Primary Dual Cancer: A Case Report on Synchronous Breast and Thyroid Cancer

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ABSTRACT

Introduction: The co-occurrence of synchronous breast and thyroid cancers, though rare, poses significant challenges in diagnosis and management. Breast cancer is the most common malignancy in women, while thyroid cancer, particularly papillary carcinoma, is rising in incidence. The interplay among hormonal, genetic, and environmental factors may contribute to the development of these malignancies, necessitating a multidisciplinary approach for effective treatment.

Clinical Presentation: A 45-year-old premenopausal woman presented with a painless lump in her right breast. Diagnostic workup revealed invasive ductal carcinoma (triple-negative) treated with breast-conserving surgery (BCS), axillary dissection, and adjuvant chemotherapy. A follow-up PET scan incidentally identified an FDG-avid thyroid lesion and suspicious supraclavicular lymph node. Subsequent investigations confirmed papillary thyroid carcinoma. The patient underwent total thyroidectomy and selective lymph node dissection, followed by radiotherapy to the breast.

Discussion: Synchronous breast and thyroid cancers highlight the need for comprehensive diagnostic evaluations, including advanced imaging and biopsy techniques. FDG-PET scans and fine-needle aspiration cytology are crucial for identifying and confirming coexisting malignancies. Shared risk factors, such as estrogen influence and genetic mutations (e.g., PTEN, TP53), may underlie their concurrent development. Literature emphasizes that synchronous cancers complicate therapeutic strategies, demanding individualized care plans. Hormonal and genetic insights are integral for understanding their coexistence and improving outcomes.

Conclusion: This case warrants the importance of vigilance for synchronous malignancies during follow-up of cancer patients. Enhanced awareness, rigorous diagnostics, and a multidisciplinary approach are essential for optimizing management. Further research is needed to elucidate the biological mechanisms linking breast and thyroid cancers, fostering advancements in personalized medicine.

Keywords: *Synchronous Malignancies, Breast Cancer, Papillary Thyroid Carcinoma, Multidisciplinary Management*

INTRODUCTION

The increasing incidence of synchronous primary cancers, particularly breast and thyroid malignancies, has drawn significant clinical interest and research attention in recent years. Breast cancer remains the most prevalent cancer among women, with its associated morbidity and mortality posing substantial public health challenges. Concurrently, thyroid cancer,

while less common, is rising in prevalence, especially among the female demographic. Notably, the unique overlap between these two cancer types raises critical questions about their etiological links, especially regarding genetic predispositions and hormonal influences. Multiple studies indicate that while the incidence of synchronous cancers remains low, occurring in approximately 10% of cancer patients, the implications for survival outcomes are profound, as seen in cases of breast cancer alongside thyroid carcinoma.[1] Synchronous cancers often complicate therapeutic approaches, necessitating a multidisciplinary strategy for effective management. Interestingly, it has been observed that breast cancer survivors may face an elevated risk of developing secondary thyroid malignancies.[2] This interplay necessitates heightened awareness among healthcare practitioners regarding the simultaneous evaluation and management of these conditions to optimize patient outcomes.[3]

CLINICAL PRESENTATION

A 45-year-old premenopausal woman with no history of exogenous estrogen intake presented to the surgical oncology OPD in cancer institute with a painless lump in her right breast. Physical examination revealed a firm, fixed mass of approximately 2.5×2 cm in the upper outer quadrant of the right breast. Diagnostic mammogram and ultrasound imaging confirmed the presence of a suspicious mass, and a core biopsy was performed, which revealed invasive ductal carcinoma, grade-3, IHC- triple negative breast cancer (CT2N0). Then patient underwent breast conservation surgery with level I & II axillary lymph node dissection. The final histopathology confirmed a 2.9 x 2.6×2 cm tumor, with clear surgical margins and presence of total 2 lymph node metastasis making a final diagnosis of pT2N1. After healing of surgical wound approximately after 3 weeks of surgery, the patient received 4 cycles of three weekly adjuvant chemotherapy with an Epirubicin + Cyclophosphamide regimen followed by 4 cycles of three weekly Paclitaxel. After completion of the surgery and chemotherapy patient underwent a PET scan for follow up evaluation, which incidentally revealed a FDG avid enlarged and sub centimetric sized left supraclavicular lymph node of size 13.3×10.8 mm with SUV max of 7.3. Then patient was advised for high resolution ultrasound of neck which revealed ill-defined wider than taller solid hypoechoic lesion of size 6.1×5 mm in right lobe of thyroid (TIRADS 4) and enlarged hypoechoic left supraclavicular suspicious node of size 9.5×12 mm. Fine Needle Aspiration cytology of the thyroid lesion confirmed papillary thyroid cancer. She underwent total thyroidectomy and left

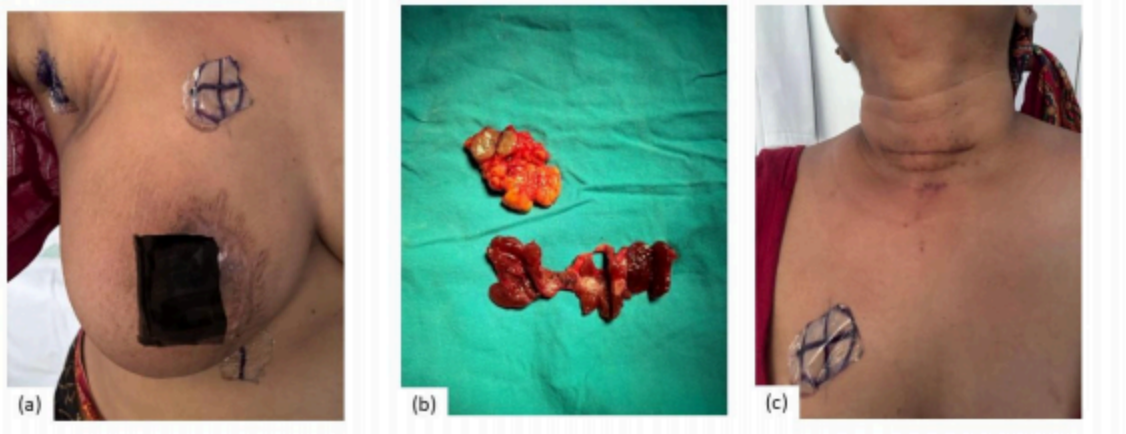

Figure 1: (a) Image showing scar following breast conservation surgery and radiotherapy marking, (b) Image showing total thyroidectomy specimen, (c) Image showing neck scar after total thyroidectomy surgery

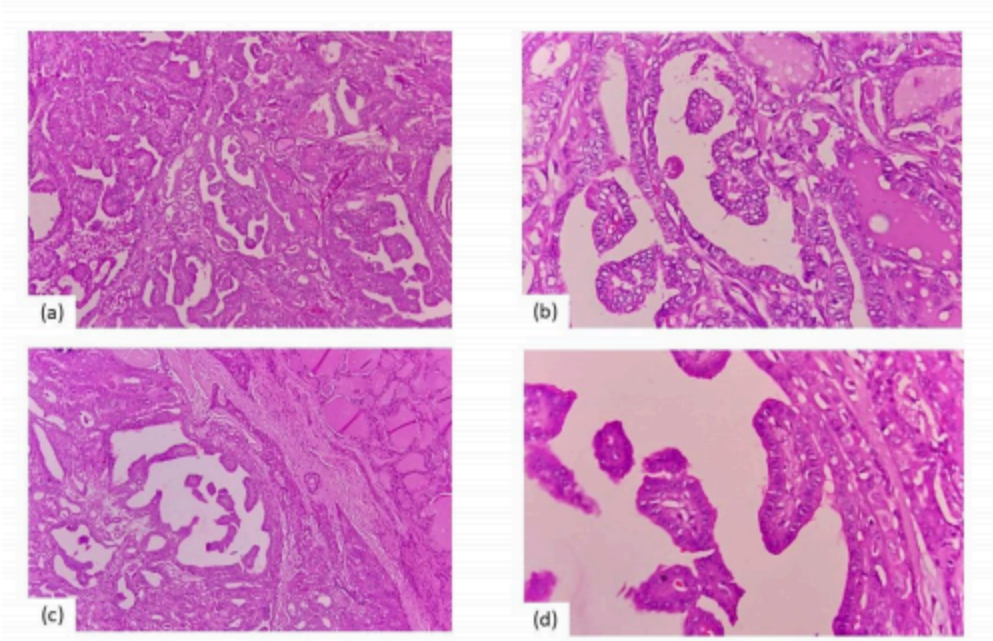

Figure 2: (a) PTC with papillary processes(100x) Low Power Field, (b) PTC - Papillary with nuclear features(400x) High Power Field, (c) PTC and Normal follicles 100x, (d) Papillary processes with nuclear features 400x

selective lymph node dissection level II to V. Final histopathology confirmed a 0.4cm papillary carcinoma thyroid of classical type with no evidence of metastasis to lymph node. The patient then subsequently received radiotherapy to breast as part of breast conservation therapy.

DISCUSSION

The exploration of synchronous breast and thyroid cancers has garnered significant scholarly attention, highlighting the necessity of a nuanced understanding of their co-occurrence. Literature indicates that patients with synchronous

malignancies face distinct therapeutic challenges and varying prognostic outcomes, necessitating a comprehensive approach to diagnosis and treatment. For instance, a 61-year-old woman presented with synchronous anaplastic thyroid carcinoma and ductal carcinoma of the breast, underlining the potential genetic and hormonal interconnections that may exist between these cancers.[4] Similarly, reports indicate that long-term hormone therapy, particularly estrogen, may contribute to the development of both cancers, as seen in cases involving hormone receptor-positive tumors.[5]

Further complicating management, a study revealed that synchronous tumors can yield operational risks during simultaneous surgical interventions, emphasizing the importance of meticulous preoperative assessments.[4] Understanding the shared risk factors and interactions between these malignancies is critical, as it may enhance patient management and inform tailored therapeutic strategies.[1] Additionally, the need for heightened awareness among clinicians about the implications of concurrent diagnoses is paramount for optimizing patient outcomes.[6] The accurate diagnosis of synchronous breast and thyroid cancers necessitates the use of advanced imaging and biopsy techniques to differentiate these malignancies and inform treatment strategies. Modalities such as ultrasound, computed tomography (CT), and positron emission tomography (PET) play critical roles in identifying and characterizing suspicious lesions. For instance, FDG PET/CT has proven effective in visualizing both breast and thyroid tumors, as demonstrated in studies highlighting abnormal uptake in dual carcinoma cases, thereby facilitating early diagnosis.[7] Following imaging, fine needle aspiration cytology (FNAC) is employed to obtain tissue samples, allowing pathologists to confirm diagnoses and discern between primary tumors and metastases.[4] Furthermore, the use of immunohistochemistry offers deeper insight into tumor markers that can elucidate the relationship between these synchronous malignancies, providing clinicians with vital information to tailor appropriate therapeutic regimens.[4] The integration of these techniques is essential for developing an accurate diagnostic framework in cases of concurrent breast and thyroid cancers.[5]

The interplay between genetic predispositions and environmental influences plays a pivotal role in the synchronous occurrence of breast cancer and thyroid cancer, as highlighted by various case reports. Moreover, genetic factors, such as mutations in the PTEN and TP53 genes, have been implicated in the development of both cancers, suggesting a

shared genetic susceptibility that warrants further investigation.[4] The presence of common hormonal receptors in breast and thyroid tissues suggests a complex relationship between these cancers, with studies indicating heightened risk for individuals with a history of one malignancy developing the other.[4] Furthermore, environmental factors, including previous radiation exposure from therapeutic interventions, further complicate this interrelationship, underlining the need for comprehensive risk assessments and surveillance strategies in affected patients.[6]

The interplay of hormonal factors is critical in understanding the synchronous development of breast and thyroid cancers, particularly given their shared hormonal influences. Estrogen has been established as a significant player in breast carcinogenesis, while thyroid hormones appear to modulate breast tissue growth and function, thereby creating a potential nexus between these malignancies.[4] Clinical evidence suggests that patients with hormone receptor-positive cancers may be at an elevated risk for developing secondary malignancies, including thyroid cancer, due to long-term hormone exposure.[4] Additionally, alterations in thyroid hormone levels and receptor signalling have been implicated in breast cancer pathogenesis, highlighting a complex relationship wherein thyroid dysfunction may exacerbate breast cancer progression.[2] Notably, genetic mutations such as those in PTEN and p53 are shared between these cancers, indicating that hormonal and genetic factors could jointly influence their synchronous occurrence.[4,5] Therefore, a multi-faceted approach, considering both hormonal and genetic influences, is essential for effective management and surveillance of patients presenting with synchronous breast and thyroid malignancies.[1,8]

CONCLUSION

In summary, the occurrence of synchronous breast and thyroid cancers underscores the necessity for enhanced awareness and rigorous diagnostic protocols among clinicians. Given the shared hormonal influences and potential genetic links between these malignancies, early identification and management are critical for improving patient outcomes. The simultaneous occurrence of breast and thyroid cancers presents significant implications for clinical practice, as the findings underscore the complexity of diagnosing and managing synchronous malignancies. Future research on synchronous breast and thyroid cancers should prioritize the elucidation of biological mechanisms underlying their coexistence, particularly focusing on the hormonal and genetic pathways that may

predispose individuals to develop both malignancies. A multidisciplinary approach, involving oncologists, surgeons, and genetic counsellors, may enhance care protocols, facilitating personalized treatment plans that account for individual patient risk factors and comorbidities associated with these dual malignancies.

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