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# <sup>177</sup>Lu-Labeled Macroaggregated Albumin Imaging and Treatment Effect in Patient with Cystic Thyroid Nodule

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A number of different peptides or antibodies have been labeled with <sup>177</sup>Lu and used for clinical imaging and treatment. To our knowledge, <sup>177</sup>Lu had never before been used to label macroaggregated albumin, and our radiopharmacy laboratory at Istanbul University–Cerrahpaşa made a special effort to do so. We present the case of a 43-y-old man whose cystic thyroid nodule was treated with an intranodular injection of <sup>177</sup>Lu-macroaggregated albumin and imaged with SPECT/CT.

**Key Words:** <sup>177</sup>Lu; MAA; cystic thyroid nodule

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**T**he radionuclide <sup>177</sup>Lu is a β- and γ-emitter that has a physical half-life of 6.73 d and allows delivery of high activities to cancer cells (1). <sup>177</sup>Lu-DOTATATE is a radiolabeled somatostatin analog approved for treatment of patients with somatostatin receptor–positive neuroendocrine tumors (2). <sup>177</sup>Lu-labeled prostate-specific membrane antigen therapy, which uses inhibitors of the prostate-specific membrane antigen, is a novel agent in patients with metastatic castration-resistant prostate cancers (3). Macroaggregated albumin is a human serum albumin that can be routinely labeled with <sup>99m</sup>Tc and <sup>68</sup>Ga (4,5). In our radiopharmacy laboratory, we successfully labeled macroaggregated albumin with <sup>177</sup>Lu. Our aim was to determine, in a patient with a cystic thyroid nodule, whether the labeled <sup>177</sup>Lu-macroaggregated albumin would remain within the nodule only and not cross to the other side of the body. In addition, our aim was to evaluate the effect of treating the nodule with β-irradiation from the <sup>177</sup>Lu. Our study protocol was approved by the Istanbul University–Cerrahpaşa ethical committee (study 83045809-604.01.02), and the patient gave written and oral informed consent to the procedure.

## CASE REPORT

The patient was a 43-y-old man with a cystic thyroid nodule who refused to undergo surgery or alcohol injection. When he presented to our department, thyroid ultrasound was performed and showed that the nodule was on the right lobe of the thyroid gland. We described our proposed treatment and imaging method to him, and he agreed to undergo it. A 40.7-MBq (1.1-mCi) activity of <sup>177</sup>Lu-macroaggregated albumin was injected into the nodule under ultrasound guidance. SPECT/CT scans were subsequently acquired after 1 h, 1 d, and 1 wk to see whether the activity had remained limited to the nodule or had gone beyond it (Fig. 1). The images showed only intranodular activity; there was no activity elsewhere. Thyroid ultrasonography was performed 1 d, 1 wk, 1 mo, and 3 mo after the treatment. At 3 mo, the ultrasound images showed a decrease in nodule size and volume (Fig. 2). For this procedure, the total radiation dose to which the patient was exposed was calculated to be approximately 20 Gy.

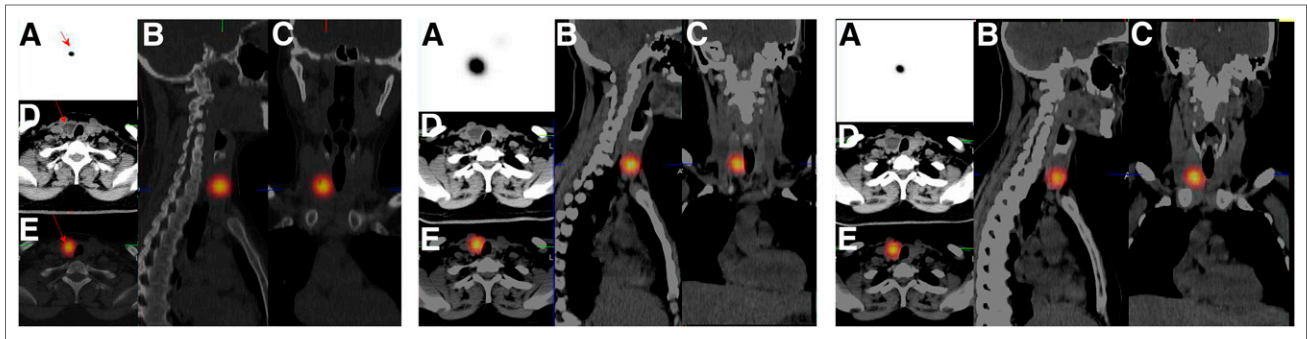
## DISCUSSION

Treatment of benign cystic thyroid nodules is generally undertaken for cosmetic reasons or to reduce symptoms of local compression. The use of percutaneous ethanol injection for such treatment was introduced into clinical practice in 1990 (6). Ethanol injection was initially proposed as an alternative to surgery or radioiodine administration but causes irreversible tissue damage, protein denaturation, and coagulative necrosis and can have complications, the most common one being pain and less common ones being hematoma, dyspnea, and vocal cord paralysis (7). Surgery, on the other hand, is curative but has disadvantages such as general anesthesia–related complications, scar formation, and hypothyroidism. Our patient was not willing to under either ethanol injection or surgery.

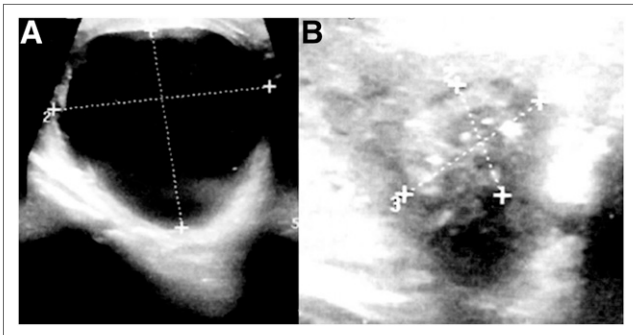
<sup>177</sup>Lu is in clinical use to label prostate-specific membrane antigen for treatment of prostate cancer, as well as to label DOTATATE for treatment of somatostatin receptor–positive neuroendocrine tumors. In this case report, we have demonstrated another successful use of <sup>177</sup>Lu—to label macroaggregated albumin for treatment of cystic thyroid nodules. Our patient, who had rejected surgery and ethanol injection, was able to accept this alternative treatment and volunteered to undergo it.

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**FIGURE 1.** Imaging at 1 h (left panel), 24 h (middle panel), and 1 wk (right panel) after radioactivity injection. Each panel shows SPECT (A), sagittal fusion (B), coronal fusion (C), axial CT (D), and axial fusion (E) images. Only intranodular activity is seen.



**FIGURE 2.** Thyroid ultrasound images. (A) Gross cystic nodule in right lobe of thyroid gland before therapy. Maximum diameter of nodule was  $44 \times 49 \times 45$  mm, and volume was nearly  $50 \text{ cm}^3$ . (B) Decrease in nodule size and volume after  $^{177}\text{Lu}$ -macroaggregated albumin treatment. Albumin particles can be seen in central part of nodule.

## CONCLUSION

On the basis of this case study, the use of  $^{177}\text{Lu}$ -macroaggregated albumin for imaging and therapy of cystic thyroid nodules can be considered feasible. The use of this treatment method for hypoactive thyroid nodules might also be a possibility.

## DISCLOSURE

No potential conflict of interest relevant to this article was reported.

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