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Thyroid Artery Embolization as an Alternative Treatment for Symptomatic Substernal Goiter in a Non-Surgical Candidate: A Case Report

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Abstract

We present the case of an 82-year-old woman with progressive dyspnea, hoarseness, and dysphagia due to a large substernal multinodular goiter. Ultrasound and CT revealed a predominantly left-lobe intrathoracic goiter with significant tracheal deviation and esophageal compression. Owing to her high surgical risk and the intrathoracic extension of the goiter, selective embolization of the left superior thyroid artery was successfully performed using microspheres. At 12-month follow-up, imaging showed an 87% reduction in goiter volume, accompanied by marked improvement in dyspnea, dysphagia, and hoarseness. This unique case highlights thyroid artery embolization as a minimally invasive and effective alternative for symptomatic substernal goiters in patients unsuitable for surgery and radiofrequency ablation.

Keywords

Substernal Goiter, Thyroid Artery Embolization, Inoperable Patient, Dysphagia, Dyspnea

1. Introduction

Substernal goiters often remain clinically silent for extended periods but may eventually manifest with compressive symptoms such as dyspnea, dysphagia, and hoarseness [1]-[4]. Surgical excision remains the definitive treatment; however, in elderly patients or those with significant comorbidities, operative intervention may pose a substantial risk. In such scenarios, Selective Thyroid Artery Embolization (SETA) has emerged as a minimally invasive therapeutic alternative [1] [2]

[4] [5].

Detailed knowledge of this vascular architecture is critical during interventional procedures to avoid complications such as non-target embolization. Specifically, the thyroid gland derives its blood supply predominantly from the superior thyroid artery (originating from the external carotid artery) and the inferior thyroid artery (branching from the thyrocervical trunk). In a minority of individuals (3% - 10%), an accessory artery—commonly referred to as the thyroid ima artery—may also be present, typically arising from the aortic arch or brachiocephalic trunk [6].

Particular caution is warranted when manipulating the superior thyroid artery due to its proximity to the superior laryngeal artery, as inadvertent embolization may lead to acute vocal cord paralysis and hoarseness [1].

2. Case Presentation

An 82-year-old female presented with progressive shortness of breath, difficulty swallowing, and hoarseness, all of which markedly impacted her quality of life. Her medical history included advanced pulmonary fibrosis and pulmonary hypertension, rendering her a poor candidate for surgical management and radiofrequency ablation [7]-[9]. Preprocedural thyroid function tests confirmed euthyroidism (TSH: 0.35 μIU/mL; FT3: 2.74 pg/mL; FT4: 1.25 ng/mL).

Cross-sectional imaging with CT revealed a substernal, multinodular goiter predominantly affecting the left thyroid lobe, causing mild tracheal deviation and esophageal compression (**Figure 1**). Neck ultrasonography identified multiple EU-TIRADS 3 nodules, with an estimated lobe volume of 70 cc. Fine-Needle Aspiration (FNA) was performed, with cytology consistent with benign nodules (Bethesda Category II).

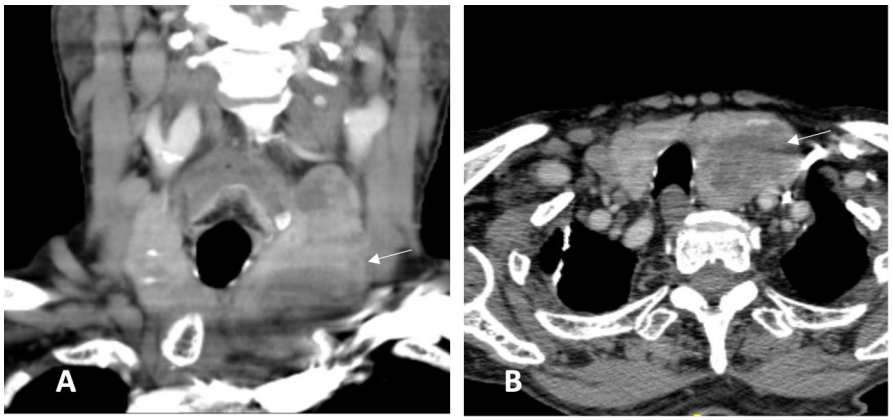

Figure 1. Pre-procedural computed tomography in (A) coronal and (B) axial planes demonstrates the total size of the substernal left thyroid lobe (white arrow) and the compressive effects exerted on adjacent structures.

3. Materials and Methods

Given the substernal extension of the goiter and the elevated surgical risk, embo-

lization of the thyroid arterial supply was selected as an alternative to thyroidectomy. Vascular access was obtained via the right femoral artery using a 5-French sheath. Selective catheterization of the left common carotid artery was performed with a 5-French catheter, followed by superselective catheterization of the left superior thyroid artery using a 2.7-French microcatheter (Figure 2). Angiographic evaluation confirmed the absence of collateral flow between the external and internal carotid circulations, thereby reducing the risk of cerebral embolization.

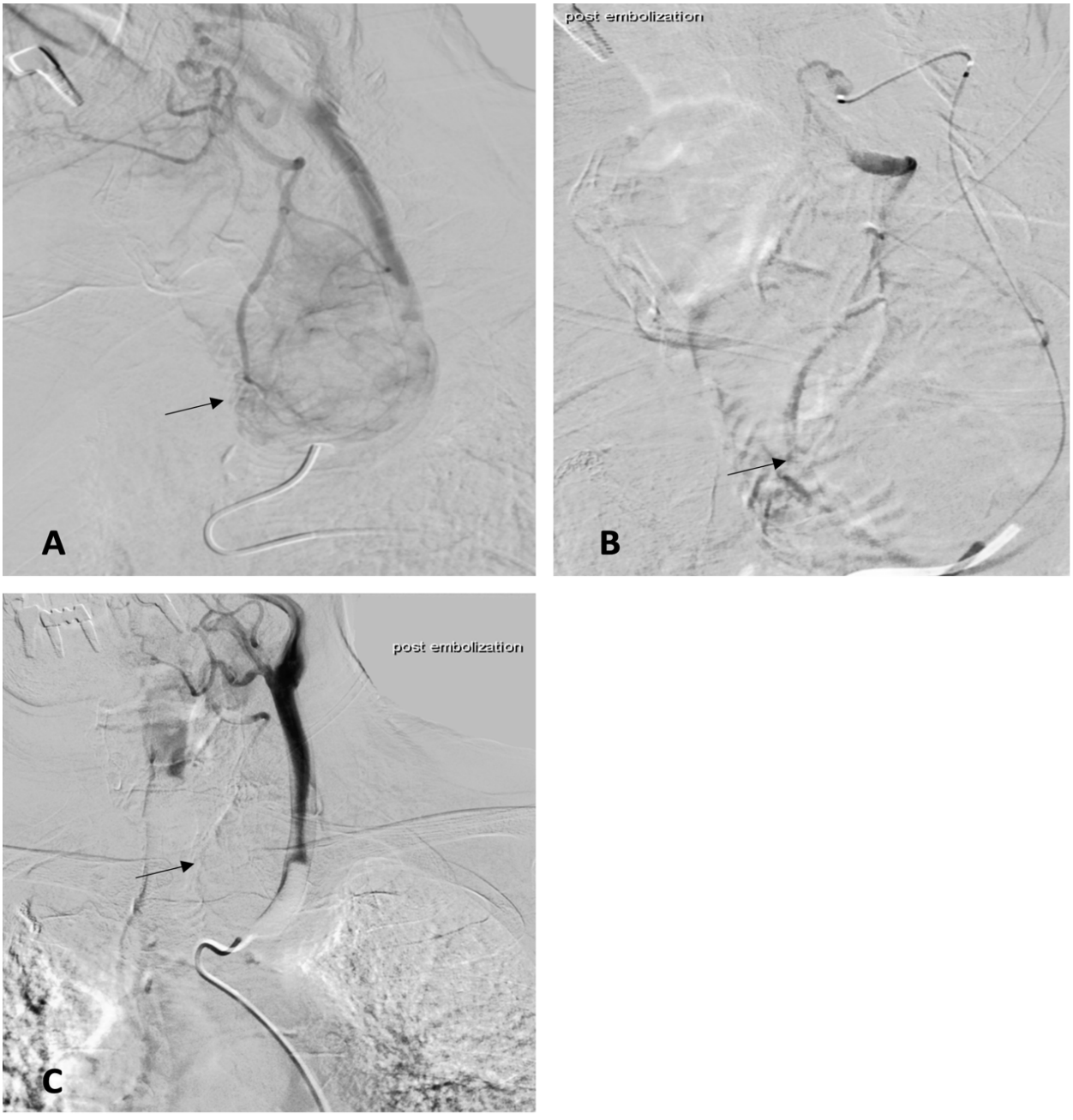

Figure 2. (A) Diagnostic angiography of the left external carotid artery demonstrates intense vascularization of the left thyroid lobe (white arrow). Post-embolization angiography of (B) the left superior thyroid artery and (C) the external carotid artery shows complete occlusion of the former and a marked reduction in vascularization of the left thyroid lobe (white arrow).

Embolization was conducted with calibrated microspheres (100 - 300 μm and 300 - 500 μm), delivered under continuous angiographic monitoring. The procedure utilized slow-flow infusion techniques and microcatheters to enhance precision and minimize the risk of non-target embolization.

Due to advanced age and vascular tortuosity associated with atherosclerotic changes, embolization of the superior thyroid artery was prioritized. Embolization of the inferior thyroid artery was reserved for possible future intervention depending on the clinical outcome.

In our interventional radiology practice, local infiltration with lidocaine (Xylocaine) is employed to achieve effective analgesia at the puncture site, offering a rapid onset of action and adequate pain control for percutaneous procedures while minimizing systemic adverse effects [10]-[12].

4. Results

The embolization procedure achieved complete occlusion of the targeted left superior thyroid artery and a marked reduction in vascularization of the left thyroid lobe, as confirmed under fluoroscopy (**Figure 2**). The patient experienced transient hoarseness after SETA, which resolved completely within 6 months, likely due to non-target embolization of the superior laryngeal branch. No other immediate or delayed complications were observed. The patient experienced significant symptomatic relief.

After the procedure, the patient received prophylactic antibiotics (cephalosporin) for five days, along with corticosteroid therapy (Methylprednisolone) for ten days due to the hoarseness [13].

Repeat thyroid function testing one day after SETA showed a negligible decline in TSH (0.15 μIU/mL) and a slight rise in FT3 (5.67 pg/mL) and FT4 (2.32 ng/mL). At 6-month follow-up, the patient was euthyroid.

Follow-up imaging at 12 months (CT and ultrasound) demonstrated a substantial reduction in thyroid lobe volume—from 70 cc to 6.1 cc—representing an 87% decrease (**Figure 3** and **Figure 4**).

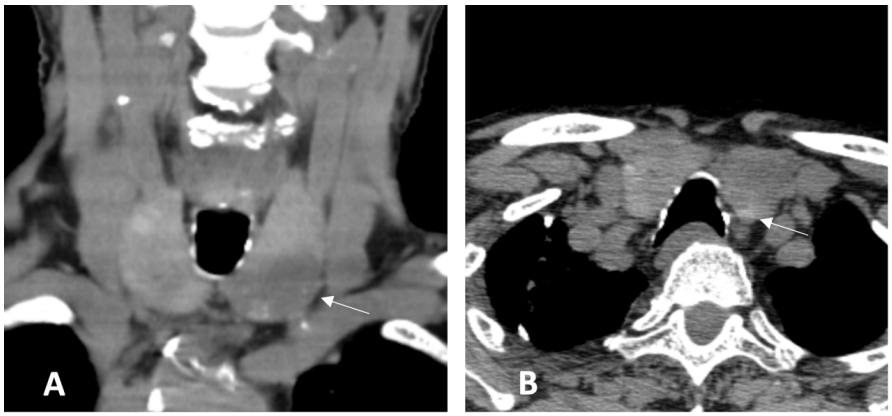

Figure 3. Follow-up computed tomography in coronal (A) and axial (B) planes at 12 months demonstrates a significant reduction in the size of the left thyroid lobe (white arrow).

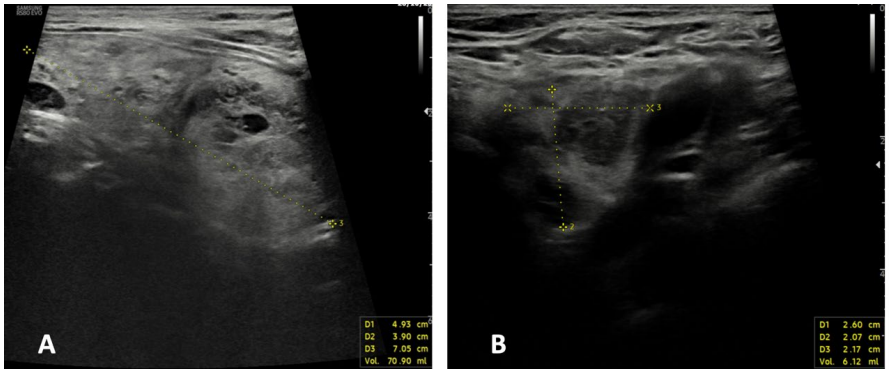

Figure 4. (A) Pre-procedural ultrasound evaluation revealed a total volume of 70 cc for the left thyroid lobe. (B) At 12-month follow-up, ultrasound demonstrated a significant reduction, with the volume measuring 6.1 cc.

5. Discussion

Thyroid artery embolization is gaining recognition as a viable option for patients with symptomatic goiters who are not candidates for surgery or radiofrequency ablation [7]-[9]. By reducing arterial perfusion, TAE induces ischemic necrosis, leading to a progressive reduction in glandular volume [1].

The primary objective in this case was to achieve a volume reduction exceeding 50%, alleviate compressive symptoms, and improve the patient's functional status. These targets were met successfully, aligning with outcomes reported in existing literature. In particular, Ducloux *et al.* reported a 39% diminution of thyroid volume, stable up to 6 months [1]. Similarly, Tartaglia *et al.* mentioned a substantial decline in thyroid volume among the 10 patients included in their research [4]. Yilmaz *et al.* mentioned that the mean thyroid volume was reduced from 147.0 mL to 62.6 mL six months after the TAE [3]. Also, the decrease of compressive symptoms was mentioned in the literature.

A second session or embolization of the inferior thyroid artery was not performed on our patient due to the absence of clinical symptoms. In the article of Tartaglia *et al.*, two patients required a second embolization procedure 60 days after due to relapse of the thyroid hyperfunction [4].

Although effective, the technique carries a risk of non-target embolization, particularly when involving the superior thyroid artery, due to potential communication with intracranial or laryngeal vessels. The use of microcatheters and controlled infusion rates helps mitigate this risk. In rare instances, complications such as retinal artery occlusion have been documented [1]. In our patient, transient hoarseness was attributed to possible inadvertent embolization of the superior laryngeal artery, a known, albeit uncommon complication. Similarly, in the study by Tartaglia *et al.*, one patient developed paralysis of the right hemilarynx, hoarseness due to right true vocal cord paralysis, and swallowing incoordination, which resolved after 6 months [6]. Yilmaz *et al.* reported complications in 27 of 56 patients, including both minor and major events [3].

Short-lived, asymptomatic hyperthyroidism has been observed in patients un-

dergoing endovascular embolization of goiters, likely resulting either from thyroid tissue necrosis with subsequent hormone release or from the direct effects of iodine-containing contrast media during catheterization. In most cases, these changes resolve spontaneously [1]. It is worth noting that in the study by Yilmaz *et al.*, 19 of 22 patients with non-Graves' hyperthyroidism became euthyroid [3]. In our patient, who was euthyroid before the embolization, only a mild, temporary decline in TSH and a rise in FT3 and FT4 were noted the following day. At follow-up, the patient was euthyroid.

6. Conclusion

Selective thyroid artery embolization represents a promising non-surgical strategy for the management of substernal compressive goiters in patients for whom surgery is contraindicated. In this case, SETA was performed safely, achieving substantial symptom improvement and marked reduction in goiter volume, with minimal adverse effects.

Declarations

Ethics Approval and Consent to Participate

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Authors' Contributions

All authors have made substantial contributions to all of the following: 1) made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work; 2) drafted the work or revised it critically for important intellectual content; 3) approved the version to be published; and 4) agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflicts of Interest

The authors declare that they have no competing interests.

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