

CASE REPORT

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An uncommon site for papillary thyroid carcinoma metastasis: a case of breast involvement

Lovenish Bains^{1*} , Uday Kumar Katuri¹ , Chaitanya Polisetty¹, Pawan Lal¹ and Meeta Singh²

Abstract

Background Papillary thyroid carcinoma (PTC) is a slow-growing neoplasm with an overall favorable prognosis, frequently disseminated via lymphatic channels in the cervical region. The occurrence of thyroid carcinoma metastasizing to the breast is infrequent, with the mechanism of dissemination remaining unclear.

Case summary A 63-year-old female presented with a painful, progressive mass on the right breast upper outer quadrant for 3 months with bloody discharge from the nipple and cervical lymphadenopathy level 2–5 by axillary lymphadenopathy and shortness of breath. On examination, 8 cm x6 cm, a well-defined lump was palpable on the right breast, with soft to firm consistency. The swelling was fixed to the underlying tissues. The patient had undergone a total thyroidectomy for papillary carcinoma 10 years back and another surgery for pre-sternal thyroid swelling 3 years back which was also papillary carcinoma. Fine needle aspiration cytology (FNAC) was inconclusive and a core cut biopsy from the breast was taken which was suggestive of papillary thyroid carcinoma. Henceforth a Positron emission tomography (PET) scan was done that showed increased fluorodeoxyglucose (FDG) uptake by the lesion, cervical and axillary lymph nodes. The patient was advised for radioactive iodine ablation and palliation.

Discussion Papillary thyroid cancer (PTC) is the most common thyroid malignancy, often spreading via lymphatics. Regional metastasis to the neck is frequent, though metastasis outside the deep cervical chain is rare. Distant metastases occur in 1% of PTC patients mainly in the lungs and bones. The precise mechanisms enabling the spread of thyroid carcinoma to the breast remain insufficiently understood. A small subset of medullary thyroid carcinomas has been observed to display metastasis to the breast, which majorly disseminates by hematogenous route. Ours is a rare case of PTC showcasing metastasis to the breast. Proposed mechanisms encompass dissemination via intraoperative seeding and lymphatic routes.

Conclusion Metastasis of papillary thyroid carcinoma to the breast is very rare in the current body of literature; however, a small number of cases of medullary thyroid carcinomas in the breast have been identified, predominantly disseminated via the hematogenous route. Therefore, the identification of a mass in the breast may warrant consideration as a metastatic lesion in the setting of pre-existing thyroid carcinoma. Radioactive iodine ablation (RAI) and radiotherapy might be recommended for palliation.

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Keywords Papillary thyroid carcinoma (PTC), Breast metastasis, Lymph nodes, Metastasis

Introduction

Thyroid cancer has one of the highest incidences within endocrine malignancies at 10.1 per 100,000 women and 3.1 per 100,000 men globally [1], Papillary thyroid carcinoma (PTC), is the most common type of thyroid cancer overall, comprising 84% of all incident cases with a peak incidence is in the third to fifth decades of life. PTC disseminates primarily via the lymphatic route with higher incidences of micro-metastasis without any obvious lymphadenopathy, The rate of regional PTC metastasis to the neck is relatively high, while metastases outside the deep cervical chain are rare, however, distant metastases do occur in up to 3–5% of patients, typically to lung and bone [2]. Other unusual sites of metastasis include the occipital skull and internal jugular vein, parapharyngeal space, sternocleidomastoid muscle, and even the right atrium of the heart [2, 3].

Histologically, PTC is characterized by complex branching papillae with pseudo inclusions, nuclear grooving, and psammoma bodies. Recurrence rates of papillary thyroid carcinoma are in the range of 14–30%, predominantly in the cervical region, and distant metastasis is known mainly to lungs and bones [2]. Medullary carcinoma thyroid (MCT) which is known to spread by hematogenous route has been reported to metastasize to the breast and other primary sites may rarely metastasize to breast [4]. Only anecdotal reports suggest breast metastasis from papillary thyroid carcinoma [5–7]. These cases highlight the rarity of this phenomenon and the importance of considering metastatic disease in patients with a history of thyroid cancer. We present our rare case of a 63-year-old female with metastasis in the breast ten years after thyroidectomy.

Case summary

A 63-year-old woman presented to the surgery department with progressively painful swelling in her right breast, along with bloody discharge, and stridor. Upon examination, Pulse rate was 84/min, blood pressure was 130/80 mmHg, and her respiratory rate was 18/min. A well-defined 10 cm x 6 cm x 6 cm tender swelling was detected in the upper outer and upper lower quadrant of the right breast, exhibiting a soft to firm consistency (Fig. 1). The swelling adhered to the underlying tissues and the skin above it showed ulceration in the upper outer quadrant with bilateral axillary lymphadenopathy. The other breast was normal. The patient also had involvement of bilateral cervical group of lymph nodes (level 2 to 5) which are painless on palpation. (Figure 2A and B). 70⁰ endoscopy was done which showed no involvement of vocal cords.

The patient had a history of open total thyroidectomy for papillary thyroid carcinoma a decade ago and another surgery for recurrent pre-sternal thyroid swelling three years ago which was consistent with papillary thyroid carcinoma [8]. Following the latter surgery, the patient underwent radioactive iodine ablation of 70mCi about 8 weeks post-operatively and was prescribed a daily dose of 100 micrograms of thyroxine, however she did not follow up and presented to us only after advanced disease. Fine needle aspiration cytology was inconclusive, a core cut biopsy from the breast revealed focal areas of scanty thick colloid (inspissated between cells), and the presence of typical cells, nuclear grooves, inclusions, and clustering consistent with papillary thyroid carcinoma (Fig. 3). Additionally, focal areas of necrosis and hemosiderin-laden macrophages were observed. Immunohistochemistry for breast-specific markers (e.g., ER, PR, HER2) was not performed due to the histopathological evidence of thyroid origin (positive for CK19 and thyroglobulin).

Consequently, a Positron emission tomography (PET) scan revealed elevated Fluorodeoxyglucose (FDG) done uptake in the lesion within the upper and lower quadrants of the right breast, as well as in the level II-V lymph nodes of the bilateral cervical group and bilateral axillary lymph nodes (Fig. 4A, B and C) The patient was advised for radioactive iodine ablation, unfortunately, the patient did not follow up and succumbed to the disease after 2 months.

Discussion

In 2022, thyroid cancer ranked as the seventh most common cancer overall and the fifth most common in women, with an incidence rate three times higher in women than in men. Mortality from the disease is much lower than incidence, with an estimated 44,000 deaths for both sexes combined in 2022, ranking 24th globally. Papillary thyroid carcinoma (PTC), the most common type of thyroid cancer, comprises 84% of all incident cases, with a peak incidence in the third to fifth decades of life [1].

The most common metastatic sites were lung (53.4%), followed by bone (28.1%), liver (8.3%), and brain (4.7%). Uncommon sites of metastasis include the occipital skull, internal jugular vein, parapharyngeal space, sternocleidomastoid muscle, and even the right atrium of the heart [2, 9, 10, 11]. Papillary carcinoma thyroid, despite its well-differentiated features, can manifest as either overtly or minimally invasive, with a tendency to easily spread to other organs. These tumors have a preference for lymphatic invasion over blood vessel invasion. While these tumors are generally slow-growing and exhibit



Fig. 1 Right breast lump in the upper outer quadrant with skin ulceration and axillary lymphadenopathy

a favorable prognosis, they frequently metastasize to regional lymph nodes in 5.4–13% of patients following initial surgical intervention. The occurrence of regional metastasis of PTC to the neck region is relatively high, with rare instances of metastases beyond the deep cervical chain; however, distant metastases can be observed in 3–5% of patients, commonly affecting the lungs and bones [12]. Although PTC is a disease with a generally good outcome, differentiated thyroid cancer (DTC) patients presenting with distant metastasis have less favorable prognosis.

The recurrence rate post primary treatment is approximately 1.8% annually during the initial decade. PTC exhibits a high frequency of occult micro metastasis, with rates as high as 40% among N0 patients within the central neck region. It is widely acknowledged that the spread of lymph nodes in PTC typically follows a sequence of central compartment, ipsilateral compartment, and contralateral compartment.[12,13] The primary treatment approach for most cases of thyroid cancer is surgery,

leading to significant discussions regarding the impact of nodal metastasis on both recurrence rates and overall survival [14, 15].

In our case, the patient was previously operated for pre-sternal thyroid [8] three years back presented with a breast lump with features of PTC, only few rare presentations were reported in the literature. MCT were reported to have been metastasized to the breast, the latter was known to spread by hematogenous route, while the PTC has propensity for lymphatic spread, however in overwhelming disease burden like in our case it can reach anywhere in the body.

The suggested mechanisms include incomplete clearance during primary surgery or intraoperative seeding and subsequent lymphatic dissemination. Radio-active Iodine therapy and Radiotherapy can be given for local control of the disease but prognosis remains poor in such advanced diseases and palliation should be advised. Multikinase inhibitors (MKIs) like sorafenib and Lenvatinib and Highly selective RET inhibitors, including selipercatinib and pralsetinib are the recent advances and in initial use as targeted therapies for metastatic thyroid cancer [16].

Conclusion

PTC carries overall good prognosis; it often shows occult metastasis through lymphatics to lungs and bones. Metastasis of papillary thyroid carcinoma to the breast is very rare in the current body of literature. Therefore, the identification of a mass in the breast may warrant consideration as a metastatic lesion in the setting of pre-existing thyroid carcinoma. Treatment is usually palliative in such cases.



Fig. 2 Cervical lymphadenopathy (level 2 to 5) with the scar of previous surgery (A. anterior view, B. Lateral view)

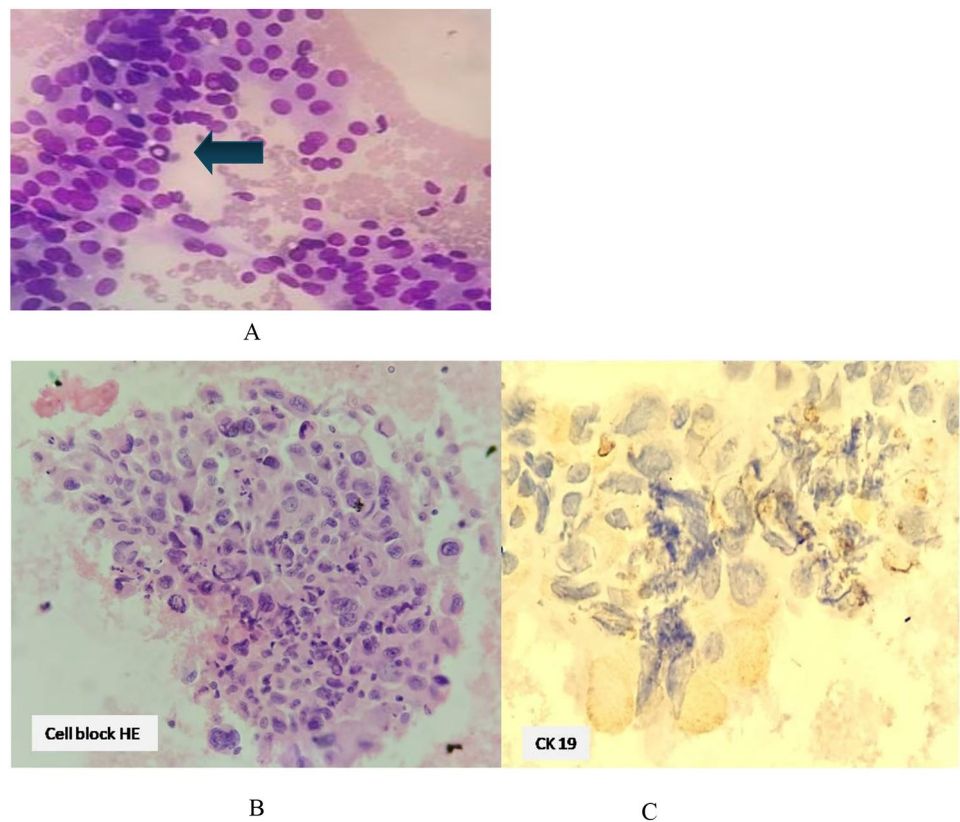


Fig. 3 **A** core needle biopsy of right breast lump-features consistent with PTC. **B** showing nuclear inclusions-orphan Annie eye appearance, **C** Immuno-histochemistry positive for CK19

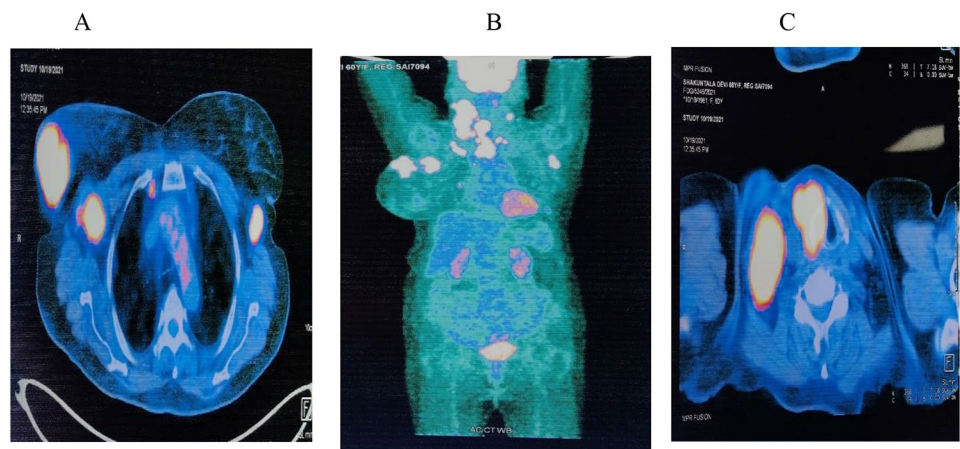


Fig. 4 **A** PET -CT images showing involvement of axillary lymph nodes. **B** involvement of cervical lymph node (level 2 to 5). **C** whole body view

Abbreviations

FDG	Fluorodeoxyglucose
FNAC	Fine needle aspiration cytology
PET	Positron emission tomography
PTC	Papillary thyroid carcinoma
USG	Ultrasonography
MTC	medullary thyroid carcinoma
DTC	Differentiated thyroid cancer
RAI	Radio-active iodine

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Author contributions

LB conceptualized the manuscript. LB and UKK reviewed the literature, analyzed data, and made major contributions to the writing of the manuscript. LB, UKK, PC and PL performed the clinical examination, surgical treatment, and clinical follow-up. MS provided the histopathological diagnosis. LB and UKK performed final review and editing of the manuscript. All authors have read and approved the final version of the manuscript.

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Data availability

All data generated or analysed during this study are included in this published article.

Declarations**Ethics approval and consent to participate**

This case report is exempt from institutional review (MAMC/IEC). Case reports upto three or less patients do not require institutional review board approval.

Consent for publication

Written informed consent to participate and written informed consent to publish were obtained from the patient prior to submission.

Competing interests

The authors declare no competing interests.

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