

Oncocytic (Hürthle Cell) Carcinoma Invading the Innominate Vein: A Case Report

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Abstract

Oncocytic (Hürthle cell) carcinoma is a rare subtype of differentiated thyroid carcinoma associated with increased vascular invasion, distant metastasis, and reduced responsiveness to radioactive iodine (RAI) therapy compared with other thyroid malignancies. Direct invasion of major mediastinal vessels, including the brachiocephalic (innominate) vein, is exceedingly rare and presents significant diagnostic and operative challenges.

We report the case of a 71-year-old male who presented with progressive dysphagia and an enlarging multinodular goiter. Initial fine-needle aspiration was benign; however, worsening compressive symptoms prompted left thyroid lobectomy, which demonstrated widely invasive oncocytic carcinoma with extensive angioinvasion (pT3a). Completion thyroidectomy with central neck dissection revealed tumor invasion of the left internal jugular and middle thyroid veins, requiring ligation. Despite adjuvant RAI therapy, serum thyroglobulin (Tg) levels progressively increased. Subsequent positron emission tomography and computed tomography demonstrated a fluorodeoxyglucose (FDG)-avid thrombus and associated venous aneurysm involving the left brachiocephalic vein.

The patient underwent successful resection via trapdoor thoracotomy with en bloc excision of the involved venous segment. Pathology confirmed metastatic oncocytic carcinoma with negative margins. This case highlights the importance of vigilant biochemical surveillance, advanced imaging, and aggressive multidisciplinary management in selected patients with oncocytic thyroid carcinoma involving the great vessels.

Categories: Cardiac/Thoracic/Vascular Surgery, Endocrinology/Diabetes/Metabolism

Keywords: hurthle cell carcinoma (hcc), innominate vein, thyroglobulin, thyroid cancer surgery, trapdoor thoracotomy

Introduction

Oncocytic carcinoma of the thyroid, previously known as Hürthle cell carcinoma (HCC), accounts for 3% to 5% of all thyroid cancers. In the United States, the incidence of thyroid cancer is approximately 12 per 100,000 persons per year and increases with age. The prevalence of thyroid cancer in women is estimated to be twice that in men, with male sex correlating with a worse prognosis [1]. HCC is a rare subtype of differentiated thyroid carcinoma arising from oncocytic follicular cells, which are characterized by abundant granular eosinophilic cytoplasm due to high mitochondrial content. Compared with other follicular-derived thyroid cancers, oncocytic carcinoma demonstrates more aggressive biologic behavior, including higher rates of vascular invasion, distant metastasis, and reduced responsiveness to radioactive iodine (RAI) therapy, contributing to inferior overall survival outcomes [2–4]. Approximately 10%–20% of patients present with metastatic disease at diagnosis, most commonly involving the lungs, bone, or mediastinum [5]. The extent of vascular invasion is among the strongest prognostic factors, with extensive angioinvasion associated with substantially increased recurrence and disease-specific mortality [6].

Although tumor thrombus involving the brachiocephalic (innominate) vein has been reported in differentiated thyroid carcinoma, including a similar case of papillary thyroid carcinoma described by Koike et al. [7], such extensive mediastinal venous involvement remains uncommon, particularly in oncocytic carcinoma. This pattern of disease underscores the potential for aggressive local extension beyond the thyroid capsule into major central thoracic vessels. We present a case of widely invasive oncocytic thyroid carcinoma with direct innominate vein involvement requiring mediastinal resection through a trapdoor thoracotomy.

Case Presentation

A 71-year-old Hispanic male with a history of hypertension and hyperlipidemia presented with progressive dysphagia and compressive neck symptoms. Initial evaluation demonstrated subclinical hypothyroidism, and cross-sectional imaging revealed a large multinodular goiter with significant mass effect and rightward tracheal deviation (Figure 1). Fine-needle aspiration (FNA) biopsy was benign. However, because of

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progressive thyroid enlargement and worsening compressive symptoms over the subsequent year, the patient underwent a left thyroid lobectomy.

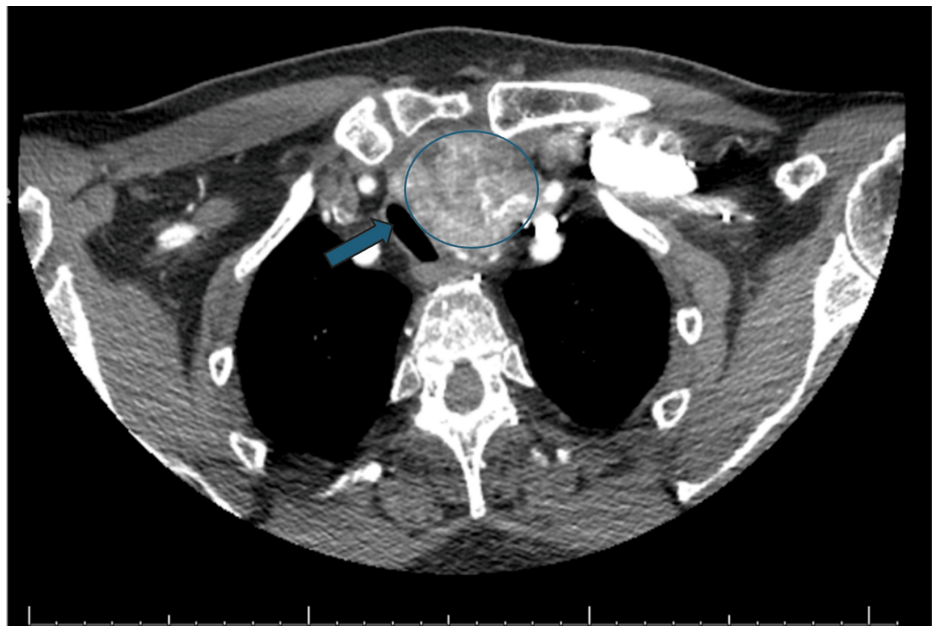


FIGURE 1: Contrast-enhanced computed tomography (CECT) of the neck demonstrating a large multinodular goiter (blue circle) causing rightward tracheal deviation (blue arrow)

Final histopathologic evaluation revealed a widely invasive oncocytic (Hürthle cell) carcinoma with extensive angioinvasion, staged as pT3a. Given the aggressive pathologic features, the patient returned two months later for completion thyroidectomy with central neck dissection. Intraoperatively, gross tumor invasion involving the left internal jugular vein and middle thyroid vein was identified. Because of direct vascular involvement, the left internal jugular vein was sacrificed and ligated proximally at the level of the superior thyroid vein branch and distally at its confluence with the left brachiocephalic vein.

Postoperative iodine-131 whole-body scintigraphy demonstrated persistent radiotracer uptake within the lower neck, concerning for residual disease (Figure 2). The patient subsequently underwent RAI therapy; however, serial biochemical surveillance over the following months demonstrated persistently rising thyroglobulin (Tg) levels without evidence of treatment response. Over the ensuing year, positron emission tomography (PET) revealed a metabolically active thrombus within the left brachiocephalic vein (Figure 3), while computed tomography (CT) demonstrated an associated venous aneurysm arising from the involved vessel, measuring 31.7 × 40.7 mm (Figure 4).

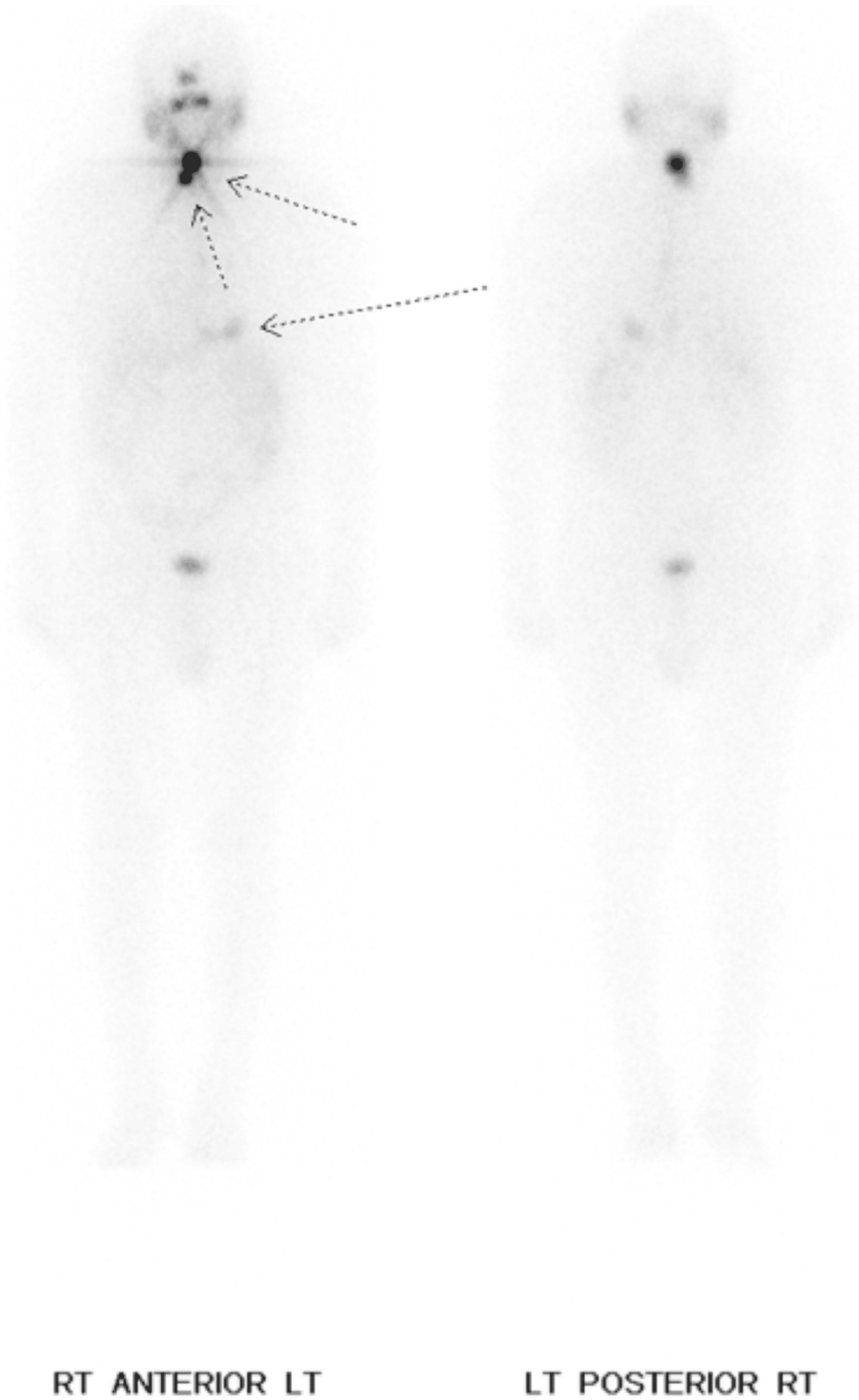


FIGURE 2: Post completion thyroidectomy iodine-131 whole-body scintigraphy demonstrating residual thyroid uptake in the lower neck

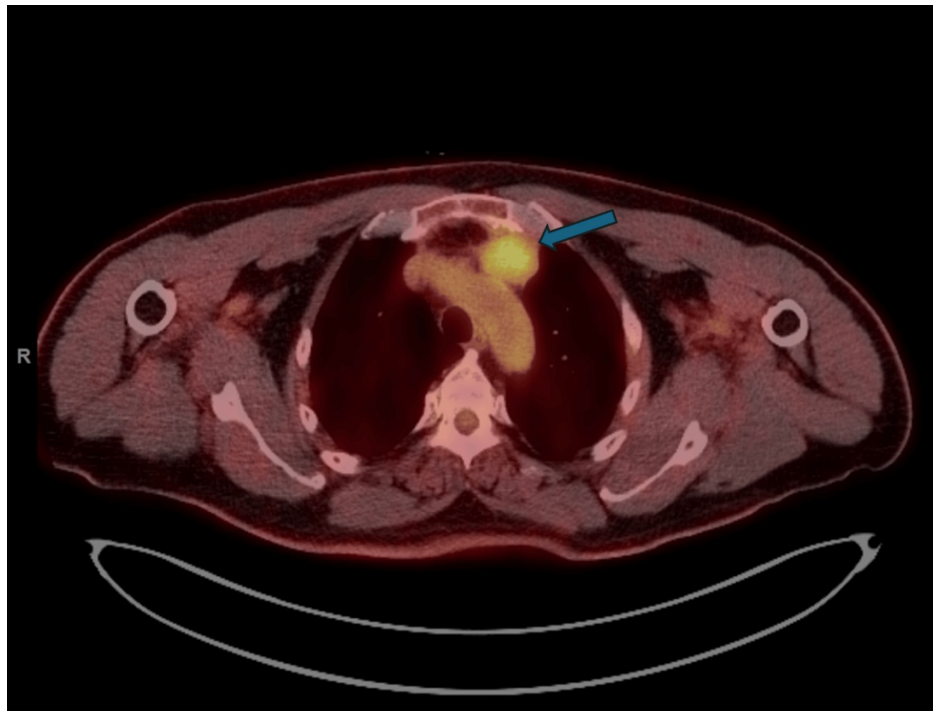


FIGURE 3: Axial fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) image showing focal increased uptake in the left brachiocephalic vein (blue arrow)

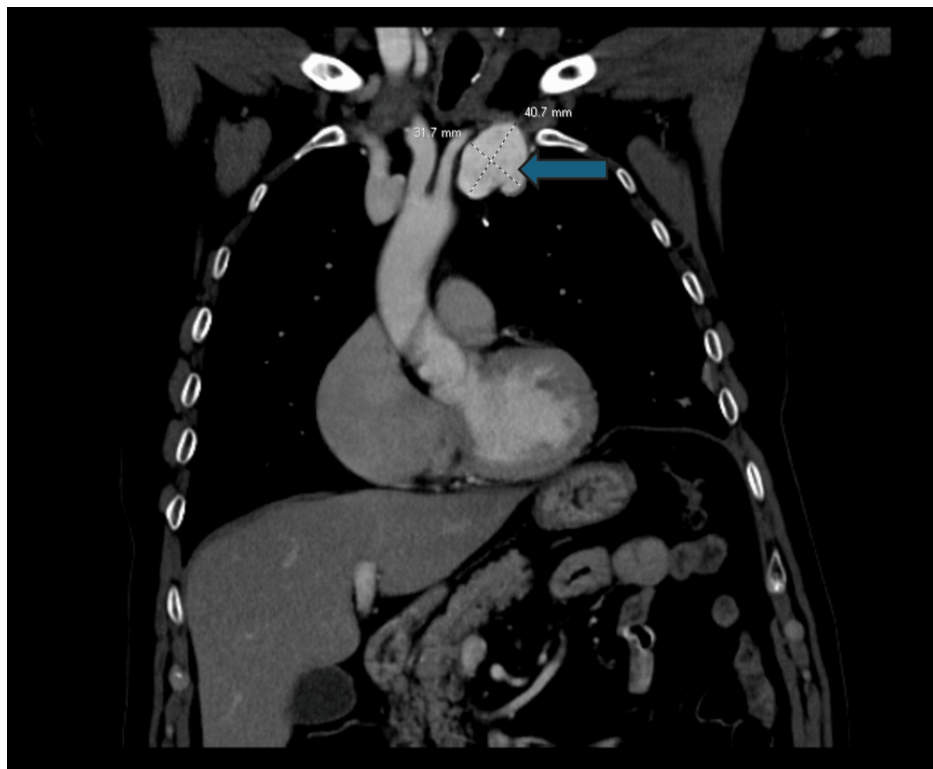


FIGURE 4: Coronal contrast-enhanced computed tomography (CECT) demonstrating aneurysmal dilatation of the left brachiocephalic vein measuring 31.7 × 40.7 mm (blue arrow)

In the setting of biochemical progression and radiographic evidence of persistent locoregional disease, multidisciplinary consensus favored operative management.

The patient underwent resection via a trapdoor thoracotomy (Figure 5), consisting of a combined supraclavicular incision, partial median sternotomy, and anterolateral thoracotomy. This approach provided wide exposure of the thoracic inlet and superior mediastinum, allowing proximal and distal control of the brachiocephalic vessels. The involved segment of the left brachiocephalic vein was then isolated and resected with secure vascular control. Final histopathology confirmed metastatic oncocytic thyroid carcinoma with negative surgical margins (Figure 6). Postoperatively, serum Tg levels declined markedly from 304.49 ng/mL to 1.17 ng/mL in one week, consistent with a substantial reduction in disease burden. The patient subsequently completed adjuvant external beam radiation therapy (6000 cGy). At six-month follow-up, he remained clinically well, with a further decline in thyroglobulin to 0.84 ng/mL and no clinical or biochemical evidence of disease recurrence.

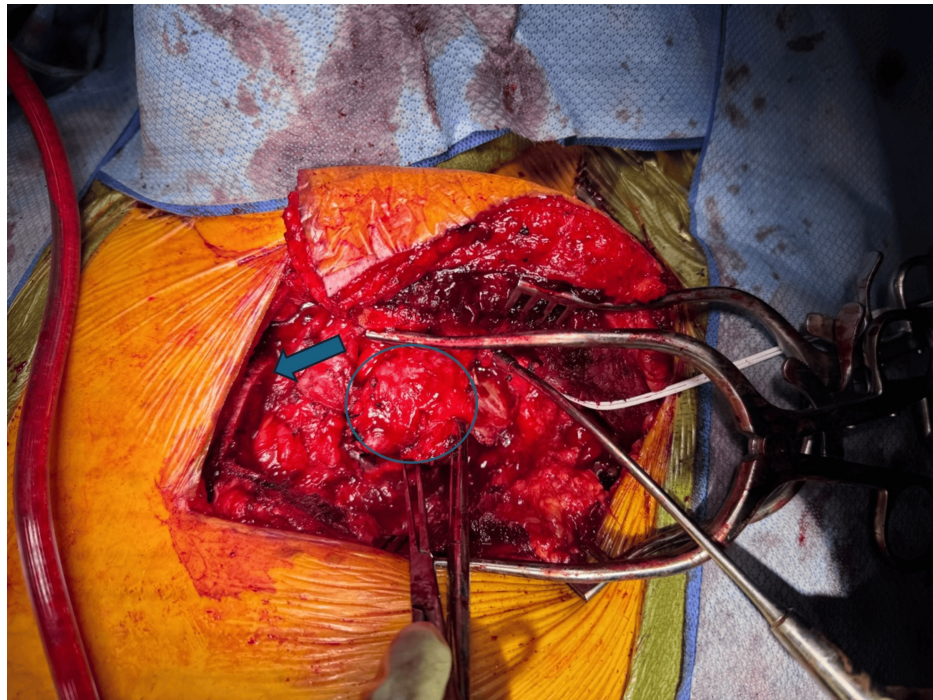


FIGURE 5: Modified trapdoor incision with resection of the clavicle, demonstrating exposure of tumor invading the brachiocephalic vein. The blue circle indicates the exposed tumor, and the blue arrow denotes the resected segment of the first rib

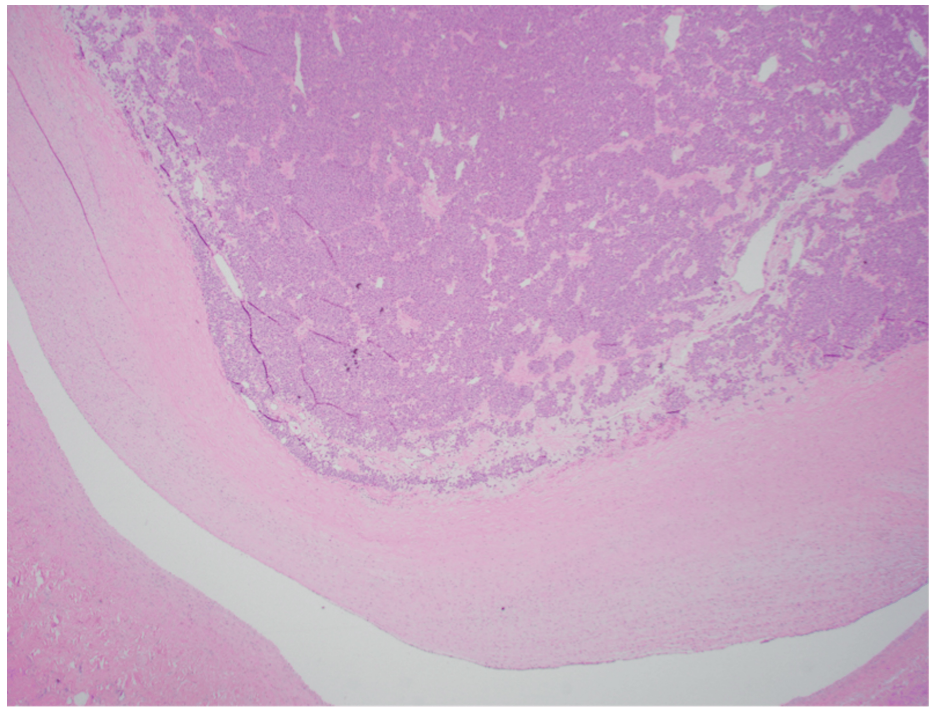


FIGURE 6: Histopathology of the innominate vein, showing metastatic cells composed of sheets of oncocytic origins with abundant eosinophilic granular cytoplasm (low power)

Discussion

This case highlights an unusual presentation of widely invasive oncocytic thyroid carcinoma with progressive mediastinal vascular involvement despite multimodal therapy. Although oncocytic carcinoma is recognized for its propensity toward angioinvasion and hematogenous dissemination [3,4], clinically significant extension into major mediastinal veins such as the brachiocephalic (innominate) vein remains exceedingly rare and presents substantial diagnostic and operative challenges. In this patient, extensive angioinvasion on initial pathology, persistent thyroglobulin elevation despite RAI therapy, and PET-avid venous disease collectively suggested biologically aggressive, structurally persistent disease requiring multidisciplinary evaluation and definitive surgical management.

The present case demonstrates several features associated with biologically aggressive oncocytic carcinoma, including extensive angioinvasion, resistance to RAI therapy, and progression despite initial surgical management. Widely invasive HCC with extensive vascular invasion is associated with significantly worse oncologic outcomes, with the degree of vascular involvement serving as one of the strongest predictors of recurrence, distant metastasis, and disease-specific mortality [6]. The extensive angioinvasion observed on initial pathology likely contributed to hematogenous dissemination and eventual mediastinal venous involvement in this patient.

Unlike papillary thyroid carcinoma, which commonly spreads via lymphatic pathways, oncocytic carcinoma demonstrates a predilection for hematogenous dissemination, most frequently to the lungs, bone, and mediastinum [3,5]. However, direct invasion into great vessels such as the brachiocephalic (innominate) vein is exceedingly rare. Most reports of thyroid carcinoma involving major veins describe papillary or follicular histologies with tumor thrombus extension into the internal jugular vein, brachiocephalic vein, or superior vena cava [8]. Reports specifically describing oncocytic carcinoma with direct mediastinal venous invasion are limited, underscoring the unusual nature of this presentation. Given the extent of extrathyroidal extension in these advanced cases, involving the superior mediastinum, operative planning often requires a multidisciplinary surgical approach to address potential involvement of major mediastinal vessels and ensure safe en bloc resection, as highlighted in prior reports of complex vascular involvement [9].

Another notable feature of this case was the development of a venous aneurysm associated with a metabolically active tumor thrombus. Venous aneurysms involving the brachiocephalic vein are themselves uncommon and are typically congenital or related to trauma, inflammation, or central venous instrumentation [10]. In this patient, progressive aneurysmal dilation likely reflected chronic tumor infiltration of the vessel wall, resulting in structural weakening and intraluminal tumor progression. The presence of increasing thyroglobulin (Tg) levels despite RAI therapy, together with PET avidity, provided

important evidence of persistent structurally incomplete disease and guided operative decision-making.

Management of advanced HCC with major vascular involvement remains challenging because of the rarity of these presentations and the limited evidence guiding treatment decisions. Surgical resection remains the cornerstone of treatment for locoregional disease when technically feasible, particularly in tumors that demonstrate poor RAI avidity [1]. In cases of great-vessel invasion, aggressive en bloc resection with vascular reconstruction may improve locoregional disease control and has been associated with prolonged survival in carefully selected patients with locally advanced differentiated thyroid carcinoma [11]. The decision to proceed with mediastinal exploration in this case was based on persistent biochemical progression, imaging evidence of isolated disease, and the potential for complete surgical clearance.

The modified trapdoor thoracotomy approach provided excellent exposure of the thoracic inlet and proximal mediastinal vasculature, allowing safe control and resection of the involved brachiocephalic vein. Surgical approaches to tumors involving the thoracic inlet remain technically challenging, and adequate exposure is critical to achieving negative margins while minimizing vascular complications. Importantly, complete resection in this patient was associated with a dramatic postoperative decline in Tg levels, supporting the role of surgery in achieving meaningful disease control even after failure of adjuvant RAI therapy.

This case adds to the limited literature on advanced oncocyctic carcinoma involving central mediastinal vasculature and highlights several important clinical considerations: first, extensive angioinvasion on pathology should raise suspicion for occult hematogenous spread; second, persistently rising Tg despite RAI therapy warrants aggressive investigation for structurally persistent disease; and third, carefully selected patients with isolated vascular invasion may benefit from aggressive multidisciplinary surgical management.

Conclusions

This report describes a rare case of widely invasive oncocyctic thyroid carcinoma with direct extension into the brachiocephalic (innominate) vein, ultimately requiring mediastinal resection through a trapdoor thoracotomy. Surgical excision remains the cornerstone of management for Hürthle cell carcinoma. Major venous invasion by oncocyctic carcinoma is rarely reported and presents unique diagnostic and technical challenges. Given the generally aggressive behavior and limited survival benefit associated with oncocyctic thyroid carcinoma, clinicians should maintain a high index of suspicion for recurrent or progressive disease in patients with persistent thyroglobulin elevation despite radioactive iodine therapy. In such cases, further evaluation for structurally occult disease, including vascular involvement, is warranted. Multidisciplinary planning and surgical resection in the setting of great-vessel invasion, when feasible, may achieve durable locoregional control and a meaningful biochemical response. This case contributes to the growing but limited literature regarding the management of advanced oncocyctic thyroid carcinoma with great-vessel invasion.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Elias Wassel, Harpreet Gill, Ashley Stading, Lawrence B. Kong

Acquisition, analysis, or interpretation of data: Elias Wassel, Harpreet Gill, Ashley Stading, Lawrence B. Kong

Drafting of the manuscript: Elias Wassel, Harpreet Gill, Ashley Stading, Lawrence B. Kong

Critical review of the manuscript for important intellectual content: Elias Wassel, Harpreet Gill, Ashley Stading, Lawrence B. Kong

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Review Board, Kaiser Permanente Southern California (KPSC) issued approval N/A. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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