

Intrathoracic toxic thyroid nodule causing hyperthyroidism with a multinodular normal functional cervical thyroid gland

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ABSTRACT Radionuclide scintigraphy with I-131 and Tc-99m pertechnetate (^{99m}TcO₄) has been widely used in detecting toxic nodules. Intrathoracic goiter usually presents as an anterior mediastinal mass. Mostly the connection between intrathoracic mass and the cervical thyroid gland is clearly and easily identified occurring as a result of inferior extension of thyroid tissue in the neck, which is called as secondary intrathoracic goiter. Completely separated, aberrant or in other words primary intrathoracic goiters arise as a result of abnormal embryologic migration of ectopic thyroid closely associated with aortic sac and descend into the mediastinum. Intrathoracic goiters are generally nontoxic nodules existing with mass effect without causing hyperthyroidism. However, mostly reported cases had enlarged thyroid glands in the neck. This report demonstrates the usefulness of I-131 and ^{99m}TcO₄ scintigraphy for detecting intrathoracic goiter causing hyperthyroidism with a normal functioned cervical thyroid gland.

Keywords: Hyperthyroidism, I-131, intrathoracic goiter, Tc-99m pertechnetate, toxic nodule

INTRODUCTION

It is essential to localize the toxic region accurately in hyperthyroid patients before making a decision to remove with operation. Here we report a case of an intrathoracic toxic thyroid nodule causing hyperthyroidism with a multinodular normal functional cervical thyroid gland.

CASE REPORT

A 62-year-old female presented with a 2 years history of weakness, weight loss, tremulousness palpitations, and heat intolerance. Physical examination revealed a normal weight female in no distress; blood pressure was 120/80 mmHg supine, pulse 96, and regular. She had fine finger tremors. There was no palpable goiter. Laboratory examination results from complete

blood cell count, urinalysis, electrocardiography, and biochemical tests were within the normal limits. Thyroid function tests revealed hyperthyroidism; free T₃: 4.5 ng/mL L (normal: 1.8–5 ng/mL), free T₄: 1.83 ng/mL (normal: 0.8–1.9 ng/mL), and thyroid-stimulating hormone: 0.016 μU/ml (normal: 0.4–4 μU/ml). Radionuclide Tc-99m pertechnetate (^{99m}TcO₄) thyroid scan images obtained [Figure 1a and c] from neck and mediastinum 20 min after intervenes. Administration of 3 mCi Tc-99m pertechnetate using a parallel hole low energy all-purpose collimator. The scan showed a normoactive cervical thyroid gland and a hyperactive intrathoracic area on the left side of thyroid. Thyroid radioactive iodine uptake (RAIU) measured over the neck and the uptake after oral administration of 7 μCi I-131 was 15% at 2 h and 34% at 24 h. A thyroid scan was also obtained with gamma camera at 24 h [Figure 1b] using a parallel hole high-energy collimator. Planar images of neck and mediastinum and cervicothoracic single photon emission

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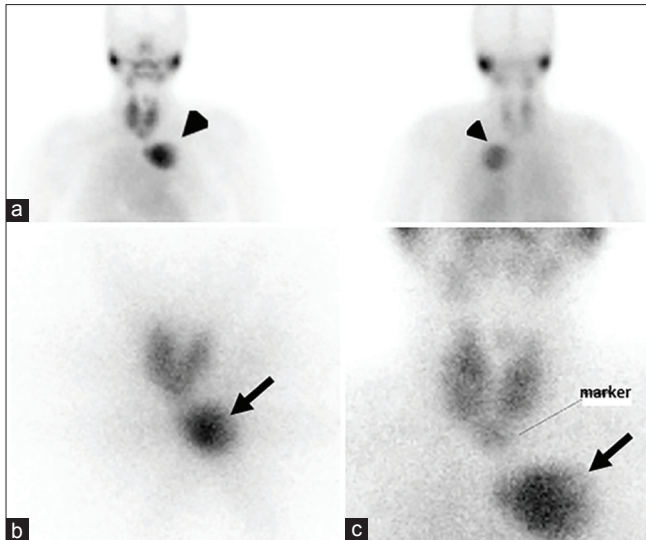


Figure 1: Tc-99m pertechnetate images of anterior and posterior thorax and mediastinum (a) showed a normoactive cervical thyroid gland and an activity accumulation in the intrathoracic area on the left side of thyroid (a, arrowheads). Anterior I-131 thyroid scan (b) revealed a normal functioning cervical thyroid gland and a hyperfunctioning intrathoracic thyroid tissue on the left side (b, arrow) and support the accumulation in the upper thoracic area. Anterior Tc-99m pertechnetate images (c, arrow) showed that it was a thyroid tissue, and a marker was located in inferior isthmus region

computed tomography images were taken. Images showed a normal functioning cervical thyroid gland and a hyperfunctioning intrathoracic thyroid tissue on the left side of thyroid. Chest roentgenogram [Figure 2] revealed widened upper mediastinum with no tracheal displacement and fibrotic changes in the basal regions that suggested bronchiectasis. Ultrasonographic assessment of thyroid bed showed a normal sized multinodular cervical goiter (right lobe: 43 mm × 17 mm × 22 mm, left lobe: 46 mm × 31 mm × 22 mm and isthmus: 5 mm) and did not define a substernal enlargement. Thoracic computed tomographic scans [Figure 3] showed a 6 cm × 6 cm × 4.5 cm diameter, smooth edge mass in the left superior portion of the anterior mediastinum with patchy calcification and heterogeneous contrasting which is related with the left thyroid lobe in a small area. There was no significant tracheal and esophageal compression or displacement.

Due to a hyperfunctioning intrathoracic goiter with a normal multinodular functional cervical thyroid gland, the patient was diagnosed as hyperthyroidism. The patient was treated with graded doses of propylthiouracil, but partial response was provided. Total thyroidectomy and excision of intrathoracic goiter was performed. Histopathological evaluation for both intrathoracic mass and cervical gland showed nodular colloid goiter. After the surgery, the patient received thyroid hormone replacement therapy with thyroxine.

DISCUSSION

Radionuclide scintigraphy is valuable in confirming suspected or clinically evident thyroid tissue that is extending into

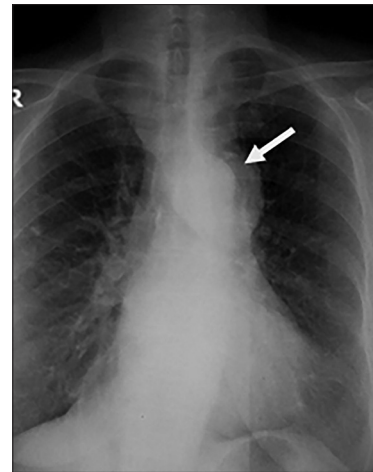


Figure 2: Chest X-ray revealed widened upper mediastinum (arrow) with no tracheal displacement and fibrotic changes on the basal regions that suggested bronchiectasis

mediastinum.^[1] Radioisotopes such as I-131 and ^{99m}TcO₄ are used to image thyroid with an uptake measurement.^[2] Although ^{99m}TcO₄ has been used for routine thyroid scintigraphy, I-131 is preferred for imaging of substernal goiter because ^{99m}TcO₄ activity in goiter remains lower comparing with high level of background activity in the heart and great vessels. Moreover, for imaging structures behind sternum, higher energy photons of I-131 are needed.^[3] In this case, our patient has high RAIU values indicating clinical hyperthyroidism; however, her cervical thyroid was in normal size without enlargement and abnormal uptake. Those suggest an external thyroidal focus such as an intrathoracic goiter. The possibility of the existence of external thyroidal tissue should be kept in mind in such suspicious cases. The case we present, a hyperthyroid patient with high radioiodine uptake without cervical thyroid enlargement suggest that the radiation is coming from intrathoracic goiter which was detected recently. Intrathoracic goiter (retrosternal or substernal) is one of the major diagnostic consideration in evaluation of upper anterior mediastinal masses. Because of iodine trapping of thyroid tissue, radioiodine scintigraphy remains an excellent confirmatory test.^[4] However, few cases of I-131 accumulations in thoracic region confirmed to be bronchogenic cyst^[5] or carcinoma^[6] have been reported were confirmed as. Many studies and cases have been reported about intrathoracic goiter. Park *et al.*^[4] analyzed 54 patients and demonstrate that most intrathoracic goiters can be diagnosed by thyroid scintigraphy with a sensitivity of 93%. They conclude that most intrathoracic goiters have thyroid function, and radioiodine scintigraphy is a definitive and cost-effective test for diagnosis. In addition, they recommend that radioiodine scintigraphy should be the first study for further evaluation of upper anterior mediastinal masses. Cengiz *et al.*^[7] reported a hyperthyroid patient with intrathoracic goiter that was cured after excision of the mass. They stated that radioactive iodine treatment may be used unless the patient has compression symptoms. Gordon *et al.*^[2] also mentioned the importance of radionuclide scintigraphy with either ^{99m}TcO₄ or I-123 in their study including children with thyroid dysgenesis.

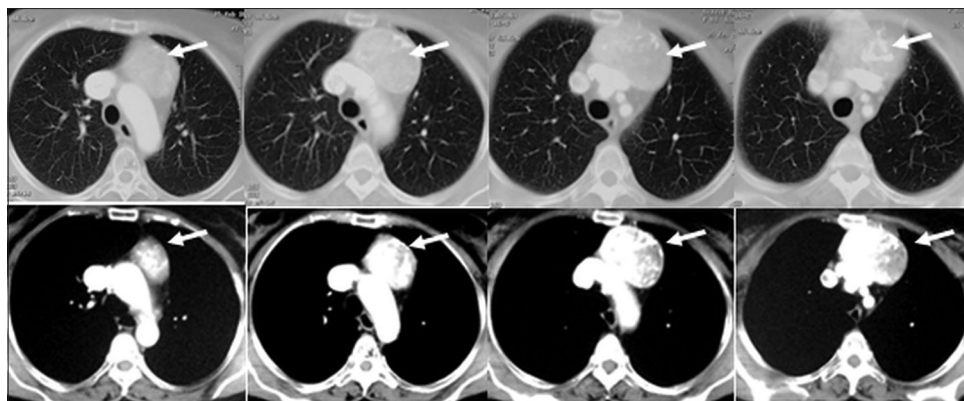


Figure 3: In thoracic computed tomography scans; axial images of lung window showed a smooth edge mass in the left superior anterior mediastinum (upper arrows), and patchy calcification and heterogeneous contrasting were seen in axial images of the bone window (lower arrows). There was no significant tracheal and esophageal compression or displacement

They use those scintigraphic modalities as a diagnostic tool averting invasive procedure such as biopsy and providing both functional and anatomic information to show where the thyroid tissue is and how effective it works. Aydin *et al.*^[8] reported a case underlining the value of $^{99m}\text{TcO}_4$ scintigraphy with and without potassium perchlorate administration. Disappearance of tracer accumulation after applying potassium perchlorate suggests that mediastinal mass was an intrathoracic goiter. Pathological improvement supports this technique as a simple, accurate, and cost-effective imaging.

In our case, high thyroid hormone levels and isotopic uptake in the intrathoracic goiter with normal uptake of the cervical thyroid were diagnostic for toxic intrathoracic goiter. Higher accumulation in thoracic mass than cervical thyroid in both $^{99m}\text{TcO}_4$ and I-131 scintigraphy reminds us the development of hyperthyroidism in the intrathoracic goiter which had not yet produced feedback suppression of the cervical thyroid. However, the possibility of autonomously functioning cervical thyroid cannot be ruled out. Our patient was cured after excision of mediastinal mass despite the absence of compression symptoms or mass effect. Intrathoracic goiters are generally considered an indication for surgery; radioiodine therapy remains a choice for those who cannot be operable because of advanced systemic disease or other reasons. Our patient did not have significant tracheal deviation or compression symptoms but her hyperthyroidism cannot be controlled by antithyroid drugs and symptomatic improvement was incomplete. This case highlights the importance of mediastinal imaging using I-131 and $^{99m}\text{TcO}_4$

scintigraphy in thyroid detection. Patients should not only be imaged with a pinhole collimator but also their mediastinal region should be viewed with parallel hole collimators.

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Conflicts of interest

There are no conflicts of interest.

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