

**¹⁷⁷Lutetium Labelled Macroaggregated Albumin Imaging and
Treatment Effect in Patient with Cystic Thyroid Nodule**

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Running Title: ¹⁷⁷Lu MAA Imaging and Treatment Effect

Abstract:

There are number of different peptides or antibodies that have been labelled with ^{177}Lu and have been used in imaging and treatment for clinical usage. To our knowledge, ^{177}Lu has never been labelled with macroaggregated albumin (MAA) before. There was special effort exerted in the radiopharmacy laboratory of Istanbul University-Cerrahpaşa, to bind ^{177}Lu with MAA (LUTMA). We present 43-year-old male patient with a cystic thyroid nodule and SPECT/CT imaging after intranodular ^{177}Lu labelled macroaggregated albumin injection and a treatment effect of this method.

Key words: ^{177}Lu , MAA, Cystic thyroid nodule

Introduction:

^{177}Lu is a β - and γ -emitting radionuclide with a physical half-life of 6.73 days that allow delivery of high activities to cancer cells (1). ^{177}Lu Dotatate is a radiolabeled somatostatin analogue that approved for treatments of patients with somatostatin receptor positive neuroendocrine tumors (2). ^{177}Lu labelled prostate specific membrane antigen (PSMA) therapy, using inhibitors of PSMA is a novel therapeutic agent in patients with metastatic castration-resistant prostate cancers (3). Macroaggregated Albumin (MAA) is a human serum albumin that can be routinely labelled with Technetium-99m and Gallium-68 (4-5). In our radiopharmacy laboratory, we successfully labelled ^{177}Lu with MAA. Our aim was to show that the labeled ^{177}Lu MAA (LUTMA) remained within the nodule only and did not cross the other side of the body. In addition, our aim was to evaluate the treatment effect of beta irradiation of ^{177}Lu on cystic

thyroid nodule. Our study protocol was approved by Istanbul University-Cerrahpaşa ethical committee (Study number 83045809-604.01.02) and this patient signed a written informed consent.

Case Report:

We present a 43-year-old male patient with cystic thyroid nodule who refused undergoing operation or alcohol injection for cystic thyroid nodule. When he applied to our department, thyroid ultrasound was performed. There was a gross cystic thyroid nodule on the right lobe of thyroid gland. We talked with him about this method and he accepted. He gave verbal and written informed consent for ^{177}Lu labelled MAA treatment and imaging. Intranodular injection of 1,1 mCi ^{177}Lu labelled MAA was conducted under ultrasound guidance (Figure 1). Post-injection SPECT/CT scans were subsequently acquired after 1 hour, 1 day and 1 week respectively to see the intranodular activity and/or activity other than the thyroid nodule (Figure 2; Figure 3). SPECT/CT images show only intranodular activity and there was no activity in the other part of the body. Thyroid ultrasound images were performed 1 day, 1 week, 1 month and 3 months after the treatment. 3 months after the therapy, thyroid ultrasound images show decreased nodule size and nodule volume after ^{177}Lu MAA treatment (Figure 4). For this procedure total dose exposure was calculated as nearly 20 Gy for 1 mCi ^{177}Lu .

Discussion:

Treatment of benign cystic thyroid nodules is generally undertaken for cosmetic reasons or for local compressive symptoms. Percutaneous ethanol injection for the treatment of cystic thyroid nodules was introduced into clinical practice in 1990 (6). Ethanol injection causes irreversible tissue damage protein denaturation and coagulative necrosis. This technique was initially

proposed as an alternative to surgery or radioiodine administration in thyroid nodules. Surgery is curative but has disadvantages, such as general anesthesia-related complications, scar formation and hypothyroidism. Ethanol injection has some complications. The most commonly reported complaint is pain. Uncommon complications include hematoma, dyspnea and vocal cord paralysis (7). Our patient did not want operation and refused injection of ethanol.

^{177}Lu can be labelled with PSMA and DOTA-TATE for treatment. These therapies are in clinic usage. ^{177}Lu was successfully labelled with MAA in Istanbul University-Cerrahpasa. Our patient accepted imaging and treatment technique as a volunteer.

Conclusion:

On the basis of this case study, ^{177}Lu MAA (LUTMA) can be feasibly considered for cystic thyroid nodules. Also it might be possible to use this treatment method for hypoactive thyroid nodules.

Conflict of interest: All authors declare that there is no conflict of interest.

Informed consent: Informed consent was obtained from participant included in this study.

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Figures and Figure Legends:

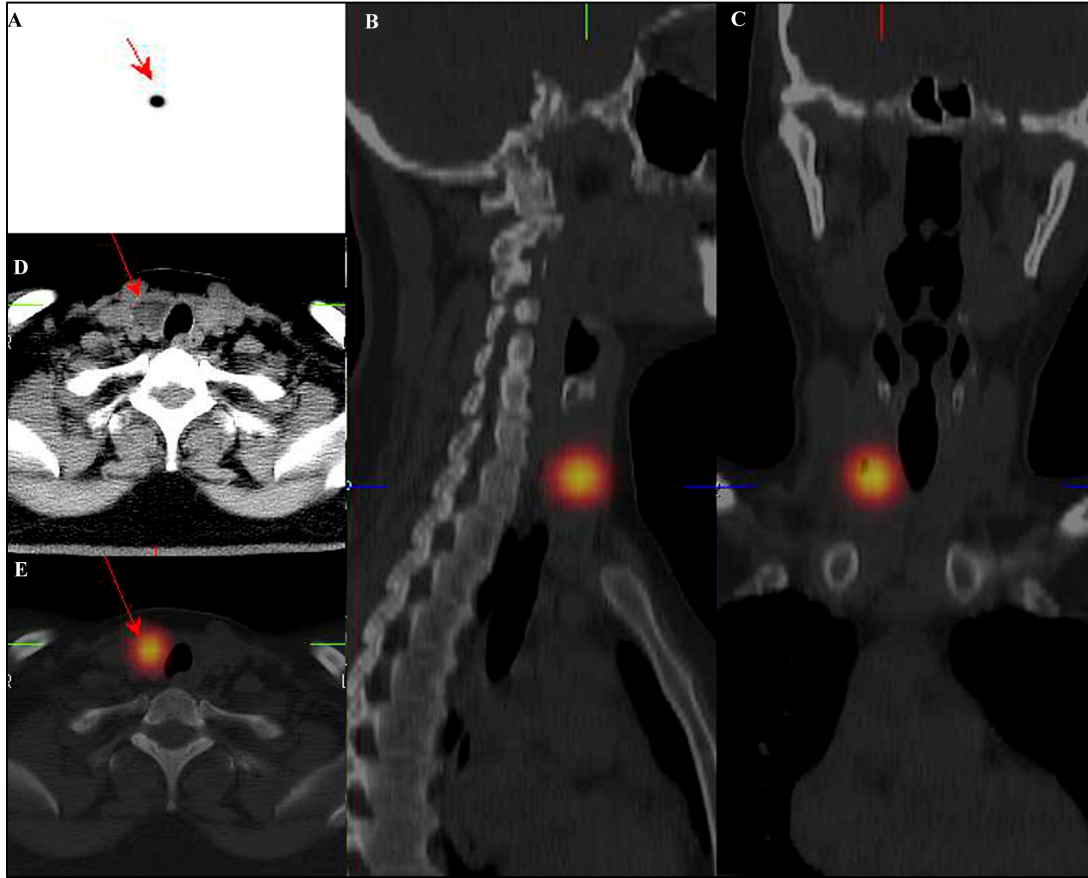


Figure 1:

Obtained images were shown in the following figures as Figure 1. One hour later SPECT (A), transaxial CT (D) and fusion (E), sagittal fusion (B) coronal fusion (C). SPECT/CT images showed only intranodular radioactivity.

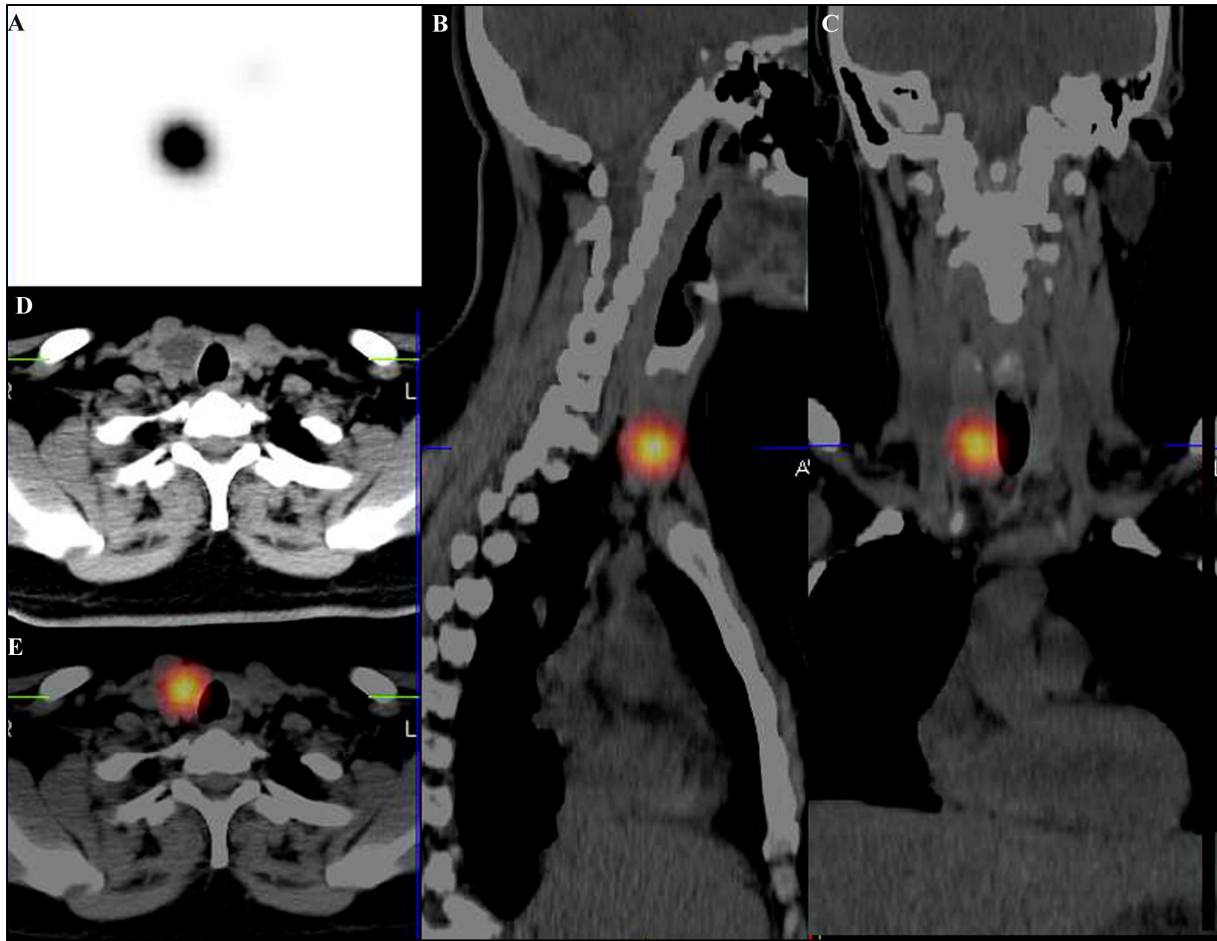


Figure 2:

24 hour after the radiactivity injection, SPECT (A), axial CT (D) and axial fusion (E), sagittal fusion (B), coronal fusion (C) SPECT/CT images show only intranodular activity and there is no activity accumulation in other part of the neck and blood pool.

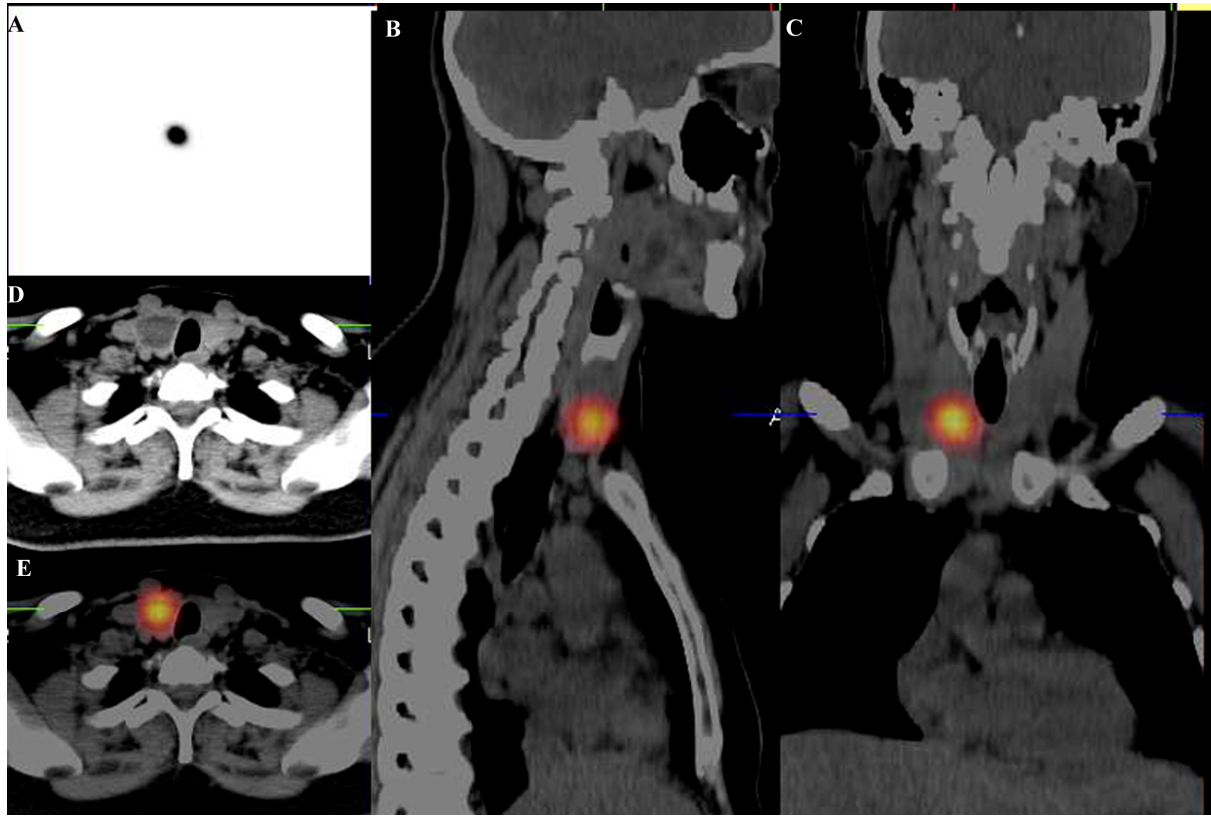


Figure 3:

1 week after the injection SPECT (A), axial CT (D) and axial fusion (E), sagittal fusion (B), coronal fusion (C) images show only intranodular activity. It is shown that the injected activity remained in the targeted nodule and there was no extranodular leakage of ^{177}Lu labelled MAA.

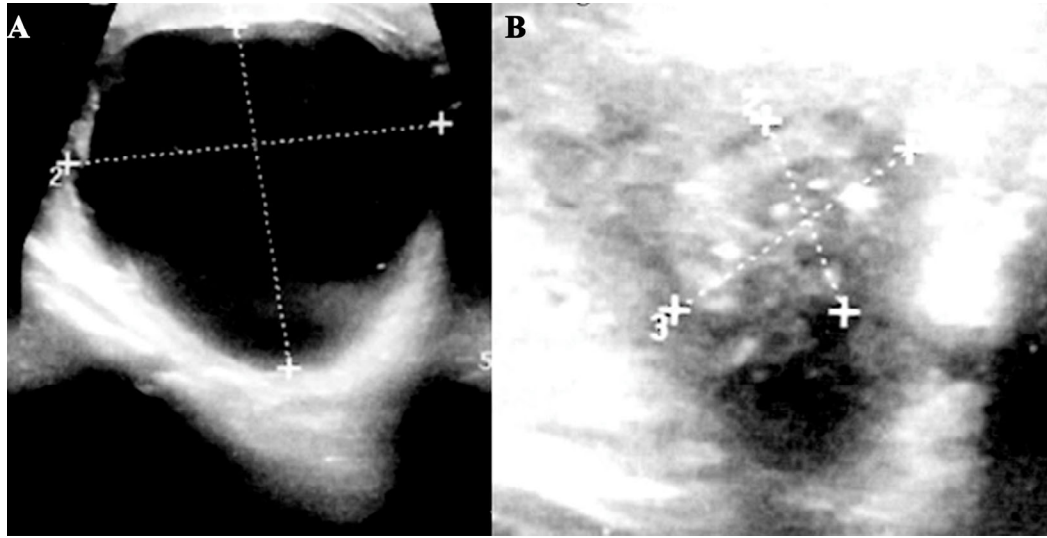


Figure 4:

Thyroid ultrasound images of the patient; in Figure 4A gross cystic nodule in the right lobe of thyroid gland can be seen before the therapy. Maximum diameters of the cystic nodule were measured as 44x49x45 mm and the nodule volume was measured as nearly 50 ml. Figure 4B image shows decreased nodule size and nodule volume after ^{177}Lu MAA treatment and albumin particules can be seen in the central part of the nodule.