

# Incidental thyroid $^{99m}\text{Tc}$ -MDP uptake in a patient affected by differentiated thyroid cancer

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## Abstract

We report a case of incidental uptake of  $^{99m}\text{Tc}$ -methylene diphosphonate in the thyroid in a 62-year-old female with a history of breast cancer treated with quadrantectomy, chemotherapy and radiotherapy, who underwent total-body-bone scintigraphy during follow up. Planar scintigraphy was followed by neck SPECT-CT that demonstrated an area of increased tracer uptake in the neck at the left lobe of the thyroid. Neck ultrasonography showed a nodule corresponding to SPECT-CT finding and the ultrasound-guided fine needle aspiration documented the presence of papillary carcinoma. The patient underwent total thyroidectomy and ipsilateral lymphadenectomy; histological examination confirmed the presence of a papillary carcinoma and the patient underwent ablation therapy with iodine-131.

**KEY words:** incidental,  $^{99m}\text{Tc}$ -MDP, bone scintigraphy, differentiated thyroid carcinoma

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## Background

$^{99m}\text{Tc}$ -MDP bone scintigraphy is a nuclear scanning test to find certain abnormalities in bone. It is mainly used to help diagnose a number of conditions related to bones, including primary bony malignancies, metastatic diseases that have spread to the bone, occult fractures and other conditions. In addition, this examination is often used for the follow up or response to treatment of some solid cancers like prostate and breast cancers [1]. Besides, the bone scan delineates a wide spectrum of non-osseous disorders: neoplastic, hormonal, inflammatory, ischemic, traumatic, excretory and artifactual entities may demonstrate abnormal soft tissue uptake of  $^{99m}\text{Tc}$ -MDP [2].

## Case report

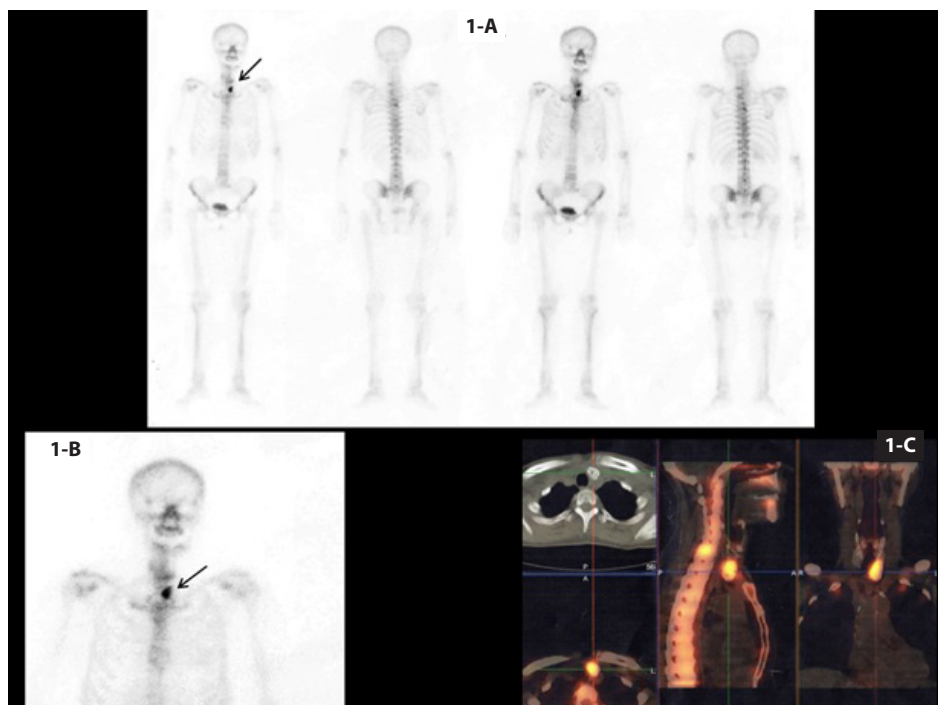
A 62-years-old female with a history of breast cancer (invasive ductal carcinoma) previously treated with quadrantectomy with axillary dissection, chemotherapy and radiotherapy underwent  $^{99m}\text{Tc}$ -methylene diphosphonate (MDP) bone scintigraphy during the follow-up in order to verify the presence of skeletal metastases.

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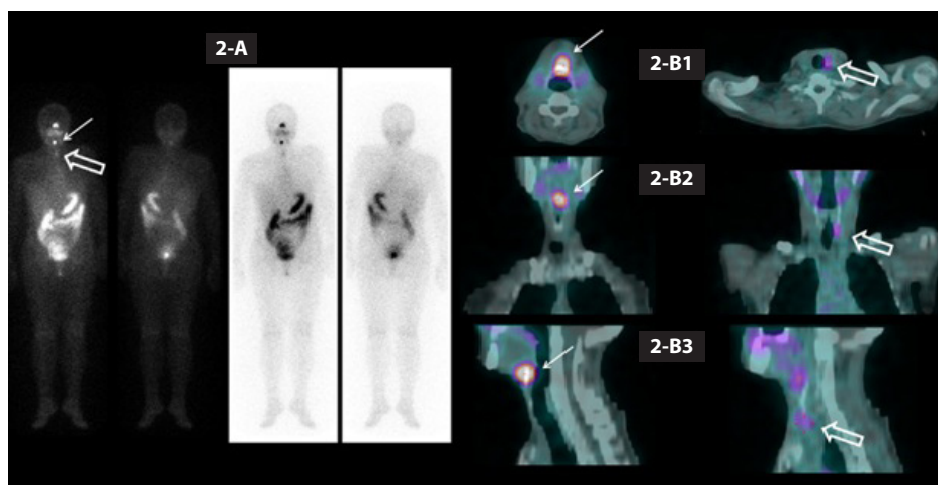
The study was negative for bone metastases but revealed an area of focal tracer uptake at the base of the neck more visible in the anterior view (Figure 1-A, 1-B), corresponding to the left lobe of the thyroid gland at the subsequent single-photon emission computed tomography-computed tomography (SPECT-CT) acquisition of the neck and thorax (Figure 1-C). CT images revealed a 2 cm solid roundish nodule. The neck ultrasonography showed a solid nodule in the left lobe of the thyroid, almost entirely calcified mainly in the capsule with a diameter of 2 cm. Ultrasound-guided fine needle aspiration (FNA) was positive for papillary carcinoma (TIR6 Bethesda system). The patient underwent total thyroidectomy associated with ipsilateral lymphadenectomy. Histological examination of the primary tumor revealed a conventional papillary carcinoma with thyroid capsule invasion and extrathyroidal extension with two left lateral cervical metastatic nodes (pT3N1a AJCC 2010 classification). Therefore, after the withdrawal of thyroid hormone therapy, she underwent iodine-131 ( $I^{131}$ ) therapy (3.7 GBq) for remnant ablation. After 72 hours the  $I^{131}$  total body planar scintigraphy (Figure 2-A) and the subsequent SPECT/CT of neck and thorax (Figure 2-B1–B3) showed high focal uptake of tracer in the upper central area of the neck due to thyroglossal duct remnant and slight uptake in left thyroid bed corresponding to residual thyroid tissue.

## Discussion

In literature many cases of incidental uptakes of  $^{99m}\text{Tc}$ -MDP at extrasosseous sites have been reported: neoplastic, hormonal,



**Figure 1A-C.** In this figure  $^{99m}\text{Tc}$ -methylene diphosphonate (MDP) bone scintigraphy is showed; **1-A.** Anterior and posterior views of the study showing the lesion (black arrow); **1-B.** An enlargement of the previous study to show more clearly the lesion in the neck; **1-C.** An acquisition of the neck and thorax of single-photon emission computed tomography-computed tomography (SPECT-CT)



**Figure 2-A.** Anterior and posterior view of  $^{131}\text{I}$  total body scintigraphy performed in the patient after radiometabolic therapy that showed focal uptake of tracer in the upper central area of the neck due to thyroglossal duct remnant (slim arrow) and slight uptake in left thyroid bed corresponding to residual parenchymal (empty arrow); **2-B1-B3.** Axial, coronal and sagittal  $^{131}\text{I}$  SPECT-TC fused images

inflammatory, ischemic, traumatic, excretory and artifactual entities may demonstrate abnormal soft tissue uptake of  $^{99m}\text{Tc}$ -MDP [2].

Radionuclide imaging with  $^{99m}\text{Tc}$ -MDP generally depends on the uptake of the tracer by normal osteoblasts reacting to bone damage produced by malignant lesions. However in certain disorders, especially those characterized by soft tissue calcification, the radiopharmaceutical may accumulate within pathologic tissue itself.  $^{99m}\text{Tc}$ -MDP thyroid incidental uptake is not very frequent

and it is possibly caused by the presence of calcification [3, 4], biopsy procedure [5], anaplastic carcinoma [6] or metastatic calcifications in patients affected by primary hyperparathyroidism [7]. It can also happen to have focal tracer uptake in the thyroid autonomous nodules that is probably caused by dissociation of  $^{99m}\text{Tc}$  from MDP. Calcified nodules may show high uptake of this radiopharmaceutical. Calcification within the thyroid may happen in both benign and malignant diseases [8]. It is well known

that microcalcifications are associated with thyroid malignancy [9]; instead the association between macrocalcifications and thyroid cancer remains still under discussion but it is mainly related to benign disease [10, 11].

The peculiarity of this report is that the finding of a nodule entirely calcified is associated with malignancy, although in clinical practice it is usually associated with benign disease. In conclusion, this report underlines the importance of further investigation of incidental findings in the thyroid at  $^{99m}\text{Tc}$ -MDP bone scan, potentially of clinical relevance and pivotal for an adequate patient management.

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