Radiology Case Reports 18 (2023) 4110–4114

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

# Unusual metastasis of papillary thyroid carcinoma to the spine: A case report☆

*Wenny Dwi Chandra, MD**, *Gustiara Munir, MD*

*Department of Radiology, Faculty of Medicine Padjadjaran University, Bandung, Indonesia*

ARTICLE INFO

*Article history:*
Received 5 July 2023
Revised 13 August 2023
Accepted 14 August 2023

*Keywords:*
Papillary thyroid carcinoma
Distant metastasis
Spinal metastasis

ABSTRACT

Papillary thyroid carcinoma (PTC) is the most common thyroid carcinoma and generally has an excellent prognosis. However, there are few cases of distant metastasis, especially to the spine, which are associated with significantly worse outcomes. Here, we present a 40-year-old male with back pain and weakness in both legs. The patient also complained of neck masses months prior to the neurological symptoms. On investigations, he was found to have multiple vertebral lesions with histopathology results of papillary thyroid carcinoma metastasis.



## Introduction

Papillary thyroid cancer (PTC) is an epithelial malignancy showing evidence of follicular cell differentiation and a set of distinctive nuclear features [1]. PTC is the most common histologic type of thyroid carcinoma, approximately 80%-90% of all thyroid cancers [2]. PTC is classified as differentiated thyroid cancer (DTC) that arises from thyroid follicular cells; DTC is usually well-differentiated but can also undergo dedifferentiation or transformation to undifferentiated cancers [3,4]. PTC often metastasizes to regional lymph nodes (30%-80%) [5] and only small cases present with distant metastasis (1%-4%) [2], commonly to the lungs [2,3,6]. Spine metastasis from PTC is rare and can only be found in a few literature. This report presents a rare case of PTC that metastasizes to the spine and discusses the role of imaging modalities in the diagnosis.

## Case presentation

A 40-year-old male came to the Emergency room (ER) of Dr. Hasan Sadikin Hospital Bandung Indonesia with chief complaints of weakness and numbness in both legs for 2 weeks prior to admission. There were also symptoms of back pain as well as difficulty to urinate and defecate. The patient then revealed that he had an enlarged neck for months prior to the neurological symptoms but never had them checked. Physical examination in the ER revealed that the patient was moderately ill with full consciousness, with blood pressure of 130/90 mm Hg, pulse rate of 99 x/m, breathing rate of 2 x/m, body temperature of 36.8°C, and oxygen saturation of 98% with room air. Further evaluations showed that the patient also had numbness at level C6 to below, low motoric function in lower limbs, and urine retention.

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

* Corresponding author.
E-mail address: wenny.dwichandra@gmail.com (W.D. Chandra).

https://doi.org/10.1016/j.radcr.2023.08.078

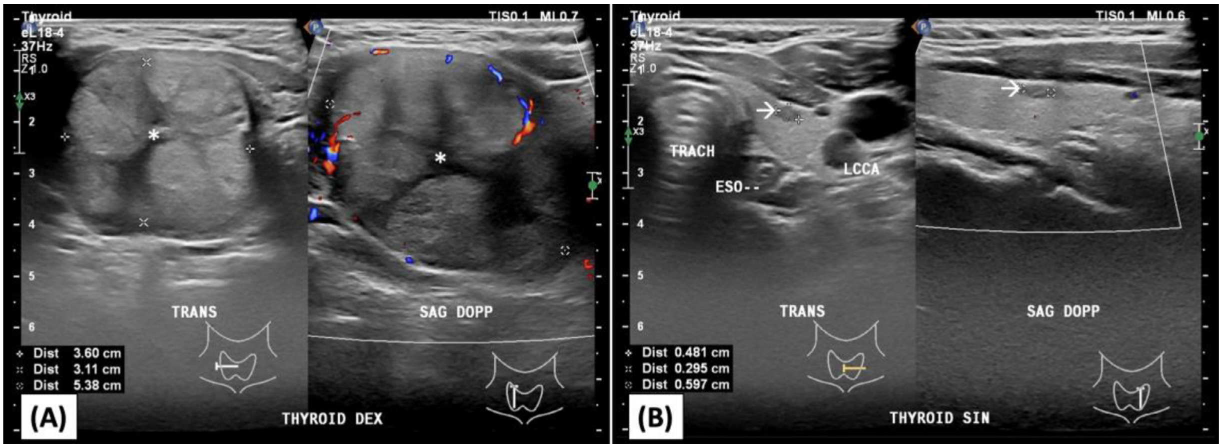


**Fig. 1 – Thyroid ultrasound showed a mass classified as TIRADS-4 in the right thyroid lobe (asterisk) and a small lesion classified as TIRADS-2 in the left thyroid lobe (arrow).**

A thyroid ultrasound showed a 3.60 × 3.11 × 5.38 cm mass classified as TIRADS-4 in the right thyroid lobe and a 0.48 × 0.30 × 0.60 cm lesion classified as TIRADS-2 in the left thyroid lobe (Fig. 1) with no lymph node enlargement. Histopathological examination of the lesion at the right thyroid lobe was suspicious for PTC. Further test using cervicothoracic X-ray showed soft tissue mass pushing the trachea to the left with blurring of T1 pedicle and T7 vertebral body deformity (Fig. 2). Chest X-ray showed no lung metastasis (Fig. 3). Due to the X-ray result, the patient then underwent spine magnetic resonance imaging (MRI) which showed masses at T1 vertebra, and T7 vertebral body, as well as signal intensity changes at the L2 vertebral body (Fig. 4). Further biopsy examination of vertebral mass at levels T1 and T7 revealed metastasis from PTC.

## Discussion

The thyroid gland produces thyroid hormones which regulate metabolism by increasing basal metabolic rate, enhancing the actions of catecholamines, and regulating the development and growth of nervous tissue and bones [7,8]. Thyroid follicles are microscopically spherical sacs that make up most of the thyroid gland [7]. The wall of each follicle consists primarily of cells called follicular cells, and there are a few cells called parafollicular cells or C cells which lie between the thyroid follicles [7].

Based on its histology, thyroid cancer is divided into cancer that arises from thyroid follicular or parafollicular C cells [3,4]. Cancers that arise from thyroid follicular cells are called DTC and comprise PTC, follicular thyroid cancer (FTC), and Hurthle cell thyroid cancer (HCTC), while cancer that arises from parafollicular C cells is called medullary thyroid cancer (MTC) [3,4]. PTC is an epithelial malignancy showing evidence of follicular cell differentiation and a set of distinctive nuclear features [1]. The molecular pathogenesis is still debated, but studies have been conducted to try to determine the clonal origin of multifocal PTC [9].

In PTC, lymph node metastasis is common and is associated with a higher risk of recurrence and poorer prognosis [5,10]. However, PTC with distant metastasis only occurs in 1%-4% of all patients, and studies have shown that patients with distant metastasis have reduced survival rates by 24%-76% [2]. The most common sites for distant metastasis are the lungs then the bones [2,3,6]. Bone metastasis in thyroid cancer is independently associated with poor prognosis, with a median overall survival from detection of only 4 years [11]. Bone metastasis in PTC is the lowest among other DTC cancers with 1%-7% prevalence, while its prevalence in FTC is 7%-28% and in HCTC is 12% [6,12–14]. This lower percentage is thought to be related to the tendency of PTC to spread through the lymphatic system, while other thyroid cancers tend to spread via a hematogenous route [12]. Bone metastasis occurs in areas that are rich in blood vessels, such as bone marrow in vertebrae, ribs, and pelvis [6,13]. It is provided by Batson's vertebral venous plexus, which plays a role in the drainage of the head and neck region through an indirect connection with the inferior thyroid veins [6].

Bone metastasis in spinal regions typically affects the thoracic (60%-80%), lumbar (15%-30%), and cervical bones (<10%) [13]. The vertebral body (85%) is the most common site for initial involvement, even though the posterior aspect may also be involved (66%) [13]. The metastasis lesions are mostly osteolytic with bone destruction leading to new bone formation that replaces the bone marrow and compresses the spinal cord with an extension into surrounding soft tissues [6,13].

Radicular pain is the most common presenting symptom of spinal metastases, but is often clinically silent [13,15]. The pain may be due to pathological fracture which may cause spinal cord or nerve root compression, as well as from the tumoral release of cytokines within the bone [15,16]. Limb weakness is also the second most common presenting symptom which is usually found during physical examination; this is thought to be caused by metastatic invasion of the spinal canal that spreads via the posterior aspect of the vertebral body [13].

Fine-needle aspiration biopsy (FNAB) is frequently the initial diagnostic method used in the detection of PTC [1]. FNAB is

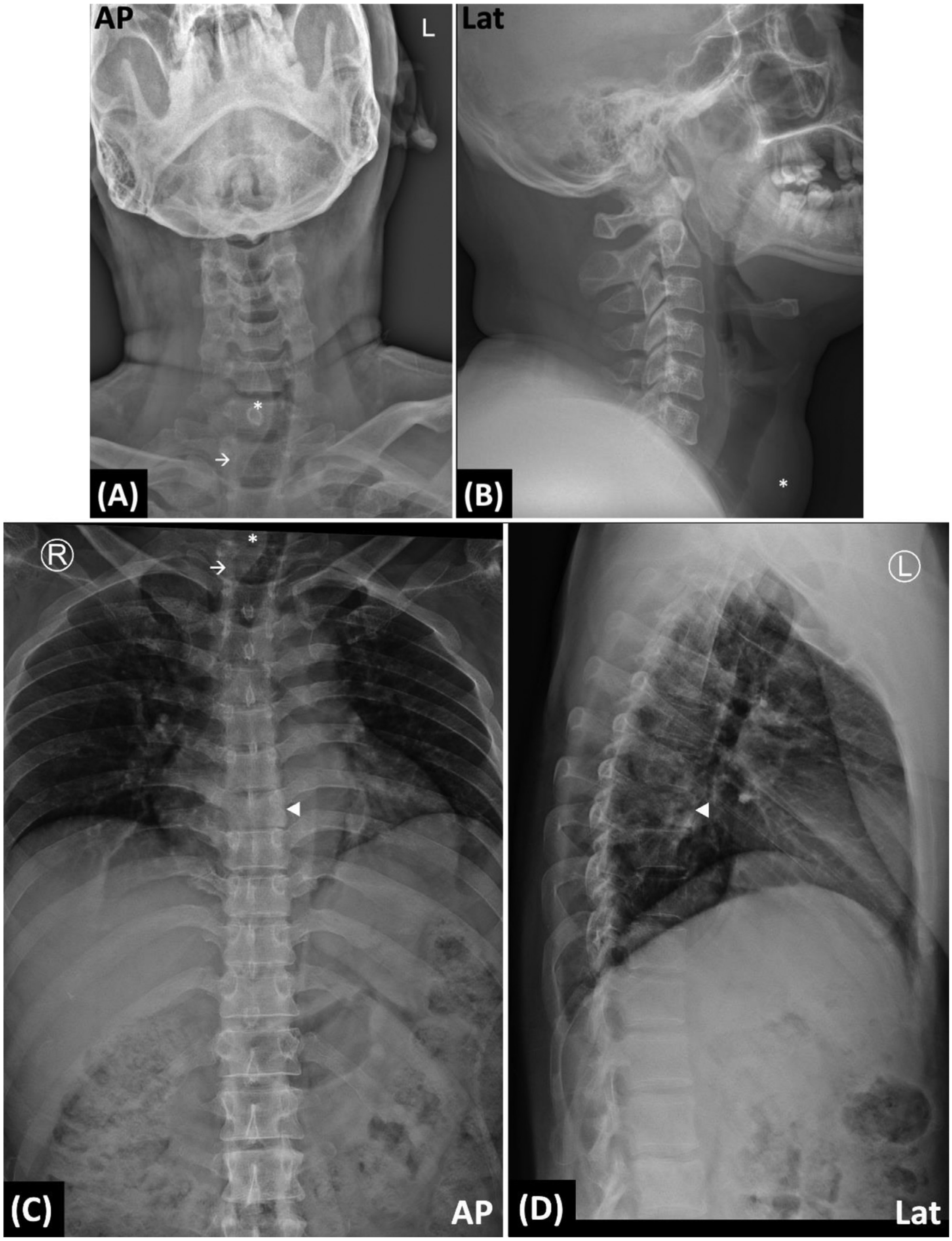


**Fig. 2 – Cervical and thoracal x-ray revealed (A) and (C) Anteroposterior projection cervical and thoracic X-ray showed a soft tissue mass at C6-T1 level (asterisk) that pushed the trachea to the left. There were also blurring of the T1 pedicle (arrow) and deformity of the T7 vertebral body (arrowhead). (B) Lateral projection cervical X-ray showed soft tissue mass anterior to the trachea (asterisk). (C) and (D) Anteroposterior and lateral projection thoracic X-ray showed deformity of the T7 vertebral body (arrowhead).**

an accurate method for differentiating benign from malignant thyroid nodules [17]. The cytologic criteria to make a definitive diagnosis of PTC include large monolayer sheets of follicular epithelial cells with enlarged nuclei containing fine powdery chromatin, intranuclear cytoplasmic inclusions and nuclear grooves, and papillary structures with or without tall columnar cells [1,17]. In patients where the primary carcinoma is defined, it is recommended that a biopsy is performed on the bone lesion suspected of metastasis [15]. A needle biopsy is recommended for patients with suspected metastases to the spine, even if the patient is known to have thyroid cancer because it is possible for another tumor type to be present [15].

Radiology imaging has an important role in diagnosing and evaluating metastasis in PTC. A plain X-ray is recommended to identify metastatic lesions, tumor mass, and evaluation of spinal stability, although not sensitive in early

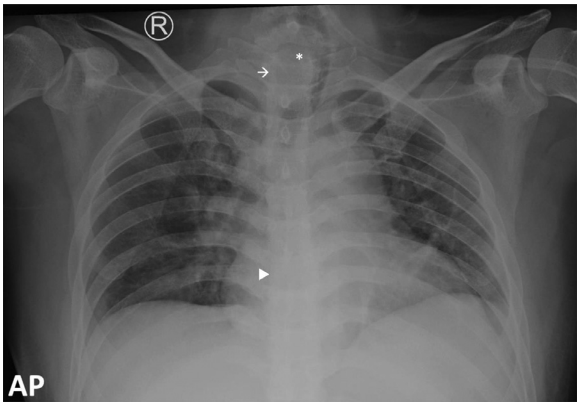


**Fig. 3 – Chest X-ray showed soft tissue mass at C6-T1 level (asterisk) that pushed the trachea to the left, blurring of the T1 pedicle (arrow) and deformity of the T7 vertebral body (arrowhead); with no lung metastasis.**

spinal metastatic diagnosis [13]. Metastatic lesions are seen as vertebral body involvement, erosion of the spinous process, and blurring of the pedicles [13]. X-ray is also indicated as a first-line imaging study in patients with bone pain to rule out any pathological fractures accompanying the metastatic lesions [6].

Computed tomography (CT) scan is an excellent modality in assessing the osseous and the extension of the lesion, with 74% sensitivity and 56% specificity in identifying metastatic lesions, vertebral destruction, and spinal stability [6,13]. It is considered a better modality than X-ray in detecting bone metastasis as it can recognize a bony metastatic lesion up to 6 months earlier than an X-ray [18]. On CT scan, the spinal lesions are mostly osteolytic [6,13].

To confirm the diagnosis, a MRI, which is the gold-standard imaging modality in spinal metastasis is needed [13]. MRI is better at differentiating soft tissue structures, is essential for the assessment of epidural, nerve, and spinal cord involvement, as well as is more sensitive at detecting even


**Fig. 4 – MRI (A) and (B) contrast-enhanced T1-weighted Dixon water-only. (C) and (D) Fat-saturated contrast-enhanced T1-weighted image. (A) and (C) Sagittal and axial images showed enhanced masses at the right thyroid lobe (asterisk) and T1 vertebral (arrow). (A) and (D) images showed an enhanced mass at the T7 vertebral body (arrowhead) that compressed the spinal cord. (B) Sagittal image showed signal intensity changes at the L2 vertebra (empty arrow).**

very small bone marrow metastasis [6,13]. On MRI, spine metastasis showed a hypointense or isointense lesion on T1 weighted-image (T1WI), hyperintense or showed halo sign on T2 weighted-image (T2WI), and enhancing marrow lesion on T1 fat saturated (T1FS) with contrast [18].

In this report, the patient had thyroid lesions which are detected with ultrasound examination, and the lesions were confirmed as PTC by histopathologic examinations. Due to the neurologic symptoms, the patient underwent more imaging examinations to detect distant metastasis to the spine. The patient's cervicothoracic X-ray and spine MRI results confirmed the presence of multiple metastasis vertebral masses which may be accompanied by soft tissue involvement and spinal compression. This report shows even though bone metastasis in PTC is rare, spinal metastasis should be considered in patients with neurological symptoms, especially back pain and limb weakness. This report also highlights the role of multiple imaging modalities in detecting and evaluating bone metastasis lesions.

## Conclusion

PTC with distant metastasis may occur in 1%-4% of all patients, rarely to the spines. Overall, understanding the characteristics and manifestations of PTC, including its propensity for spinal metastasis as well as the use of imaging modalities, are crucial for appropriate management and prognosis assessment.

## Patient consent

Complete written informed consent was obtained from the patient for the publication of this study and accompanying images.

## REFERENCES


[1] Limaiem F, Rehman A, Anastasopoulou C, Mazzoni T. Papillary thyroid carcinoma. StatPearls 2023.

[2] Toraih EA, Hussein MH, Zerfaoui M, Attia AS, Marzouk Ellythy A, Mostafa A, et al. Site-specific metastasis and survival in papillary thyroid cancer: the importance of brain and multi-organ disease. Cancers 2021;13(7):1625.

[3] Amin MB, Edge SB, Gfeene FL, Byrd DR, Brookland RK, Washington MK, et al. AJCC cancer staging manual. 8th ed. Chicago: American Joint Committee on Cancer, Springer; 2017.

[4] Fallahi P, Ferrari SM, Elia G, Ragusa F, Patrizio A, Paparo SR, et al. Primary cell cultures for the personalized therapy in aggressive thyroid cancer of follicular origin. Semin Cancer Biol 2022;79:203–16.

[5] Liu X, Ouyang D, Li H, Zhang R, Lv Y, Yang A, et al. Papillary thyroid cancer: dual-energy spectral CT quantitative parameters for preoperative diagnosis of metastasis to the cervical lymph nodes. Radiology 2015;275(1):167–76.

[6] Nervo A, Ragni A, Retta F, Gallo M, Piovesan A, Liberini V, et al. Bone metastases from differentiated thyroid carcinoma: current knowledge and open issues. J Endocrinol Invest 2021;44(3):403–19.

[7] Derrickson BH, Tortora GJ. Tortora's Principles of anatomy & physiology. Danvers MA: Wiley; 2017. p. 2017.

[8] Moore KL, Agur AMR, Dalley AF. Clinically oriented anatomy. Philadelphia: Wolters Kluwer; 2018. p. 1153. p.

[9] Muzza M. The clonal origin of multifocal papillary thyroid cancer: intrathyroidal spread or independent tumors? Minerva Endocrinol 2021;46(1):35–44.

[10] Liu C, Xiao C, Chen J, Li X, Feng Z, Gao Q, et al. Risk factor analysis for predicting cervical lymph node metastasis in papillary thyroid carcinoma: a study of 966 patients. BMC Cancer 2019;19(1):622.

[11] Iñiguez-Ariza NM, Bible KC, Clarke BL. Bone metastases in thyroid cancer. J Bone Oncol 2020;21:100282.

[12] Takayanagi A, Hariri O, Ghanchi H, Miulli DE, Siddiqi J, Vrionis F, et al. Unusual metastasis of papillary thyroid cancer to the thoracic spine: a case report, new surgical management proposal, and review of the literature. Cureus 2017;9(4):e1132.

[13] Ramadan S, Ugas MA, Berwick RJ, Notay M, Cho H, Jerjes W, et al. Spinal metastasis in thyroid cancer. Head Neck Oncol 2012;4:39.

[14] Jayarangaiah A, Kemp AK, Theetha Kariyanna P. Bone Metastasis. StatPearls. Treasure Island (FL): StatPearls Publishing; 2023.

[15] Wexler JA. Approach to the thyroid cancer patient with bone metastases. J Clin Endocrinol Metab 2011;96(8):2296–307.

[16] Mossa-Basha M, Gerszten PC, Myrehaug S, Mayr NA, Yuh WT, Jabehdar Maralani P, et al. Spinal metastasis: diagnosis, management and follow-up. Br J Radiol 2019;92(1103):20190211.

[17] Mittendorf EA. When fine-needle aspiration biopsy cannot exclude papillary thyroid cancer: a therapeutic dilemma. Arch Surg 2006;141(10):961.

[18] Shah LM, Salzman KL. Imaging of spinal metastatic disease. Int J Surg Oncol 2011;2011:1–12.