Scintigraphic demonstrations of a retrosternal goiter

Descripción gammagráfica de un bocio retrosternal

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Retrosternal goiter is a major diagnostic consideration in evaluation of an anterior mediastinal mass, accounting for approximately 1% of all mediastinal masses. Scintigraphy with thyroid specific radiopharmaceuticals plays an important role in diagnosis of patients with a retrosternal goiter. Here, we report on a case of retrosternal goiter that was demonstrated more clearly by \(^{123}\)I scintigraphy than other imaging modalities, such as conventional contrast-enhanced computed tomography, \(^{99m}\)Tc pertechnetate scintigraphy, and \(^{18}\)F FDG PET/CT.

A 56-year-old female visited our hospital for further evaluation of an anterior mediastinal mass discovered incidentally. She had a history of near-total thyroidectomy due to a non-toxic nodular goiter and has been receiving thyroid hormone replacement. Result of a thyroid function test showed a mild hyperthyroid profile with serum T3 of 2.56 ng/mL, free T4 of 1.40 ng/dL, and thyroid-stimulating hormone of 0.21 uIU/mL. Conventional contrast-enhanced computed tomography demonstrated a large highly enhancing mass (5.6 cm × 4.3 cm) with multiple small calcifications (Fig. 1A). The \(^{18}\)F FDG PET/CT image showed diffusely increased FDG uptake in the anterior mediastinal mass, and maximum standardized uptake value of the uptake was 3.0 (Fig. 1B). Scintigraphy with 5mCi \(^{99m}\)Tc pertechnetate showed only faint mediastinal activity, without definitely characterizing the mediastinal mass (Fig. 1C). Scintigraphy with 5mCi \(^{123}\)I performed 24h after tracer administration showed intense tracer uptake in the remnant thyroid tissue at anterior neck and the mediastinal mass (Fig. 1D). The patient was diagnosed as having a retrosternal goiter based on findings on chest CT and \(^{123}\)I scintigraphy and under regular surveillance.

Ectopic thyroid tissue is the result of a failure or abnormal embryologic migration of the thyroid anlage. \(^{18}\)F FDG PET/CT is widely used for evaluation of the malignant nature of mediastinal masses. However, increased FDG uptake can also be demonstrated in various benign lesions, including a retrosternal goiter, non-invasive thymoma, and teratoma. The innate ability to trap iodine and produce thyroglobulin is shared by normal and ectopic thyroid tissues; therefore, ectopic thyroid tissue can be visualized on scintigraphy using thyroid specific radiopharmaceuticals, such as \(^{123}\)I, \(^{131}\)I, or \(^{99m}\)Tc pertechnetate. Enhanced expression of sodium-iodide symporter, which actively mediates iodide transport into the thyroid follicular cells, is a key mechanism of tracer uptake in functioning thyroid tissue. The radiiodine represents both uptake and organization of iodine in thyroid tissues. \(^{99m}\)Tc pertechnetate can be trapped as an iodine analog in the tissue at the early phase; however, it is not organified for synthesis of thyroid hormone. For use in confirmation of ectopic thyroid tissues, radiiodines are biologically more preferred than \(^{99m}\)Tc pertechnetate as agent by their higher thyroidal accumulations and the higher gamma energies (159 keV of \(^{123}\)I, 364 keV of \(^{131}\)I, and 140 keV of \(^{99m}\)Tc, respectively). Although \(^{131}\)I is cheaper, with greater availability than \(^{123}\)I, it has disadvantages of poor imaging characteristics due to the too high gamma energy and high radiation burden to patients by concomitant beta ray and long half-life. Therefore, we would recommend \(^{123}\)I scintigraphy as the first nuclear medicine imaging study for evaluation of a retrosternal goiter.
Figure 1. Conventional contrast-enhanced computed tomography demonstrated a large highly enhancing mass (5.6 cm × 4.3 cm) with multiple small calcifications (A). The $^{18}$F FDG PET/CT image showed diffusely increased FDG uptake in the anterior mediastinal mass, and maximum standardized uptake value of the uptake was 3.0 (B). Scintigraphy with 5mCi $^{99m}$Tc pertechnetate showed only faint mediastinal activity, without definitely characterizing the mediastinal mass (C). But, scintigraphy with 5mCi $^{123}$I performed 24h after tracer administration showed intense tracer uptake in the remnant thyroid tissue and the mediastinal mass (D).

Conflict of interest

The authors declare no conflict of interest.

References

