^{99m}Tc- avid Lymph Node Metastasis in A Patient with Papillary Thyroid Carcinoma-A Case Report

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ABSTRACT

Papillary thyroid carcinoma (PTC) is the most common form of thyroid cancer, typically characterized by a favorable prognosis. However, lymph node metastasis is a common feature in PTC and can complicate treatment decision and affect patient outcome. Imaging modalities such as ultrasound and CT scan are routinely used to detect lymph node involvement rather than 99mTc-petechnetate scintigraphy. This case report presents rare instance of technetium avid lymph node metastasis in a patient with PTC. The findings suggest that certain metastatic lymph nodes in PTC demonstrate technetium uptake potentially due to altered vascularity, the tissue characteristics in metastatic environment. The use of 99mTc-petechnetate imaging in PTC may provide additional diagnostic value, especially in cases with inconclusive findings from conventional imaging modalities. This case emphasizes the importance of considering a broad range of imaging techniques for accurate staging and treatment planning in patient with thyroid cancer. Further studies are needed to explore the mechanism behind technetium uptake in metastatic lymph node and to assess its prognostic significance.

Keywords: Technetium avid, Papillary thyroid carcinoma, Lymph node, Metastasis

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INTRODUCTION

Thyroid cancer is the 11th most common cancer worldwide (1). In recent years the incidence of Differentiated Thyroid Cancer (DTC) has shown a significant upward trend (2). PTC is the most common type of thyroid cancer, accounting for 80% of all thyroid cancers (3-4). While the prognosis for PTC is generally favorable, the occurrence of lymph node metastasis can complicate clinical management and influence long-term outcomes. Like other primary malignancies of the head and neck, thyroid cancer follows a consistent pattern of spread in the cervical lymph nodes. The central compartments, levels 6 and 7, are the first echelon of involvement, followed by spreading to the lateral compartments, levels 2-5, followed by the contralateral side (5). According to the 2015 American Thyroid Association (ATA) guidelines, radioactive iodine therapy (RAI) is recommended for all high-risk and selective intermediate-risk patients with DTC (6). 99mTc-pertechnetate has long been used in clinical practice as an imaging agent for evaluating thyroid diseases, and it is cheap, widely available, has ideal imaging characteristics, and has favorable dosimetry. 99mTc- pertechnetate scanning is commonly used to detect any thyroid remnants following total thyroidectomy, and it may provide beneficial data on the extent of remnant tissue without the need for 131I or 123I. Over the last few decades, extrathyroidal 99mTc-petechnetate uptake has rarely been reported (7).

The present case report describes a patient with a follicular variant of PTC whose lateral compartment cervical lymph nodes metastases were detected using 99mTc-petechnetate scintigraphy after total thyroidectomy and during evaluation for radioactive iodine therapy.

CASE REPORT

A 42 years old, preoperatively euthyroid and diabetic woman was diagnosed as a case of papillary thyroid carcinoma and was referred to Institute of Nuclear Medicine and Allied Sciences (INMAS), Jashore for radioactive iodine ablation after total thyroidectomy. Post-surgical evaluation showed high level of TSH (75.5µIU/mL) and normal serum Thyroglobulin (Tg) level (<0.01ng/mL) but raised serum anti Tg antibody level (37.6 IU/mL). High Resolution Ultrasound of neck shows multiple enlarged lymph nodes with altered

echoes, microcalcification, loss of fatty hilum and abnormal vascular pattern on color doppler at level-IV of right side of neck. Thyroid scan with 99mTc-petechnetate showed no residual thyroid tissue but multiple areas of increased and abnormal radiotracer uptake in the right side of lower cervical region which were consistent with ultrasound findings of enlarged neck nodes. The findings were in favor of a case of technetium avid metastatic lymph nodes. The patient underwent a selective neck dissection due to growing metastatic lymph nodes, and after revision surgery, histopathology revealed metastatic lymph nodes from papillary thyroid carcinoma. After that, the patient was sent to our facility for radioactive iodine ablation treatment. A repeat thyroid scan with 99mTc-petechnetate reported no aberrant radiotracer uptake in the cervical region, which had been observed prior to the revision surgery. Subsequently with proper evaluation and staging as a high-risk patient, the patient was treated with 5550 MBq (150 mci) of radioactive iodine. The patient is currently receiving timely follow-up.

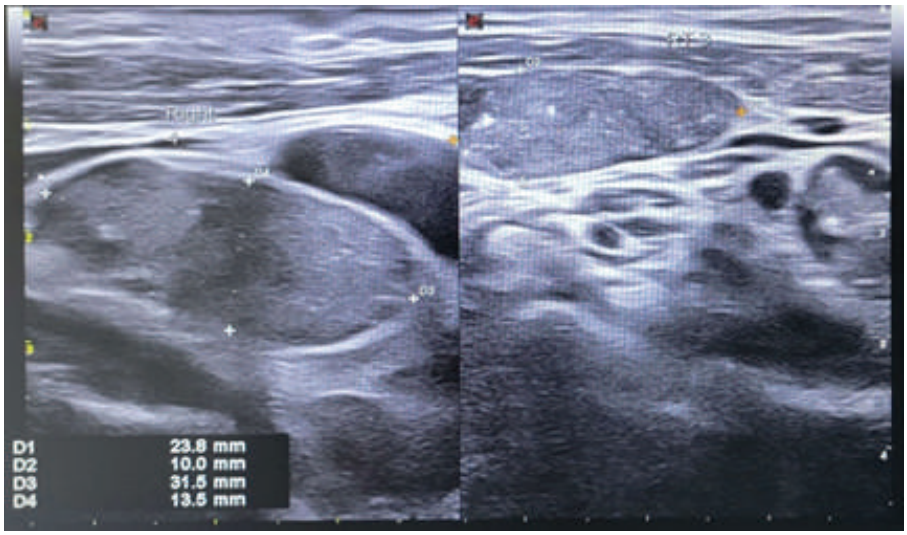

Figure 1: High Resolution Ultrasound of neck shows enlarged lymph nodes with altered echo, macrocalcification and loss of fatty hilum at level-IV of right side of neck

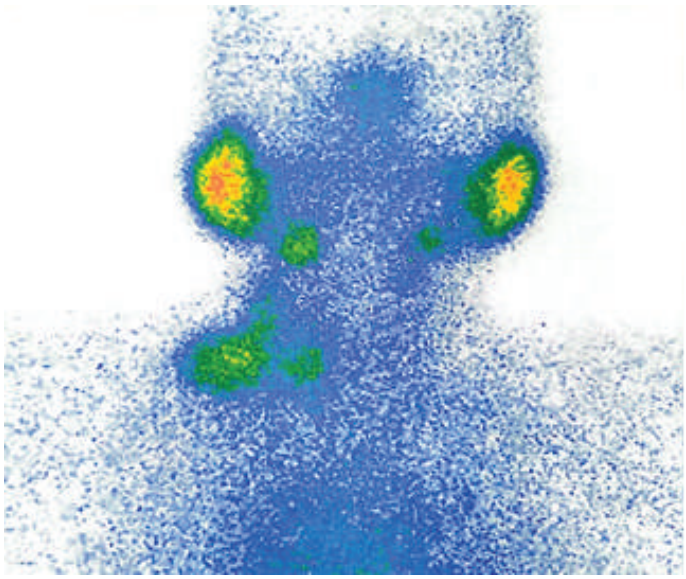

Figure 2: ^{99m}Tc-petechnetate scan shows abnormal and increase radiotracer uptake at right side of lower cervical region before selective neck dissection.

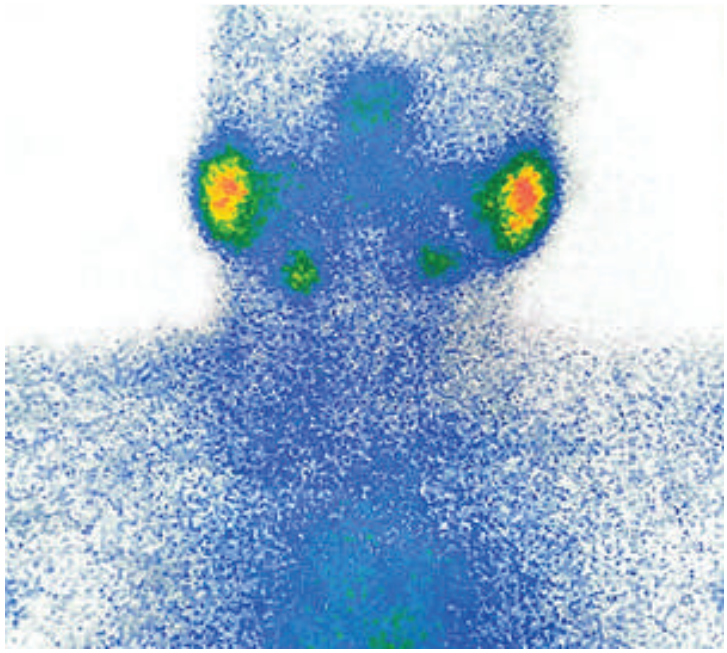

Figure 3: ^{99m}Tc-petechnetate scan shows no abnormal radiotracer uptake noted in cervical region after selective neck dissection.

DISCUSSION

The occurrence of lymph node (LN) metastasis in DTC is notably high, constituting a significant risk factor for the recurrence of DTC and diminished overall survival. Hence, the identification of LN metastasis subsequent to DTC surgery holds paramount significance for the patient's prognosis and treatment considerations (1). ^{99m}Tc- pertechnetate scan is often used to evaluate thyroid residue before the initial RAI therapy, but it is rarely used to detect suspected DTC metastases. The main reason is that although 99mTc-petechnetate and iodine form monovalent anions, have similar physical and chemical properties, and can be accumulated by sodium-iodide symporter (Na+/I symporter) located in the cell membrane of thyroid cells, 99mTc-petechnetate can't further participate in thyroid hormone synthesis after entering thyroid cells (and has faster elution). So, the metastases from DTC may not show 99mTc-pertechnetate uptake (7-8). However, the present study incidentally identified technetium-avid metastatic LN at the right side of the neck (level IV), which are consistent with USG findings. After selective neck dissection, the histopathology report shows this was a metastatic lymph node in a patient with papillary thyroid carcinoma. The fact that 99mTc-petechnetate was able to be absorbed by thyroid cancer tissue under the mediation of sodium-iodide symporter proteins and abnormally increased ^{99m}Tc-petechnetate uptake of the lesions outside of the thyroid bed/gland is a characteristic of metastatic thyroid cancer tissues in a known case of thyroid cancer patient, suggesting the lesion likely originated from thyroid tissue (9-10).

The uptake of ^{99m}Tc-pet technetate in metastatic lymph nodes is unclear. But in this case, 99mTc-pertechnetate uptake in lymph nodes may be linked to the specific biochemical environment of the metastatic site. Metastatic lymph nodes in PTC might show increased perfusion or altered microvascular characteristics, enhancing 99mTc-petechnetate deposition. The mechanism behind 99mTc-petechnetate avidity in the PTC-associated lymph node may be multifactorial, involving tumor-associated changes in blood flow, cell membrane properties, and receptor activity that can facilitate ^{99m}Tc-petechnetate uptake.

CONCLUSION

The significance of sophisticated imaging methods in the identification and treatment of metastatic diseases is shown by this instance of technetium-avid lymph node metastases in PTC. In the diagnostic workup of

differential thyroid carcinoma, technetium avid lymph node involvement should be taken into account, despite its rarity, especially in patients with atypical presentations or during treatment follow-up. To further understand the mechanisms underlying this phenomenon and to improve the use of 99mTc- pertechnetate scans in the treatment of metastatic PTC, more research is necessary.

REFERENCES

1. Liu J, Li X, Li L, Yin Y, Cai H, Yi H. Unexpected 99mTc-pertechnetate avidity of lymph node metastases predict better response to radioiodine therapy in differentiated thyroid cancer patients with lymph node metastases. American Journal of Nuclear Medicine and Molecular Imaging. 2024;14(1):63.
2. Lim H, Devesa SS, Sosa JA, Check D, Kitahara CM. Trends in thyroid cancer incidence and mortality in the United States, 1974-2013. Jama. 2017 Apr 4;317(13):1338-48.
3. Abdullah, M.I., Junit, S.M., Ng, K.L., Jayapalan, J.J., Karikalan, B., Hashim, O.H. (2019). Papillary Thyroid Cancer: Genetic Alterations and Molecular Biomarker Investigations. International Journal of Medical Sciences, 16(3), 450-460.
4. Essentials of Nuclear Medicine and molecular Imaging,7th edition, page- 97.
5. Wang LY, Ganly I. Nodal metastases in thyroid cancer: prognostic implications and management. Future Oncology. 2016 Apr 30;12(7):981-94.
6. Haugen BR. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: what is new and what has changed?. Cancer. 2017 Feb 1;123(3):372-81.
7. Long B, Yao LF, Chen SC, Shui J, Ye XM, Yi HQ, Lou C. Clinical significance of extra-thyroid 99mTc-pertechnetate uptake before initial radioiodine therapy for differentiated thyroid carcinoma. Journal of International Medical Research. 2021 May;49(5):03000605211012667.
8. Zuckier LS, Dohan O, Li Y, Chang CJ, Carrasco N, Dadachova E. Kinetics of perrhenate uptake and comparative biodistribution of perrhenate, pertechnetate, and iodide by NaI symporter–expressing tissues in vivo. Journal of Nuclear Medicine. 2004 Mar 1;45(3):500-
9. Wang CY, Xiao BR, Shen MJ, Shen Y, Cui KW. 99mTcO4− scintigraphic detection of follicular thyroid cancer and multiple metastatic lesions: a case report. Oncology Letters. 2013 Dec;6(6):1729-32.
10. Kumaresan K, Sastry RA. Localization of Tc-99m pertechnetate in lymph node metastasis from occult thyroid carcinoma. Clinical nuclear medicine. 1994 Dec 1;19(12):1112.