

## Discordant uptake of Tl-201 and Tc-99m MIBI in a patient with follicular adenoma

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Two phase Tl-201 and Tc-99m MIBI thyroid scintigraphies were carried out in a 30-year-old woman who had a solitary cold thyroid nodule seen on a pertechnetate scan. Although an early Tl-201 thyroid image showed intense uptake in the nodule, Tc-99m MIBI demonstrated a hypoactive lesion on the early image. Delayed thyroid scans showed faster washout from the nodule compared to normal thyroid tissue for both Tl-201 and Tc-99m MIBI. Later on, the patient was operated on and the nodule was found to be a follicular adenoma by histopathological diagnosis.

**Key words:** Tl-201, Tc-99m MIBI, thyroid nodule

### INTRODUCTION

Tc-99m MIBI (MIBI) is a well established myocardial perfusion imaging agent as an alternative to Tl-201.<sup>1</sup> Both Tl-201 and MIBI have been reported to localize in various benign and malignant lesions.<sup>2–5</sup> They have been used to differentiate benign from malignant thyroid nodules and to visualize suppressed thyroid tissue in patients with autonomously functioning thyroid nodules.<sup>6–9</sup> We present a case of thyroid follicular adenoma that unexpectedly showed discordant uptake of Tl-201 and MIBI.

### CASE REPORT

A 30-year-old woman noticed an anterior neck swelling and was admitted to our hospital. There was no previous history of thyroid disease. Physical examination revealed a firm, mobile nodule in the right lobe. Thyroid function confirmed by serum hormone measurements was normal. Ultrasound examination performed by a 7.5 Hz transducer probe showed a solitary, solid lesion (1.5 × 1.1 × 0.9 cm in diameter) in the lower part of the right lobe. Tc-99m pertechnetate scan acquired with a pin-hole collimator

revealed a hypoactive nodule in the right lobe consistent with the ultrasound finding (Fig. 1). Fine needle aspiration biopsy (FNAB) was performed with a 22 gauge needle and as a result follicular carcinoma was suspected. Two weeks later, the patient decided to be operated on. Before the operation, Tl-201 and MIBI scans were performed at 3-day interval by means of a large field of view Siemens (Erlangen, Germany) gamma camera fitted with a high resolution collimator on a 128 × 128 matrix. MIBI scintigraphy was performed 15 min (early) and 90 min (delayed) after IV injection of 370 MBq (10 mCi) of the tracer into the left arm. Labeling efficiency was assessed by thin layer chromatography and found to be greater than 95%.

An early Tl-201 scan (Fig. 2A) was acquired 15 min after IV injection of 74 MBq (2 mCi) of the agent into the left arm and showed intense uptake in the nodule with an early ratio (ER: nodule to normal thyroid tissue uptake on the early image) of 2.90. Delayed imaging performed 3 hours after Tl-201 administration demonstrated faster washout from the nodule than from normal thyroid tissue with a delayed ratio (DR: nodule to normal thyroid tissue uptake on delayed image) of 0.50 (Fig. 2B). The retention index [RI: (DR – ER) × 100/ER] was found to be –82.<sup>5,6</sup>

The early MIBI image (Fig. 3A) showed a hypoactive nodule (ER: 0.80) in the right lobe of the gland which was not consistent with the early Tl-201 image. DR of 0.71 and RI of –11 (Fig. 3B) demonstrated faster washout from the nodule than in normal thyroid tissue as seen on Tl-201 images (Fig. 2).

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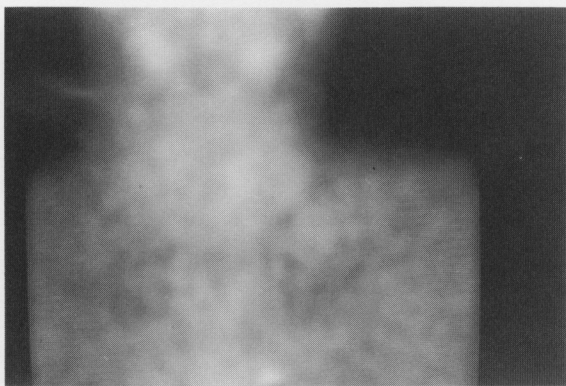
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**Fig. 1** A 30-year-old woman had a solitary cold nodule in the lower part of the right lobe demonstrated with Tc-99m pertechnetate scintigraphy.



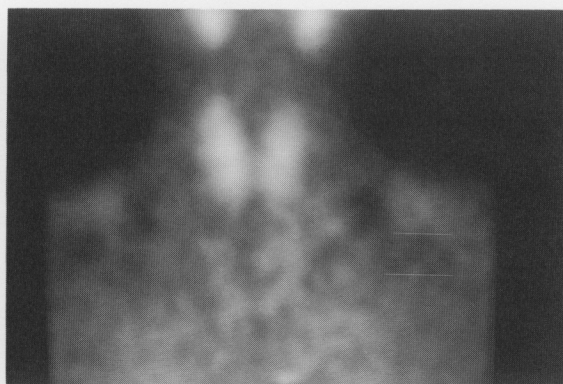
**A**



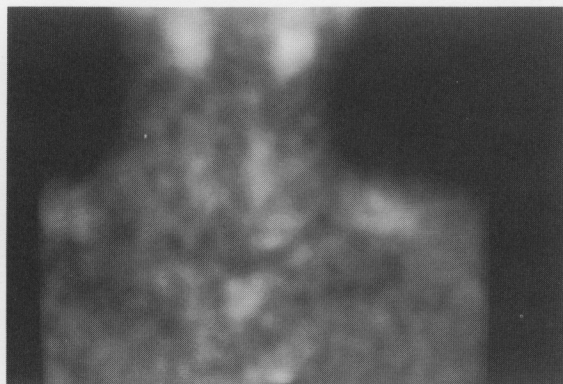
**B**

**Fig. 2** A) Early Tl-201 thyroid image showed intense uptake in the nodule with an ER of 2.90. B) Delayed scan showed faster washout from the nodule compared to normal thyroid tissue with a DR of 0.50 and a RI of -82.

Hemithyroidectomy with isthmectomy was performed. The histopathological examination of both the frozen section and resected surgical specimens revealed a benign nodule of follicular adenoma.



**A**



**B**

**Fig. 3** A) Early Tc-99m MIBI scintigram showed slightly hypoactive nodule (ER = 0.80) in the right lobe of the gland which was not consistent with early Tl-201 image. B) Tc-99m MIBI also showed faster washout from the nodule with respect to normal thyroid tissue with a DR of 0.71 and a RI of -11.

## DISCUSSION

Follicular carcinoma is an expansile neoplasm that nearly always is more or less encapsulated and has many similarities to follicular adenoma.<sup>10</sup> Adenoma is defined as a solitary, encapsulated lesion having a uniform internal architecture that is substantially different from the surrounding thyroid parenchyma and is compressing the adjacent gland.<sup>10</sup> Some follicular adenomas are hypercellular and may contain mitotic figures, so that they resemble well-encapsulated follicular carcinoma.<sup>10</sup> Although, fine needle aspiration biopsy (FNAB) is more reliable than other diagnostic approaches in the differential diagnosis of thyroid nodules,<sup>11</sup> it has limited value in the differentiation of follicular adenoma from carcinoma.<sup>12</sup> LiVolsi comments that FNAB cytology alone is not an adequate diagnostic technique for follicular tumors, for reasons intrinsic to the nature of these lesions.<sup>13</sup> Rather, FNAB cytology is a screening technique to help to select nodules that should be surgically excised. Gharib and Goellner suggested that all lesions with suspicious FNAB

findings require operation, because of the 30% incidence of malignancy observed in such cases in their patient series.<sup>14</sup> Both Tl-201 and MIBI have been used in the preoperative evaluation of thyroid nodules.<sup>6,7,15,16</sup> Both agents have high affinity for malignant thyroid nodules,<sup>6,7,15,16</sup> but it has generally been reported that Tl-201 and MIBI have a high sensitivity but low specificity due to their high affinity for benign thyroid nodules as well.<sup>7,15,16</sup> To increase the specificity, delayed scans were used by many investigators.<sup>6,7,15,16</sup> Early and delayed images have also been quantitatively analyzed by means of ER and DR.<sup>6,17</sup> Some investigators used RI to show the degree of retention in the lesion quantitatively with high sensitivity and specificity.<sup>5,6</sup>

In this case, early Tl-201 scan demonstrated intense uptake in the nodule with an ER of 2.90 which is in agreement with previous studies,<sup>6,7,15-17</sup> but early MIBI scan showed a slightly hypoactive nodule (ER: 0.80) in the right lobe of the gland which was not consistent with the early Tl-201 image. The size of the nodule in early Tl-201 scan seemed to be larger than the stated dimension of the nodule measured by ultrasound and than the trapping defect seen in the pertechnetate scan. It might be due to high count rates from too much activity of Tl-201 in the nodule resulting in image distortion.<sup>18,19</sup> Discordant uptake of Tl-201 and MIBI might be related to different mechanisms of uptake of the agents by tumor tissue<sup>20,21</sup> or, related to the overexpression or increased functioning of the P-glycoprotein (Pgp) molecule.<sup>22,23</sup> Kapucu et al. postulated that demonstration of lymphoma with Tl-201 but not with MIBI indicated resistance to chemotherapy with partial or no response as a result of overexpression or increased functioning of Pgp molecules.<sup>22</sup> Bhatnagar et al. showed that the expression of Pgp on parathyroid adenomas varies considerably and might play a role in individual cases in the dual phase parathyroid studies.<sup>23</sup> It was shown that immunostaining for Pgp was not specific in the diagnosis of thyroid carcinoma since positive reactivity was seen in 41% of benign thyroid conditions.<sup>24</sup>

Both agents showed faster washout from the nodule than from normal thyroid tissue with a DR of 0.50 for Tl-201 and 0.71 for MIBI. A RI of -82 for Tl-201 and -11 for MIBI also showed the benign nature of the nodule.

In the present case Tl-201 and MIBI showed discordant uptake in the thyroid nodule. Low uptake on the early MIBI image might be related to overexpression of the Pgp molecule or different uptake mechanisms of the agents. Both agents effectively determine the benign nature of the nodule. Both DR and RI of MIBI and Tl-201 might be used in the preoperative assessment of patients with cold thyroid nodules when FNAB is inconclusive or raises the suspicion of malignancy.

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