

## Scintigraphic findings of MALT lymphoma of the thyroid

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Mucosa-associated lymphoid tissue (MALT) lymphoma has been established as a distinct entity among non-Hodgkin's lymphomas, and the most common primary site is the stomach. We describe scintigraphic findings in a patient with MALT lymphoma of the thyroid. A 71-year-old woman with Hashimoto's thyroiditis suffered from rapid cervical swelling, and ultrasonography and CT revealed a thyroid nodule. The nodule showed accumulation of  $^{99m}\text{Tc}$  pertechnetate comparable to the surrounding thyroid tissue, mimicking a benign nodule. Both  $^{67}\text{Ga}$  and  $^{201}\text{Tl}$  imaging visualized the lesion as an increased uptake area. After radiotherapy, abnormally increased uptake disappeared on  $^{67}\text{Ga}$  images, which predicted a favorable outcome. MALT lymphoma of the thyroid may be visualized as a warm nodule on  $^{99m}\text{Tc}$  pertechnetate scintigraphy.

**Key words:** MALT lymphoma, thyroid,  $^{201}\text{Tl}$ ,  $^{67}\text{Ga}$ ,  $^{99m}\text{Tc}$

### INTRODUCTION

PRIMARY THYROID LYMPHOMAS are rare disorders among thyroid tumors and among lymphomas. They consist of heterogeneous types of diseases and present various clinical and pathological features.<sup>1</sup> Low-grade B-cell lymphoma of mucosa-associated lymphoid tissue (MALT) type, or MALT lymphoma, is one of the major histologies among primary thyroid lymphomas. It was first described in 1983,<sup>2</sup> and was established as a distinct entity among non-Hodgkin's lymphomas in the revised European-American lymphoma (REAL) classification published in 1994<sup>3</sup> and in the classification published by the World Health Organization (WHO) in 2001.<sup>4</sup> Whereas the most common site of its occurrence is the stomach, it originates in various organs including the thyroid, salivary gland, lung, and orbit.<sup>5</sup> The MALT lymphoma is neoplastic

proliferation of lymphoid tissue triggered by either chronic inflammatory disorders or an autoimmune disease such as *Helicobacter pylori* infection of the stomach and Sjögren's syndrome. As for MALT lymphoma of the thyroid, a close association with Hashimoto's thyroiditis has been recognized,<sup>6</sup> but there are few descriptions in the literature concerning scintigraphic findings in patients with MALT lymphoma of the thyroid.<sup>7</sup> In this report, we show scintigraphic findings in a patient who developed MALT lymphoma of the thyroid during follow-up for Hashimoto's thyroiditis.

### CASE REPORT

A 71-year-old woman presented with rapid swelling in the anterior portion of her neck for a month. She was diagnosed as having Hashimoto's thyroiditis nine years before the presentation, and was maintained in a euthyroid state with the administration of levo-thyroxine. On physical examination, a hard mass was palpable on the left anterior portion of the neck, but she complained of no tenderness in the mass. Ultrasonography showed a circumscribed, hypoechoic mass  $3.1 \times 4.4 \times 2.6$  cm in diameter in the lower portion of left thyroid lobe (Fig. 1).

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CT showed a mass in the left thyroid lobe, which was of relatively low density compared with the right lobe after the intravenous administration of iodinated contrast medium (Fig. 2). Normal thyroid tissue was not observed around the mass.

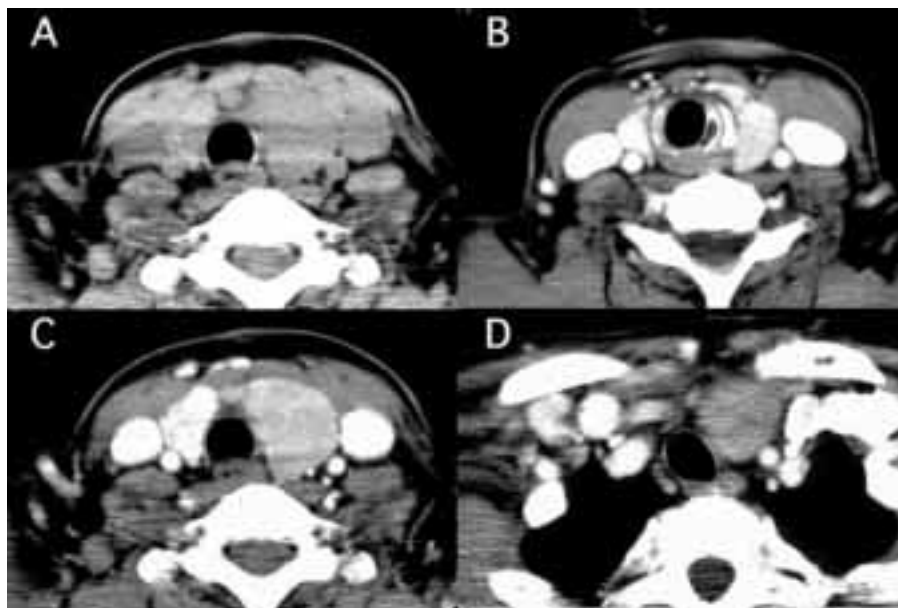
She underwent imaging with  $^{201}\text{Tl}$  and  $^{99\text{m}}\text{Tc}$  pertechnetate to characterize the thyroid nodule. Early and late scans were acquired 15 minutes and three hours after the injection of 74 MBq of  $^{201}\text{Tl}$  chloride, respectively. After completion of the late  $^{201}\text{Tl}$  imaging, 111 MBq of  $^{99\text{m}}\text{Tc}$  pertechnetate was injected and the image was taken 15 minutes later. Early  $^{201}\text{Tl}$  imaging demonstrated increased uptake in the nodule in the left thyroid lobe (Fig.



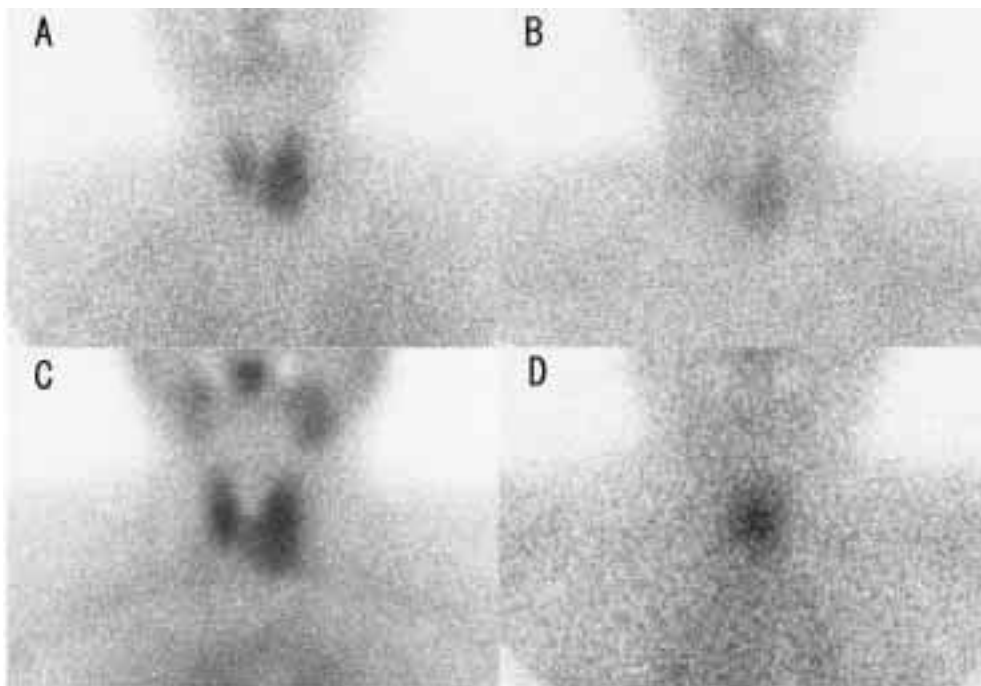
**Fig. 1** Ultrasonography of the thyroid. Transverse view shows that the left thyroid lobe is enlarged and contains a predominantly hypoechoic mass with some internal amorphous high echoes.

3A). There were no other sites of abnormally increased accumulation in the neck. On the late  $^{201}\text{Tl}$  image, mild retention of  $^{201}\text{Tl}$  was seen in the lesion (Fig. 3B). Technetium-99m pertechnetate imaging demonstrated enlargement of the lower portion of the left thyroid lobe with slightly reduced activity in the area of the nodule (Fig. 3C). Because no prominent defect was noted in the nodule, it was interpreted as benign.

Thyroid lymphoma was suspected based on pre-existing Hashimoto's thyroiditis and rapid growth of the mass despite the scintigraphic impression. Needle biopsy was carried out and histological examination showed diffuse infiltration of small to medium lymphocytes. The lymphocytes were negative for IgG light chains ( $\kappa$ ,  $\lambda$ ) and IgM, predominantly positive for CD20, and mixed with a small number of positive cells for CD45RO on immunohistochemical staining. The lesion was diagnosed as low-grade B-cell lymphoma of MALT-type. Gallium-67 scintigraphy was performed to evaluate the presence of occult involvement of lymphoma. Images obtained three days after the injection of 111 MBq of  $^{67}\text{Ga}$  citrate demonstrated increased accumulation in the anterior neck, corresponding to the known lesion (Fig. 3D). No other areas of abnormal accumulation were noted. Based on the diagnosis of localized MALT lymphoma of the thyroid, she received radiation therapy at a dose of 41.5 Gy for her neck. The neck mass disappeared on palpation after the radiotherapy. Gallium-67 scintigraphy was performed again and showed resolution of the abnormal deposit observed previously, confirming remission of the tumor. She has remained free of clinical disease for six years.



**Fig. 2** Plain (A) and contrast-enhanced CT of the neck through the levels of upper (B), middle (C), and lower (D) portions of the thyroid nodule. The left thyroid lobe is enlarged and is relatively hypodense compared with the right lobe after contrast enhancement. There is no overlying normal thyroid tissue.



**Fig. 3** Scintigraphy of the thyroid: anterior neck views obtained 15 minutes (A) and three hours (B) after the injection of  $^{201}\text{Tl}$ , 15 minutes after the injection of  $^{99\text{m}}\text{Tc}$  pertechnetate (C), and three days after the injection of  $^{67}\text{Ga}$  (D). The early  $^{201}\text{Tl}$  image shows increased uptake in the nodule in the left thyroid lobe (A), and the late  $^{201}\text{Tl}$  image demonstrates mild retention in the area (B). Enlargement of the lower portion of the left thyroid lobe is noted (C). Accumulation in the thyroid is almost homogeneous except for the lower medial portion of the left lobe, where slight reduction in the activities is discerned (C). A focus of increased accumulation is noted in the neck, corresponding to the nodule (D).

## DISCUSSION

There are some reports about scintigraphic findings of thyroid lymphomas,<sup>8-11</sup> but there is little literature specifically addressing scintigraphic findings of MALT lymphoma of the thyroid.<sup>7</sup> Because the most common histology among thyroid lymphomas is diffuse large cell lymphoma, which is classified as intermediate or high grade, previous descriptions of thyroid lymphomas may not truly represent findings in low-grade lymphoma of the MALT type. It would be helpful for nuclear medicine physicians to elucidate scintigraphic findings in patients who were specifically diagnosed as having MALT lymphoma of the thyroid. In the patient described here, pre-existing Hashimoto's thyroiditis and rapid enlargement of the anterior neck mass suggested the possibility of primary thyroid lymphoma, and MALT lymphoma was histologically proven.

Gallium-67 localization in lymphomas depends on the histological type and proliferative rate. Whereas high-grade lymphomas have high  $^{67}\text{Ga}$  avidity, low-grade lymphomas tend to have poor avidity.<sup>12-14</sup> Although technical advances may have increased the sensitivity of  $^{67}\text{Ga}$  scintigraphy to low-grade lymphomas, the sensitivity to MALT lymphomas is still low.<sup>15</sup> Thallium-201

scintigraphy may be more useful than  $^{67}\text{Ga}$  scintigraphy in low-grade lymphomas.<sup>12,13</sup> As for primary thyroid lymphomas, high accumulation of both  $^{67}\text{Ga}$ <sup>8-10</sup> and  $^{201}\text{Tl}$ <sup>11</sup> has been demonstrated. In the patient presented here, both  $^{67}\text{Ga}$  and  $^{201}\text{Tl}$  accumulated in the thyroid lesion of MALT lymphoma. Although MALT lymphomas are considered localized diseases, frequent dissemination of MALT lymphoma at diagnosis has also been demonstrated.<sup>16</sup> Whole-body assessment with  $^{67}\text{Ga}$  or  $^{201}\text{Tl}$  may be useful for the initial workup in MALT lymphoma. In our patient,  $^{67}\text{Ga}$  scintigraphy contributed to excluding the presence of distant lesions.

Thallium-201 accumulates in normal thyroid tissue, and  $^{67}\text{Ga}$  is often localized in nontumorous thyroid tissue in patients with Hashimoto's thyroiditis.<sup>9</sup> Such accumulation may disturb the evaluation of residual lesions after treatment. In the present patient, high  $^{67}\text{Ga}$  uptake was exclusively seen in the lymphoma lesion, and we selected  $^{67}\text{Ga}$  for evaluation of the therapeutic effect. After radiotherapy, abnormally increased  $^{67}\text{Ga}$  uptake had disappeared, suggesting good response. Relapse has not occurred for six years, and the  $^{67}\text{Ga}$  finding after therapy appears to be consistent with a favorable outcome.

Technetium-99m pertechnetate imaging visualizes malignant thyroid nodules as defects in general, and a

warm or hot nodule is usually benign. Decreased uptake has also been demonstrated in primary thyroid lymphoma,<sup>8,17</sup> but <sup>99m</sup>Tc pertechnetate accumulated in the MALT lymphoma lesion in our patient. The finding of a warm nodule may lead to diagnosing it erroneously as benign. Although uptake in overlying functioning thyroid tissue may mimic uptake in a small nodule, this situation was excluded with the CT findings in this patient, confirming accumulation in the lymphoma lesion itself. Localization of <sup>99m</sup>Tc pertechnetate has been described in thyroid carcinoma,<sup>18</sup> and our observations indicate that the tracer may also accumulate in MALT lymphoma of the thyroid.

In summary, we describe scintigraphic findings in a patient with MALT lymphoma of the thyroid. Both <sup>67</sup>Ga and <sup>201</sup>Tl preferentially accumulated in the lesion, and <sup>67</sup>Ga imaging aided the assessment of the response to radiotherapy. Technetium-99m pertechnetate imaging failed to delineate the lesion as a cold nodule. Thyroid lymphomas present various histopathological features, leading to various clinical features, and imaging findings in lymphomas may differ depending on histologies. Further addition to our knowledge of scintigraphic findings in MALT lymphomas is desirable for the sophistication of our clinical practice.

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