

# Total Thyroidectomy Without Sternotomy for a Massive Retrosternal Goiter with Simultaneous Occurrence of Two Thyroid Carcinomas: Outcomes and Surgical Approach

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**Abstract:** Retrosternal goiters often lead to compressive symptoms such as dyspnea, dysphagia, and neck fullness, and pose significant surgical challenges. The standard treatment is total thyroidectomy, though the need for sternotomy depends on the size and extension of the goiter. We present a case of a 51-year-old woman with a progressively enlarging anterior neck mass. Imaging revealed markedly enlarged thyroid lobes with retrosternal extension, causing tracheal deviation and narrowing. CT showed heterogeneous nodules with cystic, necrotic, and calcified components; the lobes measured 13×7×8.2 cm and 8.3×4.6×5.1 cm. No lymphadenopathy was noted. She underwent total thyroidectomy via a 6 cm collar incision, using careful dissection and manipulation despite deep intrathoracic extension. Gross pathology revealed intact capsules, and histopathology showed a thyroid collision carcinoma: a minimally invasive follicular carcinoma (pT3a, pN0a) on the left and an encapsulated angioinvasive oncocytic carcinoma (pT1b, pN0a) on the right. Postoperatively, the patient experienced transient hypoparathyroidism, which resolved with calcium supplements. This case highlights the feasibility of performing total thyroidectomy for giant retrosternal goiters without sternotomy, even when the goiter extends to the lung hilum. Avoiding sternotomy minimizes perioperative risks and recovery times. Histopathology revealed synchronous differentiated carcinomas of follicular origin, highlighting the importance of complete resection in retrosternal goiters.

**Keywords:** Huge Retrosternal Goiter; Total Thyroidectomy; Surgical Approach; Feasibility; Case Report.

## 1. Introduction

Retrosternal goiter refers to a thyroid enlargement that extends into the mediastinum, typically defined by more than 50% of its mass located below the thoracic inlet [1]. Such goiters are encountered in about 1-20% of patients undergoing thyroidectomy, depending on definitions, and most often occur in middle-aged to older adults with a female predominance [2]. They usually develop over the years and can remain asymptomatic until the mass becomes large enough to compress adjacent structures [3]. Compressive symptoms are common, including dyspnea, orthopnea, dysphagia, neck fullness, and

hoarseness, due to tracheal and esophageal compression or deviation [2]. In addition to mass effect, retrosternal goiters carry a risk of harboring malignancy; studies have reported malignancy in approximately 5-21% of such goiters [2, 4].

Given the potential for airway compromise and occult malignancy, the definitive management for a substernal goiter is surgical removal, typically total or near-total thyroidectomy [7]. The level of inferior extension, e.g., whether the goiter extends beyond the aortic arch or into the posterior mediastinum, may necessitate sternotomy [2]. In general, however, there is broad consensus that the majority of retrosternal goiters can be removed through a cervical incision alone, and that an extra-cervical approach, partial or full sternotomy, or rarely thoracotomy, is only needed in a minority of cases [1, 2]. Rugiu et al. reported that only 7.5% of retrosternal goiter cases (4 of 53 patients) required a sternotomy [3], and more recent studies show sternotomy rates generally in the 2-10% range [1, 4].

In this report, we present the case of a 51-year-old lady with a giant retrosternal multinodular goiter extending to the level of the right lung hilum with two primary thyroid carcinomas. This report primarily highlights the feasibility of performing total thyroidectomy for a massive retrosternal goiter extending to the lung hilum without sternotomy. The synchronous occurrence of two differentiated thyroid carcinomas is presented as an important secondary finding, underscoring the oncologic justification for complete gland removal.

## 2. Case Report

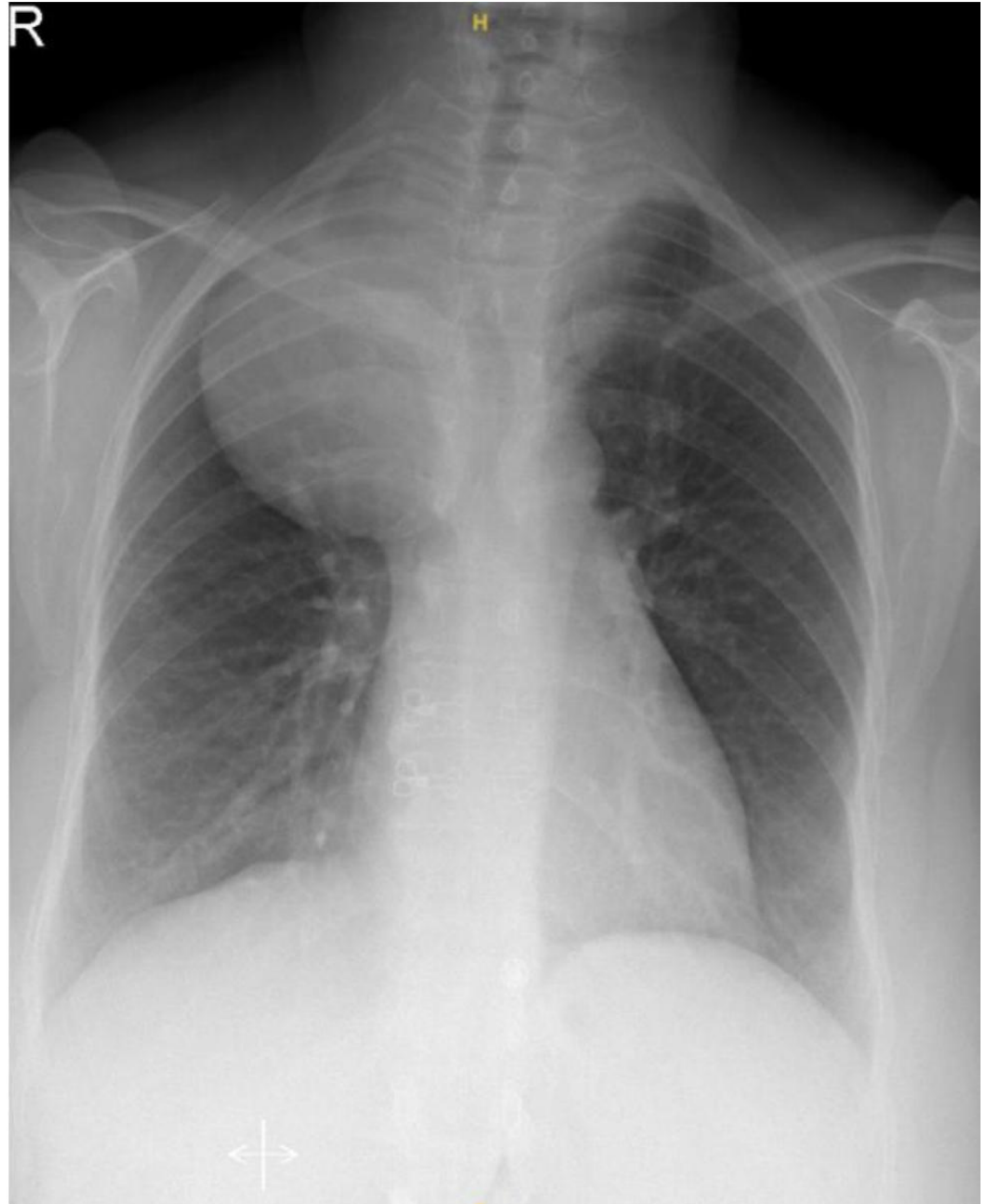
A 51-year-old female patient, medically and surgically free, was referred from the primary healthcare center to our institution for further evaluation and management of a suspected thyroid mass. Over the preceding several months, the patient had noticed the gradual onset and progressive enlargement of a noticeable swelling in the anterior neck region. Notably, she denied experiencing any associated compressive symptoms such as dysphagia, dyspnea, or changes in vocal quality. On physical examination, a sizable, firm, and painless mass was palpated in the anterior cervical region, with no movement observed on deglutition. Routine laboratory investigations were performed to comprehensively assess thyroid functionality, including serum levels of thyroid-stimulating hormone (TSH), free thyroxine (FT4), and free triiodothyronine (FT3). All obtained laboratory parameters were within normal limits, consistent with euthyroid clinical status. A standard chest radiograph demonstrated marked widening of the superior mediastinum along with evident leftward deviation of the trachea, suggestive of an anterior mediastinal mass. Based on these radiographic findings, the differential diagnosis notably included the possibility of a retrosternal goiter as shown in figure 1.

Subsequent thyroid ultrasonography (US) provided further insight, revealing a markedly enlarged, heterogeneous gland harboring multiple solid and complex nodules of varying sizes. The most prominent nodule in the right thyroid lobe measured approximately 4.4 × 4.6 cm and exhibited features of cystic degeneration, with inferior extension into the upper mediastinum. The largest nodule in the left lobe measured 5.6 × 3.1 cm. Accurate assessment of the overall thyroid dimensions was limited due to the gland's retrosternal extension. Further imaging of computed tomography (CT) of the neck and chest with contrast agent demonstrated markedly enlarged thyroid lobes with significant retrosternal extension, more pronounced on the right side, resulting in displacement and narrowing of the trachea.

The right and left lobes measured 13 × 7 × 8.2 cm and 8.3 × 4.6 × 5.1 cm, respectively. Both lobes exhibited heterogeneous contrast enhancement with areas of necrosis and coarse calcifications. No significant cervical, mediastinal, or axillary lymphadenopathy was identified, and there was no evidence of vascular invasion. Minimal atelectasis was noted in the right upper lobe, likely secondary to mass effect. No intrathoracic metastases were seen (Figure 2). An ultrasound-guided fine-needle aspiration (FNA) was attempted on two accessible nodules in the left thyroid lobe. Both samples were reported as follicular

lesion of undetermined significance (Bethesda Category III). However, the largest retrosternal nodules were inaccessible to FNA due to their deep intrathoracic extension beyond the reach of ultrasound guidance.

**Figure 1.** Posteroanterior chest X-ray showing a right upper zone opacity with features suggestive of retrosternal extension.



The patient subsequently underwent total thyroidectomy without neck dissection on the 16th of September 2024. Under general anesthesia, a collar incision approximately 6 cm in length was performed. Subsequent careful dissection involved subcutaneous fat and platysma muscle, with advancement of upper and lower skin flaps. A longitudinal dissection of the investing fascia and cautious separation of the strap muscles were performed. The left thyroid lobe was visualized first and noted to have significant retrosternal extension. Ligation of the superior thyroid artery was performed near the gland, and the recurrent laryngeal nerve (RLN) was visualized and preserved. Following successful

dissection and removal of the left lobe, the surgical team proceeded to the right lobe, which also exhibited marked retrosternal extension.

**Figure 2.** Computed tomography of the neck and chest with contrast (coronal view) demonstrates massive bilateral thyroid enlargement with retrosternal extension and compressive effect on mediastinal structures.

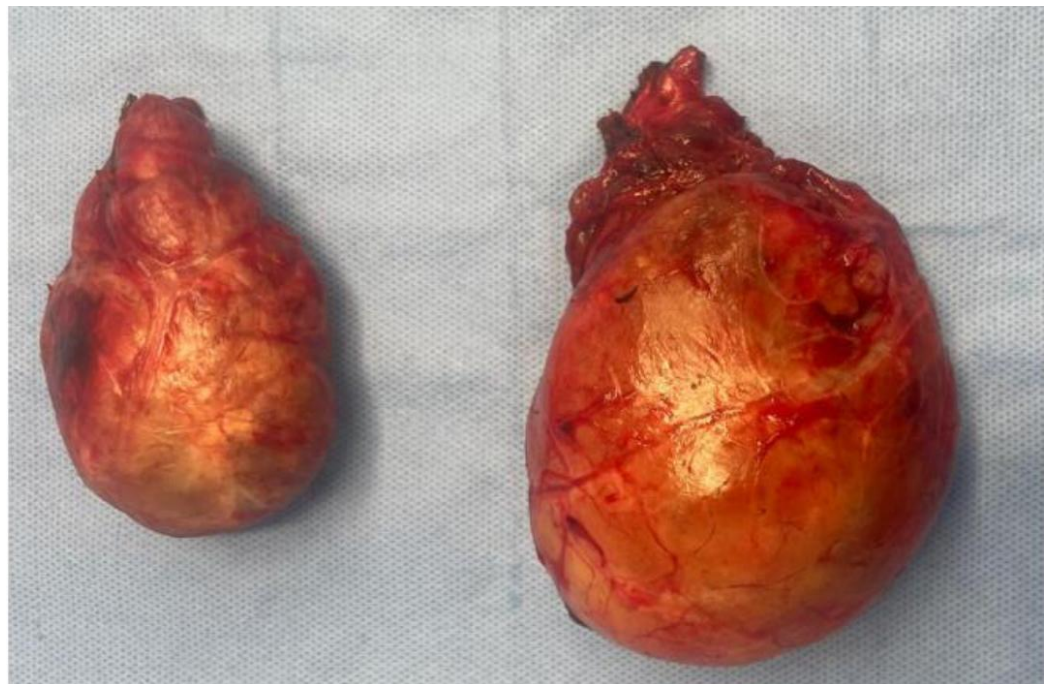


Significant difficulty was encountered during extraction, requiring careful and gentle blunt finger dissection. Due to the anticipated complexity, a thoracic surgeon remained on standby. Ultimately, the thoracic surgeon's intervention was not required, and the right thyroid lobe was mobilized and removed after careful visualization and preservation of the RLN. Hemostasis was effectively achieved using surgical hemostatic agents, and surgical drain was secured in place. Closure was achieved through the re-approximation of

the strap muscles, platysma, and skin closure. The patient was extubated uneventfully and transferred to the recovery room.

Gross examination of the excised surgical specimen revealed the right thyroid lobe measuring  $13 \times 7 \times 8$  cm and the left thyroid lobe measuring  $8.5 \times 4.5 \times 5$  cm, as displayed in Figure 3. Both lobes exhibited a smooth external surface enveloped by an intact capsule. The tissue was firm on palpation, with no visible evidence of capsular disruption, invasion into surrounding structures, or attached lymph nodes. Externally, there were no apparent areas of hemorrhage, necrosis, or cystic degeneration. The thyroid parenchyma appeared preserved. Post-operative histopathological diagnosis revealed thyroid collision carcinoma involving minimally invasive follicular thyroid carcinoma in the left thyroid lobe (Figure 4A). It encapsulated angioinvasive oncocytic carcinoma in the right thyroid lobe (Figure 4B). The pathological staging was determined to be pT3a pN0a for the follicular carcinoma of the left thyroid lobe and pT1b pN0a for the oncocytic carcinoma of the right thyroid lobe.

**Figure 3.** Gross specimen showing enlarged thyroid lobes with absent isthmus; the right thyroid lobe measuring  $13 \times 7 \times 8$  cm and the left thyroid lobe measuring  $8.5 \times 4.5 \times 5$  cm.



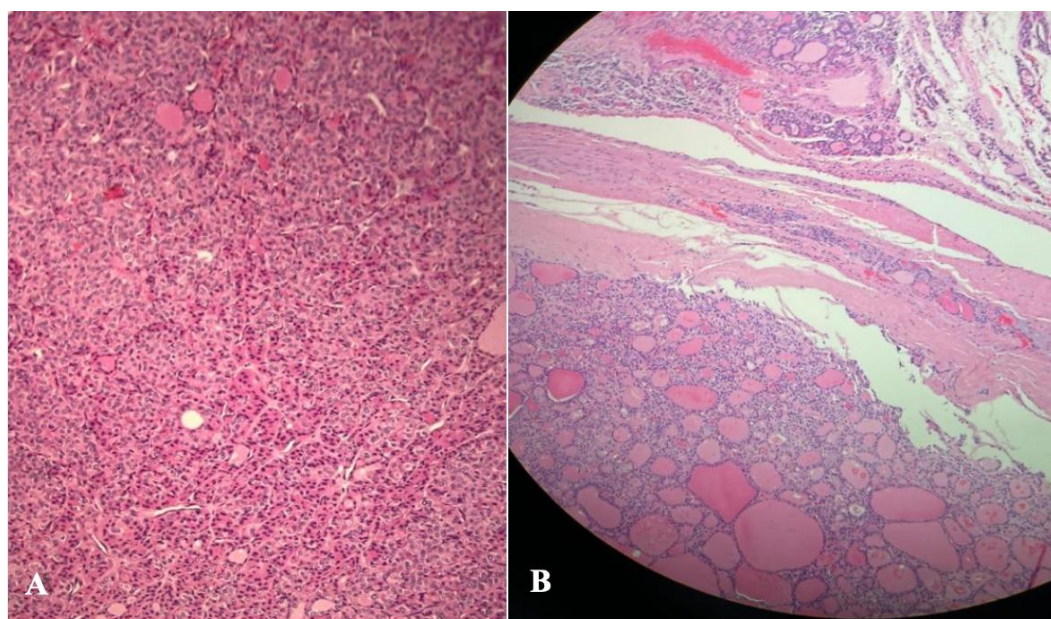
Postoperatively, the patient experienced transient iatrogenic hypoparathyroidism, with initial corrected calcium levels documented at 1.88 mmol/L (reference range 2.10–2.55 mmol/L). Her calcium levels gradually normalized, reaching 2.35 mmol/L on subsequent assessments after she started taking calcium supplements. At the latest follow-up visit, the patient was asymptomatic and showed no clinical signs of hypocalcemia; corrected calcium levels remained stable at 2.35 mmol/L. Regular outpatient follow-up was scheduled at six-month intervals for ongoing surveillance.

### 3. Discussion

Various definitions exist for retrosternal goiter (RSG). A common definition is that more than 50% of the thyroid mass extends below the thoracic inlet into the mediastinum [3]. Furthermore, alternative classification systems categorize goiters based on their spatial extent as visualized on imaging; for example, Huins et al. defined Grade I as extending to the aortic arch, Grade II as extending to the pericardium, and Grade III as extending below the right atrium [8]. In our case, the goiter extended to the level of the hilum, which

by any definition qualifies as a severe retrosternal extension. Surgery is indicated for essentially all RSG, even if asymptomatic [9, 10]. This is due to the risks of continued growth leading to acute airway compromise and the substantial incidence of occult malignancy. Nonsurgical measures, i.e., thyroxine suppression or radioiodine, are generally ineffective at shrinking large RSGs [9]. Guidelines and expert consensus advocate resection since it can be done with low mortality and acceptable morbidity in experienced hands [9]. Surgical intervention was warranted in our patient due to the substantial mass effect of the goiter on the trachea and mediastinum, a decision further supported by the subsequent pathological identification of two distinct malignancies.

**Figure 4.** Microscopic view of minimally invasive follicular thyroid carcinoma demonstrating uniform follicular cells arranged in microfollicles and trabeculae; (B) Histologic section of encapsulated oncocytic angioinvasive carcinoma with prominent eosinophilic granular cytoplasm and large hyperchromatic nuclei.



A critical part of planning surgery for RSG is determining if a cervical approach will suffice or if a sternotomy or other extra-cervical approach will be needed. Preoperative CT imaging of the neck and chest is the most helpful tool for mapping the extent and relationships of the goiter, guiding this decision. The existing literature identifies several imaging characteristics that predict the necessity of sternotomy. The most cited predictor is the extent of the goiter inferior to the thoracic inlet. Goiters extending beyond the aortic arch on CT are much more likely to need a sternotomy [3, 11]. In one large series, all patients who required sternotomy had thyroid tissue extending below the aortic arch [11]. Extension to the carina or pericardium level is an even stronger indicator [3]. Our patient's right lobe descended to the carinal level (hilum). However, it was removed through a cervical incision, underscoring that extension beyond the arch is not an absolute contraindication to a cervical approach but a cautionary sign. Furthermore, enormous size (>10 cm or >500 g), posterior location, ectopic thyroid tissue, or invasive carcinoma strongly suggest the need for a planned sternotomy [3, 9, 12]. Conversely, the absence of these factors means a high likelihood that a cervical approach will be sufficient.

Recent studies propose that objective CT measurements can serve as a predictor of sternotomy. Torre et al. found that the ratio of the goiter's mediastinal component diameter to the thoracic inlet diameter was a strong predictor, with a ratio  $\geq 1.24$  having 100% sensitivity and 89% specificity for requiring a sternotomy [10]. Similarly, Linhares et al. reported that the depth of substernal extension was the only independent predictor of needing a sternotomy; in their series, about 15.5% of substernal goiters required a partial

or full sternotomy, and a threshold depth on CT had 94% sensitivity and 86.5% specificity [13]. Our case aligns with this, as we avoided sternotomy despite the goiter's impressive extent. Nonetheless, thorough imaging and contingency planning are essential. We had a cardiothoracic surgeon on standby for our patient, and informed consent covered the possibility of sternotomy if we encountered unforeseen difficulty.

The vast majority of RSG can be delivered through the neck. A standard collar incision, known as the Kocher incision, is often extended slightly laterally or inferiorly as needed for optimal exposure. In some cases, a vertical extension of the incision to the sternal notch is used to gain more inferior reach [3]. However, a subset of RSG does require an extra cervical approach, typically a partial or full sternotomy and occasionally a lateral thoracotomy in cases of posterior mediastinal extension. Sternotomy is performed in conjunction with cervical incision. In the series by Perrot et al., sternotomy was reserved for invasive or ectopic cases and difficult recurrences and was not used just for size or depth alone [9]. In their 185-patient experience, 13 (6%) required sternotomy, mostly aligning with those criteria. The downside of sternotomy is the added morbidity; a median sternotomy roughly doubles the operative time and significantly increases blood loss and hospital stay compared to a cervical approach [11]. In the study by Nankee et al., sternotomy procedures were associated with a significantly longer average operative duration of approximately 2 hours and more significant blood loss, averaging around 600 mL, compared to the transcervical approach, which resulted in an average blood loss of 190 mL [11]. Furthermore, the postoperative hospital stay for sternotomy patients was approximately 3 days, in contrast to the 1-2-day average observed for patients undergoing cervical-only procedures.

Sternotomy carries risks of sternal wound complications, e.g., infection, dehiscence, osteomyelitis, pleural injury requiring a chest tube, and more incredible postoperative pain [11]. However, when truly indicated, sternotomy can be performed safely. Importantly, studies show that long-term outcomes of nerve injury and hypoparathyroidism are no worse in patients who needed sternotomy compared to those who underwent cervical approach [11]. Thus, while sternotomy is more invasive, it should not be hesitated upon when necessary to ensure a safe thyroidectomy in complex cases, and its presence alone does not portend a poor outcome.

The simultaneous presence of distinct primary thyroid malignancies is an uncommon phenomenon. While previous studies have reported the coexistence of papillary and medullary thyroid carcinomas, the occurrence of two histologically different neoplasms of follicular origin within the same thyroid gland remains exceedingly rare. In a retrospective review conducted between 2007 and 2014, Polat et al. examined 3,700 thyroidectomy cases and identified only 20 patients who exhibited synchronous neoplasms of follicular cell origin within a single thyroid gland (1.9%) [5]. All patients had papillary thyroid carcinoma, predominantly the classical variant, coexisting with a second distinct neoplasm, including follicular carcinoma, Hurthle cell carcinoma, follicular adenoma, or Hurthle cell adenoma. Recent case reports have described even rarer scenarios involving concurrent small lymphocytic lymphoma in the lymph nodes of patients with synchronous papillary thyroid carcinoma and medullary thyroid carcinoma. Hao et al. reported a 75-year-old female in whom cervical lymph node metastasis of papillary thyroid carcinoma occurred alongside isolated medullary thyroid carcinoma in the thyroid and coexistent small lymphocytic lymphoma [6].

In our case, the synchronous presence of two differentiated thyroid carcinomas of follicular origin was a rare but clinically important event. While this was not the primary focus of our report, it reinforces the rationale for complete thyroidectomy in retrosternal goiters, given the potential for occult malignancy. The evidence shows that the incidence of cancer in RSGs is similar to that in cervical multinodular goiters [14]. Several studies report malignancy rates in RSG; for example, Testini et al. found cancer in 23% of 1000 RSG cases, comparable to an extensive series of cervical goiters [15]. A 2023 study by Prete

et al. confirmed that about 1 in 10 RSG harbored a clinically significant (>1 cm) differentiated thyroid carcinoma, essentially the same fraction as in cervical MNG patients [16]. Our patient had two sizable carcinomas (>2 cm) that were not diagnosed preoperatively. Preoperative FNA biopsy is often impractical in RSGs because the dominant nodules may lie below the reach of ultrasound guidance or needle, and FNA yield is lower for deep nodules [16].

The primary treatment for differentiated thyroid carcinoma is total thyroidectomy along with any involved lymph nodes. The question is whether a cervical approach can fully accomplish this if the tumor is in a substernal portion. In our patient, despite the massive goiter, we achieved a complete resection of all thyroid tissue. Both carcinomas were encapsulated within the thyroid lobes and were removed entirely. If a malignancy had been suspected preoperatively, the surgical approach might be slightly modified, but not necessarily by adding a sternotomy unless there was evidence of gross invasion. Several studies indicate that cancer in an RSG does not confer a worse prognosis purely due to its location. What matters are the usual tumor characteristics, e.g., size, histology, extrathyroidal extension, metastases, and treatment adequacy. In White et al.'s evidence-based review, substernal goiters did not have a higher incidence of aggressive histology than cervical goiters [14]. Our patient's cancers were differentiated and encapsulated; her prognosis should be excellent and similar to any other patient with two foci of well-differentiated carcinoma removed with negative margins. The retrosternal component did not compromise our ability to adhere to oncologic principles. Oncologic adequacy is ensured through complete thyroid resection, including any involved structures.

When invasion beyond the thyroid is present, a combined cervical and sternotomy approach should be employed to allow an en bloc resection for cure. Our case demonstrates successful cancer outcomes, i.e., complete resection of two occult cancers through a cervical approach, and the patient will undergo regular surveillance as per standard thyroid carcinoma follow-up. In summary, with experienced surgical technique and optimal planning, total thyroidectomy for extensive retrosternal goiters can be performed safely through a neck incision alone. The cervical approach should be considered as the first-line option, even for very large goiters, with the confidence that sternotomy can usually be avoided. This approach maximizes patient benefit by achieving a cure while minimizing surgical morbidity.

#### 4. Conclusion

In conclusion, this case highlights that even massive retrosternal goiters extending to the lung hilum can be successfully managed with a cervical approach, avoiding the morbidity of sternotomy. Thorough preoperative assessment, surgical planning, and multidisciplinary preparedness are critical for success. The incidental finding of synchronous differentiated carcinomas further underscores the importance of total thyroidectomy in retrosternal goiters. Significantly, a substernal location does not compromise the oncologic efficacy of thyroidectomy; patients with occult cancers in retrosternal goiters can expect the same prognosis as long as complete resection is achieved.

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**Conflicts of Interest:** The authors declare no conflicts of interest.

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