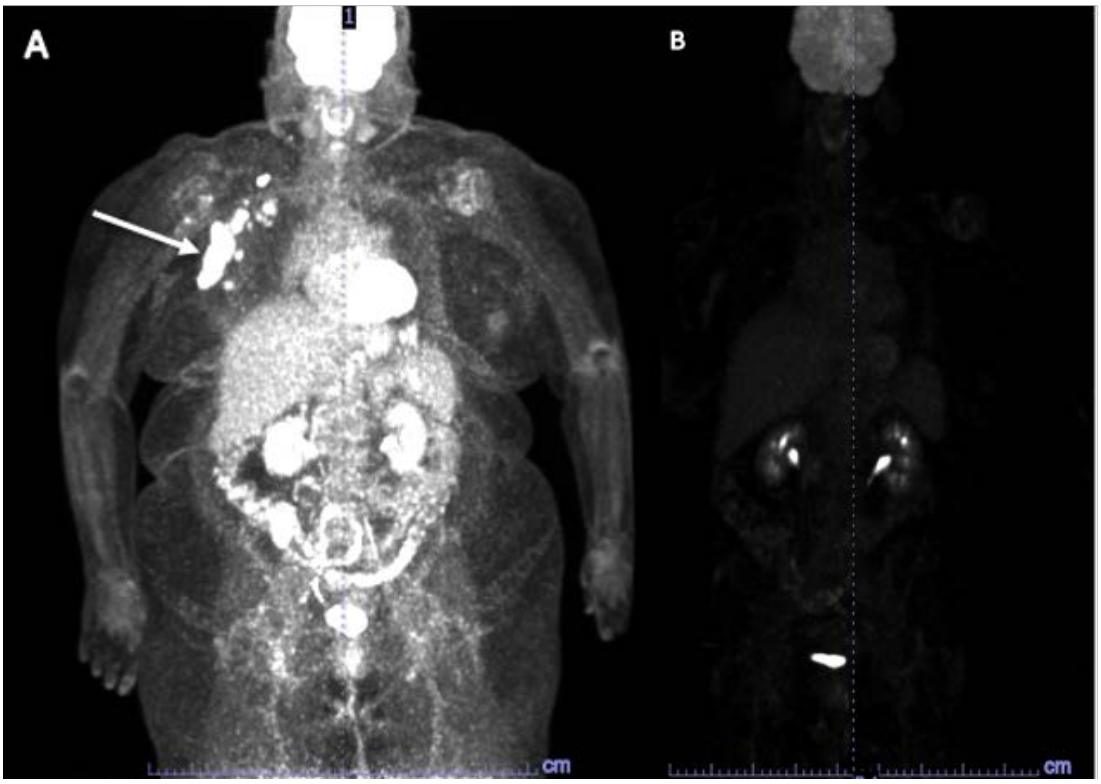

Figure 7: Maximum intensity projection sequences pre (A) and post-treatment (B) following six cycles of chemotherapy, axillary dissection, and radiation therapy. Findings: Resolution in right axillary lymphadenopathy. Technique: maximum intensity projection sequences of the axial fused PET scans in 6a and 6b.

SUMMARY TABLE

Table 1: Summary table of occult primary breast cancer

Occult Primary Breast Cancer	
Etiology	Approximately 70 percent are adenocarcinomas, 15 to 20 percent are poorly differentiated carcinomas, and an additional 10 percent represent poorly differentiated adenocarcinomas
Incidence	<1% of diagnosed breast cancers
Gender Ratio	Females more common than males
Age predilection	Increases with age
Risk factors	Late parity and family history of breast cancer
Treatment	Treat as a stage II breast cancer patient including chemotherapy and mastectomy
Prognosis	5-year survival rate: 81.6% 10-year survival rate: 68.8%
Findings on imaging	Mammogram often reveals axillary lymphadenopathy with no primary tumor. MRI microcalcifications and a spiculated well-demarcated mass with heterogenous enhancement. In addition, axillary lymphadenopathy is often seen.

DIFFERENTIAL TABLE

Table 2: Differential diagnoses for occult primary breast cancer and their respective imaging findings.

Diagnosis	Mammogram	Ultrasound	Computed tomography (CT)	MRI – T1	Pattern of contrast enhancement	PET
Primary Occult Breast Cancer	No visible evidence of primary tumor, may have axillary lymphadenopathy	No suspicious masses	No suspicious masses or calcifications.	No suspicious masses or calcifications.	Heterogenous enhancement.	Increased uptake in setting of axillary lymphadenopathy
Breast Lymphoma	Solitary, oval or round mass with indistinct or circumscribed margins. In addition to enlarged axillary lymph nodes	Hypoechoic mass	Not routinely used	Irregular margins which display a washout curve pattern	Homogenous enhancement	Isolated, solid mass with increased uptake
HIV	Variety of findings including fatty hilum abnormalities, enlarged axillary lymph nodes, and benign or malignant masses	Enlarged superficial lymph nodes	Thoracic findings may include airspace opacities	Enlarged axillary lymph nodes	Homogenous enhancement	Increased uptake in patients with HIV-associated malignancy
Sarcoidosis	Irregular, ill-defined, spiculated mass and enlarged axillary lymph nodes	Axillary lymphadenopathy	Perilymphatic nodular thickening, small nodules, ground glass opacities	Irregular, poorly defined mass	Heterogenous enhancement with rapid enhancement followed by washout	Not routinely used
Metastatic Cancer	Well-circumscribed, round mass with high density often without spiculations or calcifications	Masses with circumscribed margins and low-level internal echoes	Not routinely used	Well-circumscribed, round mass with high density often without spiculations or calcifications	Homogenous enhancement	Increased uptake in areas of metastasis

KEYWORDS

Occult primary breast cancer; axillary lymphadenopathy; magnetic resonance imaging, diagnostic mammogram.