

## Pulmonary Metastasis in Breast Carcinoma: Role of Imaging in Addressing Cases of Delayed Diagnosis

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### ABSTRACT

**Background:** Breast cancer is still the second leading cause of death, with most deaths caused by breast cancer being due to complications associated with metastasis. The target organ of metastasis that often occurs in breast cancer is the lung. Imaging modalities are essential to see breast cancer with lung metastasis and determine early intervention.

**Objective:** Report on the case of a 60-year-old female patient with lung metastasis of breast carcinoma at Bethesda Hospital, Yogyakarta.

**Case Description:** A 60-year-old female patient presented with complaints of shortness of breath on exertion and weight loss. The radiological finding was consistent a lung metastatic lesion.

**Conclusion:** Timely identification of breast cancers and lung metastases is essential for successful treatment and a favorable prognosis, as individuals with smaller tumors at diagnosis exhibit significantly reduced mortality risk and enhanced survival rates. Imaging using ultrasound-assisted mammography can be the primary modality for diagnosing, and screening of breast tumors, while for the detection of lung metastases, plain chest X-ray can be used as the primary modality for diagnosis and CT can be a supporting imaging method for the presence of smaller metastatic nodules.

**Keywords:** Breast Carcinoma; lung metastasis; radiological findings



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## Introduction

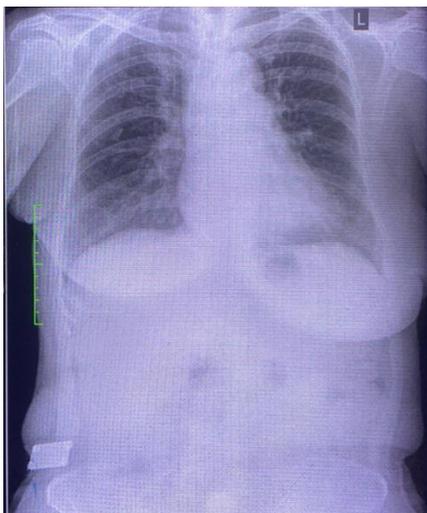
Breast cancer is the most often diagnosed malignancy among women globally and ranks as the second greatest cause of cancer-related mortality, with metastasis responsible for the majority of deaths. The lungs are a prevalent metastatic location, affected in about 50% of individuals with advanced breast cancer.<sup>1,2</sup> Prompt identification and precise diagnosis of pulmonary metastases are essential for prompt intervention and enhanced prognosis. Nonetheless, delayed diagnosis continues to pose a considerable difficulty, frequently attributed to asymptomatic early stages or sharing clinical characteristics with benign illnesses.<sup>3,4</sup> The prognosis for breast cancer patients with lung metastases remains unfavorable, notwithstanding chemotherapy and hormonal treatment guided by molecular receptor profiling.<sup>5</sup> This case report aims to delineate the diagnostic process and treatment strategy for a 60-year-old female patient with breast cancer who acquired pulmonary metastases, emphasizing the significance of imaging techniques in mitigating diagnostic delays. Mammography and ultrasound are essential instruments for breast cancer screening, nonetheless, their inadequate usage in this instance resulted in a postponement of the main tumor's diagnosis. Subsequent radiological assessments, including chest X-rays and CT scans, were crucial in detecting lung metastases, nevertheless, limitations in sensitivity resulted in the first overlooked results. This case study aims to highlight techniques for enhancing early diagnosis and optimizing management protocols in analogous clinical situations.

## Case

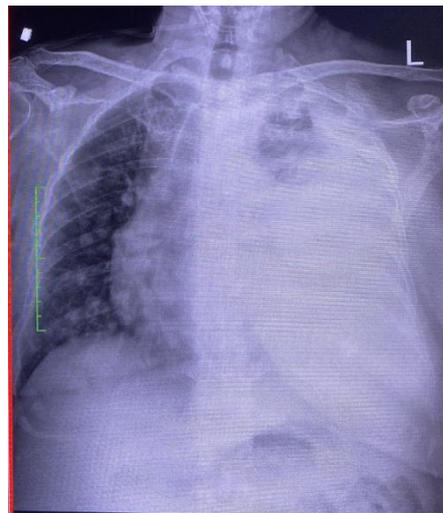
A 60-year-old female patient presented to the pulmonary outpatient clinic with a three-week history of fever, a congested nose, and a cough with white-colored sputum. The patient had a history of diabetes mellitus within the past two years. Thorax AP X-ray showed inhomogeneous opacity in bilateral haemithorax with increased perihilar and paracardial bronchovascular pattern, air bronchogram, CTR <0.5%, undeviated trachea, and left breast enlargement asymmetrical with right (Figure 1). 3 years later, the patient came back to the emergency room with complaints of shortness of breath from 1 month ago after every mild activity. In the last 6 months, the patient felt a drastic weight loss. On physical examination, there was cardiomegaly with edema in the extremities, a solitary mass in the left lower neck, and decreased vesicular sound in the left lung. An AP Thorax X-ray was performed which showed an increase in perihilar bronchovascular pattern, parenchymal lung collapse, fluid level in the left pleural cavum, parenchymal reaction, and multiple opaq nodules with clear borders on the left and right parenchyma suggestive of Bronchogenic Ca with partial left lung collapse, massive pleural effusion and bilateral satellite nodules (Figure 2). Fine needle aspiration examination showed lung adenocarcinoma and histopathological pleural biopsy showed clustered inflammatory cells consisting of lymphocytes,

leucocytes with erythrocyte background. At that time, the patient was diagnosed with EGFR-positive metastatic lung adenocarcinoma with left pleural effusion. 2 weeks later, the patient came back with complaints of coughing, shortness of breath, and weakness. Thorax CT scan showed a mass filling the inferior and superior lobes of the left lung with well-defined borders and smooth edges and narrowing of the left main bronchus, with intact bone system, leftward deviation of the sternum, multiple satellite nodules on the right haemithorax, with rightward deviation of the trachea (Figures 3 and 4). 7 months later, an AP Thorax X-ray examination showed that there was improved bronchovascular pattern, reduced air bronchogram, reduced left pleural effusion, but meniscus sign, metastatic nodules and satellite nodules were no longer prominent, leading to signs of improvement, with complaints of shortness of breath (Figure 5). The patient was diagnosed with left mammary carcinoma with lung metastatic adenocarcinoma.

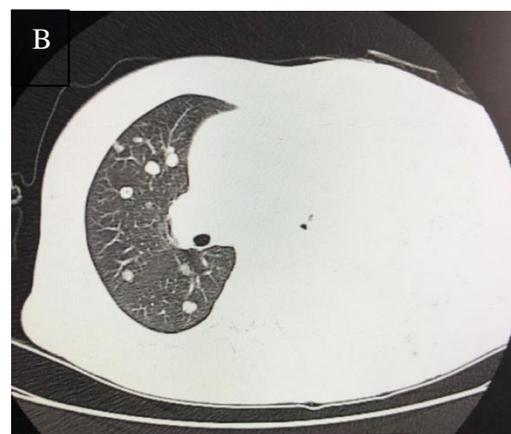
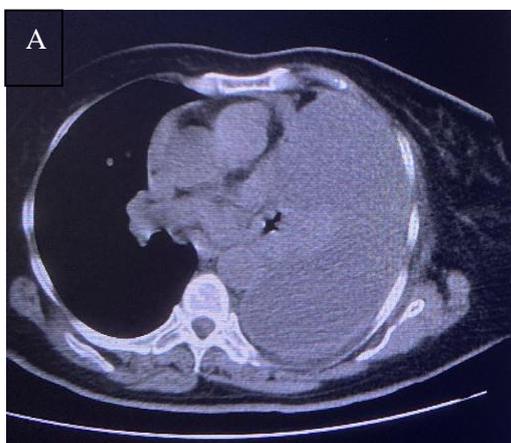
**Figure 1. First AP Thorax X-ray**



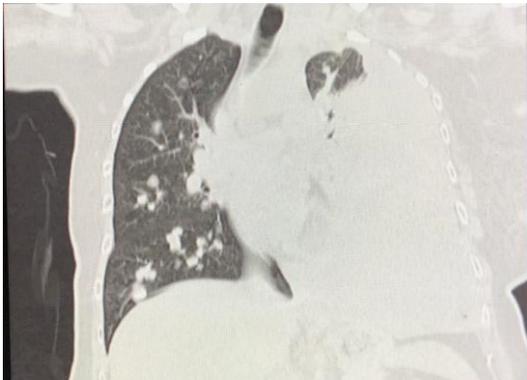
**Figure 2: Thorax X-ray of AP 3 years later.**



**Figure 3. Axial CT-Scan of Mediastinal Window (A) and Lung Window (B) of Thorax 2 Weeks Later**



**Figure 4. Coronal CT-Scan (Lung Window) of Thorax 2 Weeks Later**



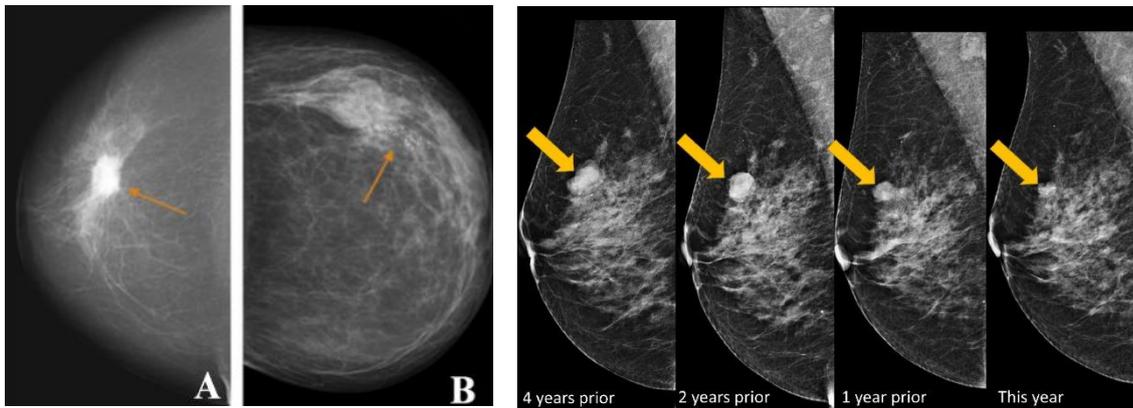
**Figure 5: Thorax X-ray of AP 7 months after the last control.**



## Discussion

This case report presents a 60-year-old female patient who experienced a significant delay in the diagnosis of breast carcinoma, which subsequently progressed to pulmonary metastases, underscoring various critical challenges in the field of oncology diagnostics and management.<sup>1,5</sup> The patient presented with non-specific respiratory symptoms, including dyspnea and unexplained weight loss, which were later identified as associated with advanced metastatic disease. Radiological assessments, including sequential chest X-rays and CT imaging, revealed notable findings suggestive of metastatic lung involvement, characterized by pleural effusion and numerous parenchymal nodules.<sup>6</sup> Nevertheless, the diagnostic process faced obstacles stemming from the absence of early breast imaging studies, particularly mammography (Figures 6-7) and ultrasound (Figure 8), which could have facilitated the earlier detection of the primary breast malignancy.<sup>7-9</sup> The diagnostic complexity heightened as histological examination of biopsy specimens revealed the presence of EGFR-positive lung adenocarcinoma, resulting in initial ambiguity concerning whether this signified a primary pulmonary malignancy or metastatic breast carcinoma, a well-documented diagnostic challenge in the literature.<sup>5</sup> The diagnostic complexity was heightened by the patient's comorbidities, including diabetes mellitus, in conjunction with the atypical evolution of radiological findings observed during her illness.

**Figures 6 and 7. Mammogram examination of breast cancer lesions**



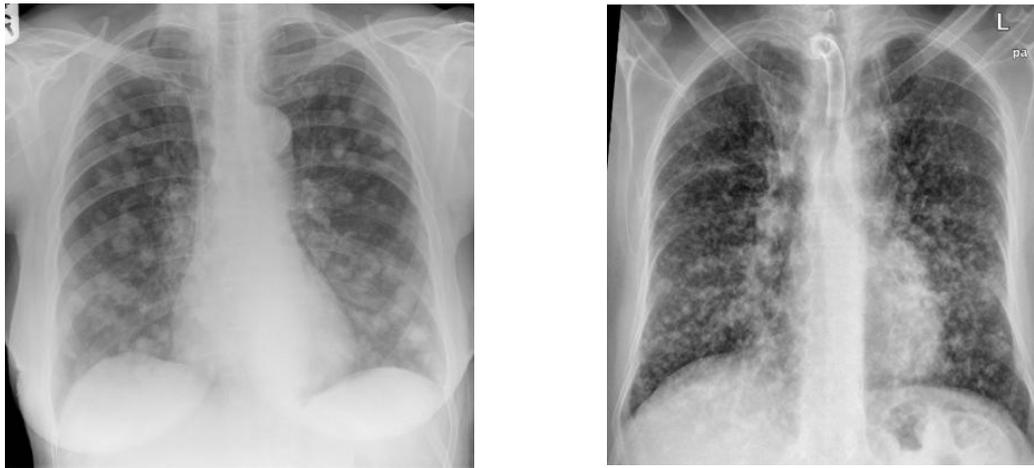
**Figure 8. Ultrasound imaging technique of breast cancer lesions**



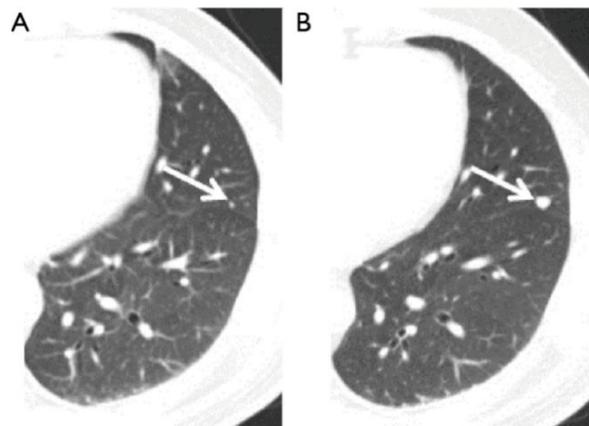
The imaging findings in this case underscore the strengths and constraints of contemporary diagnostic techniques in identifying metastatic disease. Standard chest radiography (Figures 9-10), although easily accessible and economical, exhibited restricted sensitivity for smaller metastatic lesions, especially those measuring less than 1 cm in diameter, following the existing literature on the topic.<sup>6</sup> Enhanced imaging through CT scanning (Figure 12) has facilitated better detection of pulmonary nodules, including smaller metastases; however, it still does not identify certain lesions, especially those situated near the hilar region where vascular structures may obscure small nodules.<sup>10,11</sup> The limitations of imaging highlight the necessity of utilizing a multimodal imaging strategy in these instances, as the integration of various

techniques may yield supplementary insights. This case highlights the potential utility of breast MRI in analogous clinical situations, especially considering its elevated sensitivity for identifying breast malignancies, even among patients with dense breast tissue where mammography may demonstrate reduced efficacy.<sup>12,13</sup>

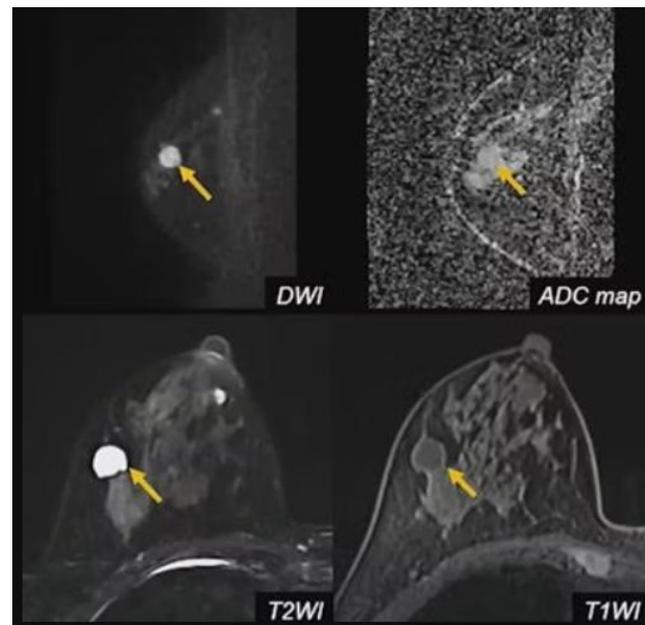
**Figures 9 and 10. Lung metastasis features on plain thorax photograph**



**Figure 11. Findings of missed lung metastatic lesions (A), and newly discovered 4 months after the initial photograph (B).**



**Figure 12. MRI imaging technique of breast cancer lesions**



The delayed diagnosis in this case can be attributed to several systemic factors, particularly the absence of initial breast imaging in a patient who was later confirmed to have metastatic breast carcinoma.<sup>7,12</sup> This oversight illustrates a prevalent difficulty in clinical practice, wherein symptoms may initially seem to arise from a specific organ system, while in reality, they may signify metastatic disease originating from an entirely different primary site. The case underscores challenges in care coordination, as the management of the patient required the involvement of various specialties, including pulmonology, radiology, and oncology, without a clear integration of these services at the initial stages of the diagnostic process. The findings are consistent with the current body of literature that illustrates the role of fragmented healthcare systems in causing diagnostic delays among cancer patients, especially in cases such as breast cancer, where early detection plays a crucial role in influencing prognosis.<sup>1,5</sup>

The clinical ramifications of this case reach beyond the singular patient, prompting broader reflections within the field of oncology practice. Initially, it underscores the necessity of sustaining a heightened level of suspicion for metastatic disease in patients who exhibit unexplained pulmonary findings, especially in the presence of malignancy risk factors.<sup>1,5</sup> Furthermore, it highlights the essential requirement for a thorough initial assessment that takes into account possible primary locations beyond the organ system that is currently exhibiting symptoms.<sup>7</sup> Third, it demonstrates the importance of a coordinated, multidisciplinary approach to cancer diagnosis and management, wherein contributions from diverse specialties can be integrated from the initial stages of patient evaluation.<sup>8</sup> The insights gained from these lessons hold substantial importance in the realm of metastatic breast cancer, as early detection and intervention can profoundly influence the course of the disease and the outcomes for patients.<sup>1,8</sup>

This case offers significant insights into the performance characteristics of different imaging modalities for the detection of pulmonary metastases from a technical standpoint. In general, the examinations that are frequently used are ultrasound, mammography, and magnetic resonance imaging (MRI).<sup>14</sup> The radiographic changes observed in the series of images illustrate the advancement of metastatic disease and the differing sensitivity of various imaging modalities at distinct stages of the condition.<sup>6</sup> The analysis of earlier and later imaging studies distinctly underscores the evolution of metastatic lesions in radiographic presentations over time. It is noteworthy that certain lesions, which may appear inconspicuous in initial assessments, can become increasingly evident as they progress or as imaging methodologies improve.<sup>10,11</sup> The findings presented here hold significant relevance for the advancement and interpretation of imaging protocols in individuals suspected of having metastatic disease.

The diagnostic challenges observed in this case highlight potential avenues for technological progress in imaging methodologies. Current modalities such as digital mammography (Figures 6-7), high-resolution CT (Figures 11), and MRI (Figure 12) serve as effective instruments for cancer detection. However, there is still potential for enhancement in sensitivity for small lesions, especially in anatomically intricate regions like the lung hila.<sup>10,11</sup> Innovative technologies like digital breast tomosynthesis, PET-MRI fusion imaging, and sophisticated computational analysis of imaging data have the potential to mitigate certain limitations in forthcoming clinical applications.<sup>9</sup> Furthermore, this case highlights the increasing significance of molecular diagnostics in elucidating ambiguous situations, as demonstrated by the critical function of EGFR testing in the diagnostic evaluation of this patient.<sup>5</sup>

In summary, this instance of a postponed breast cancer diagnosis accompanied by pulmonary metastases exemplifies the intricate challenges associated with cancer diagnosis and staging. This analysis underscores the advantages and drawbacks of existing diagnostic techniques, illustrates the repercussions of disjointed care provision, and offers critical insights for enhancing the early identification of metastatic conditions.<sup>1,5</sup> The serial imaging studies presented in the case provide significant insights into the radiographic progression of metastatic lung disease and the comparative effectiveness of various imaging modalities.<sup>6,10</sup> In progressing from this case, the findings advocate for the development of more cohesive diagnostic protocols that merge clinical suspicion with suitable imaging techniques, the regular implementation of multimodal imaging strategies in patients identified as high-risk, and improved interdisciplinary collaboration to enhance outcomes for individuals with cancer.<sup>10,13,15</sup> It is essential to integrate these methodologies with continuous advancements in imaging technology and the creation of more sensitive and specific diagnostic instruments for the detection of metastatic disease.<sup>9,11</sup>

## Conclusion

This case illustrates the potential for delayed diagnosis of breast cancer when pulmonary symptoms take precedence in the clinical presentation, potentially obscuring the signs of metastatic spread. The overlooked opportunities encompassed inadequate early breast imaging through mammography or ultrasound in the presence of respiratory complaints, an excessive dependence on basic chest X-rays that did not identify early metastases, and a lack of effective coordination among specialty teams that could have acknowledged the necessity for a thorough evaluation. The critical takeaway is that unexplained respiratory symptoms in high-risk patients necessitate a concurrent evaluation of thoracic and breast pathology through advanced imaging techniques, complemented by clinical correlation, as this comprehensive strategy may avert comparable diagnostic delays. Establishing uniform protocols for simultaneous imaging assessment and collaborative case analysis would enhance the early identification of conditions when therapeutic interventions are most beneficial, especially for aggressive malignancies with the potential for metastasis. Ongoing improvements in imaging sensitivity and the identification of specific tumor markers may significantly improve our capacity to detect these complex cases at earlier stages.

## Conflicts of Interest

The authors declare that they have no competing interests.

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