



Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Poorly differentiated thyroid carcinoma with sternal invasion. A case report and review of the literature



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ARTICLE INFO

Article history:

Received 30 June 2014

Received in revised form 11 August 2014

Accepted 9 September 2014

Available online 16 September 2014

Keywords:

Thyroid carcinoma

Poorly differentiated thyroid carcinoma

Thyroid carcinoma with invasion of the sternum

Thyroid carcinoma with sternal metastases

Sternal resection and reconstruction

ABSTRACT

INTRODUCTION: Surgical resection of poorly differentiated thyroid carcinoma with direct invasion of the sternum has not been previously reported. Only 4 cases of concomitant thyroidectomy and sternal resection and reconstruction for sternal metastases have been published.

PRESENTATION OF CASE: A 66-year-old female with a poorly differentiated thyroid carcinoma and direct sternal invasion underwent total thyroidectomy and resection of the manubrium and both clavicular heads, and chest wall reconstruction with polypropylene mesh and bilateral myocutaneous pectoralis major muscle flaps. Postoperatively, the patient received radioactive iodine ablation. She developed a local recurrence, requiring additional ablation with radioactive iodine and external beam radiation therapy. Although there was no clinical or radiographic evidence of recurrent disease 5-years postoperatively, a possible local recurrence was discovered 4 months later.

DISCUSSION: In previous case reports the sternal metastases were not in continuity with the thyroid tumor. In our patient, however, there was evidence of direct extension between the thyroid tumor and the sternal mass that were connected together with cords of tumor.

CONCLUSION: In our patient with poorly differentiated thyroid carcinoma invading the sternum, total thyroidectomy and resection of the manubrium with sternal reconstruction, combined with adjuvant radioactive iodine ablation and external beam radiation therapy was associated with prolonged survival after 5 years despite a small local recurrence.

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1. Introduction

Poorly differentiated thyroid carcinoma is rare and is usually associated with aggressive features. However, only four cases of sternal metastasis from a poorly differentiated thyroid carcinoma that underwent concomitant thyroidectomy and sternal resection and reconstruction have been published in the literature. In previous reports, the sternal metastases were separate from the thyroid mass. In our patient, however, there was evidence of direct extension between the thyroid tumor and the sternal mass.

2. Presentation of case

A 66-year-old female presented with an asymptomatic mass in the neck in March 2009. She had a long history of hypothyroidism secondary to Hashimoto's thyroiditis diagnosed in 1976, and was being medicated with levothyroxine sodium 200 mcg daily. The patient had multiple co-morbidities including morbid obesity, type

2 diabetes mellitus and hypertension. A computed tomography (CT) of the neck with contrast revealed a large, partially calcified heterogeneous mass in the right thyroid lobe with areas of necrosis, measuring 9 cm in transverse dimension, 11 cm in cranio-caudal dimension, and 7 cm in the antero-posterior dimension. There was tracheal narrowing and mass effect upon the hypopharynx and supraglottic larynx. There was evidence of direct invasion of the sternum that showed destructive changes. A contrasted CT scan of the chest showed that the mass in the manubrium measured 8.7 × 5.4 cm and also involved the left clavicular head and superior mediastinal tissues (Fig. 1). An ¹⁸F-fluoro-deoxy-glucose (¹⁸F-FDG) positron emission tomography (PET) scan showed heterogeneous radiopharmaceutical uptake compatible with areas of necrosis with an average standardized uptake value (SUV) equal to 24.84. Invasion by direct extension into the manubrium was identified, with complete destruction of the bone to the level of the sternomanubrial junction (Fig. 2). There was no mediastinal or hilar lymphadenopathy, and no pulmonary nodules or distant areas with abnormal FDG uptake were detected. A fine-needle aspiration biopsy of the thyroid mass was suggestive of follicular carcinoma. Multiple core biopsies of the sternal mass revealed an invasive follicular thyroid carcinoma.

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Fig. 1. Preoperative contrast enhanced computed tomographic scan of the chest showing a mass in the sternal manubrium that measured 8.7 × 5.4 cm at the level of the left brachiocephalic vein that also appeared to involve the left clavicular head.

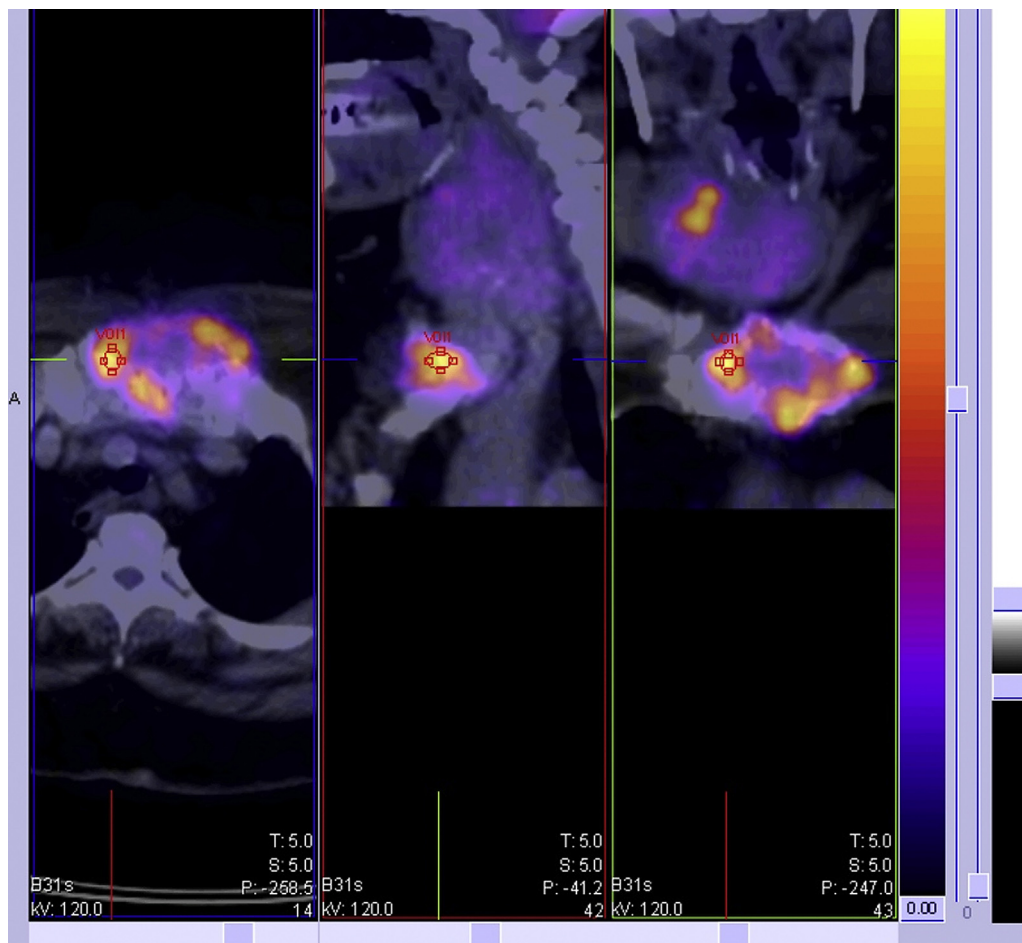


Fig. 2. Preoperative PET-CT scan showing a large, heterogeneous mass arising primarily from the right thyroid lobe that measures approximately 5.6 × 6.8 cm in greatest axial dimensions. Calcifications are present within this mass. Heterogeneous radiopharmaceutical uptake compatible with areas of necrosis is identified with an average SUV equal to 24.84. A mass was identified in the manubrium in direct contact with the thyroid tumor. Complete destruction of the manubrium down to the level of the sternomanubrial junction is identified. (CT = computed tomography; PET = positron emission tomography; SUV = standardized uptake value).

The patient underwent combined surgical resection of the locally advanced thyroid cancer invading the sternal manubrium. A low cervical incision was used to perform a total thyroidectomy and central compartment lymph node dissection. The large tumor that was replacing the right thyroid lobe extended posterior to the pharynx on the right side and into the mediastinum. Both recurrent laryngeal nerves were identified and protected. The right superior parathyroid gland was reimplanted in the left deltoid muscle. Thick cords of tumor could be seen connecting the thyroid mass and the sternal tumor. A central compartment neck dissection was performed after dividing these cords of tumor. After closing the cervical incision, the patient was kept intubated overnight. The following day, en-bloc resection of the upper half of the sternum and both clavicular heads was performed. The chest wall defect was reconstructed using polypropylene mesh and bilateral pectoralis major muscle myocutaneous flaps.

The patient had no postoperative complications. She was extubated on the first postoperative day. She had no hoarseness or dysphagia. The patient was discharged on postoperative day 14 after removal of all the drains.

Surgical pathology final report revealed that the right thyroid lobe was replaced by a multinodular mass measuring 9.5 × 7.4 × 5.2 cm. Microscopic examination of the thyroid mass showed poorly differentiated thyroid carcinoma with varied morphology and large areas of solid nests (insular carcinoma) with lymphovascular invasion, areas of coagulative necrosis, and foci with well-defined follicles (Fig. 3). Tumor was present at the

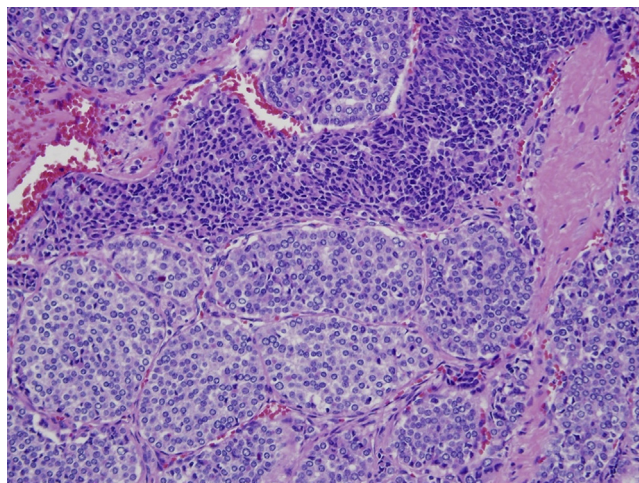


Fig. 3. Microscopic pathologic examination of the thyroid tumor with hematoxylin and eosin staining demonstrating a poorly differentiated thyroid carcinoma with varied morphology, consisting of large areas of solid nests (insular carcinoma), areas with trabeculated architecture and foci with follicles containing intraluminal colloid (×100).

right resection margins and was extending into the extrathyroid soft tissue. The sternal mass measured 10.0 × 7.5 × 5.0 cm. Microscopic examination showed poorly differentiated thyroid carcinoma invading sternum, both clavicles, skeletal muscle, adipose

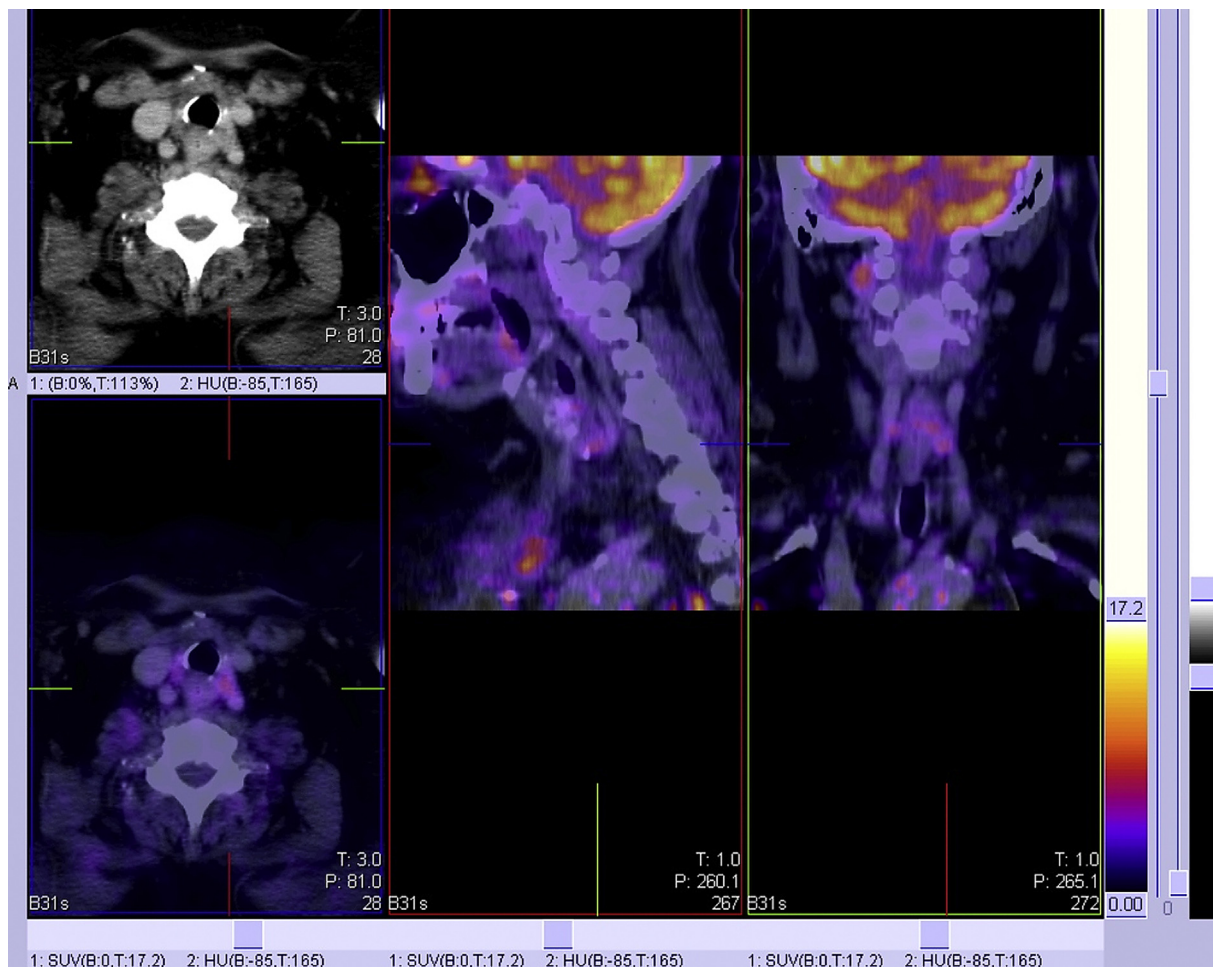


Fig. 4. Five-year postoperative PET-CT scan showing patchy FDG activity along the left posterior aspect of the innominate vein. Anterior to the trachea, soft tissue with minimal FDG activity is noted, likely reflective of prior radiation therapy. (CT = computed tomography; FDG = fluoro-deoxy-glucose; PET = positron emission tomography).

and fibrous tissue, and extension to the resection margins. Tumor cells were present in trabecular bone at the specimen edge of both clavicles. Pathologic staging was classified as stage IV-A (pT3a N1a M0).

Following discharge from the hospital, the patient was kept on a strict non-iodine diet, and was treated with liothyronine 25 mcg twice daily. Three months postoperatively, the patient received radioactive iodine ablation with 200 millicuries (mCi) of iodine-131 (¹³¹I).

The patient has been followed at regular intervals with PET–CT scans every 6 months. One year postoperatively, the PET–CT scan showed a 1.5 cm metabolically active nodule anterior to the left subclavian artery, consistent with recurrent disease (average SUV of 34.3). A CT guided percutaneous biopsy was positive for recurrent thyroid carcinoma. The patient was treated with an additional 200 mCi ¹³¹I for thyroid cancer ablation. A post ablation whole body ¹³¹I scan and single-photon emission computed tomography (SPECT) scan revealed no evidence of residual thyroid carcinoma. A repeat PET–CT scan 2 years postoperatively revealed a large soft tissue lesion in the sternal resection bed with markedly abnormal FDG activity (average SUV 32.9), compatible with recurrent disease. No new metastatic lesions were present. The tumor appeared to be invading the innominate vein and was not considered resectable. The patient subsequently received external beam radiation therapy (EBRT), with a total dose of 7000 centigray (cGy) in 35 fractions of 200 cGy to areas of FDG activity. Post-radiation therapy PET–CT scan revealed regression of tumor volume with significantly decreased metabolic activity, with an average SUV of 6.1.

A contrast enhanced CT scan of the neck obtained 5-years postoperatively showed areas of scar tissue around trachea at the site of surgical resection, but no residual tumor. No enlarged lymph nodes were seen within the neck. The PET–CT scan showed residual patchy FDG activity anterior to the trachea with minimal FDG activity, likely reflective of prior radiation therapy, although recurrent tumor could not be excluded (Fig. 4). The patient is currently receiving additional radioactive iodine ablation therapy, because a suspicious nodule was seen 5 1/2 years postoperatively on a thyrogen stimulated 123 I whole body scan in the left thyroid resection bed.

3. Discussion

Both morphologically and behaviorally, poorly differentiated thyroid carcinoma (PDTC) lie between well-differentiated (WDTC) and undifferentiated (anaplastic) carcinomas. Diagnostic criteria for PDTC include: the presence of a solid/trabecular/insular pattern of growth; and at least one of the following features: convoluted nuclei, mitotic activity $\geq 3 \times 10$ HPF, and tumor necrosis.¹ When diagnosed, PDTCs are typically at an advanced stage of disease, with extrathyroidal extension and extensive local invasion. They have a propensity to metastasize to regional lymph nodes, and distantly to the lung and bones. The 5- and 10-year survival rates are considerably worse in patients with PDTC (50% and 34%) than in patients with WDTC (95% and 86%).²

Given the aggressiveness of PDTC and the poor survival rates in patients who undergo surgery alone, a multimodality treatment approach is required. Most surgeons agree that the primary treatment is total thyroidectomy, with lymph node dissection whenever feasible. Postoperative radioactive iodine (RAI) ablation therapy is usually recommended. External beam radiation therapy (EBRT) is typically reserved for patients with incomplete resection.³

According to the Memorial Sloan-Kettering Cancer Center experience,⁴ 10 of 27 (37%) patients with PDTC presented with distant metastases. Of 14 patients (52%) who died of thyroid cancer,

11 patients died of distant disease and 3 died of uncontrollable locoregional disease with distant metastatic disease also present. The poor survival was attributable to distant metastatic disease in the majority of patients, rather than locoregional recurrence.

To our knowledge, reports of only 4 patients who underwent concomitant thyroidectomy and sternal resection and reconstruction have been published in the literature: 3 patients with PDTC,^{5–7} and one patient with a follicular thyroid carcinoma.⁸ In those patients, the sternal involvement represented metastases to the sternum that were not in continuity with the thyroid tumor. In our patient, however, there was evidence of direct extension between the thyroid tumor and the sternal mass that were connected together by cords of tumor. The only similar case previously reported in the literature was by Machens and Dralle⁹ who described a 67-year-old man who had a large follicular thyroid carcinoma with direct invasion of the sternum through adjacent tumour spread in continuity. The authors did not mention whether their patient underwent resection or not. Machens and Dralle⁹ suggested that thyroid carcinoma with concurrent tumor abutting the upper part of the sternum should not be diagnosed as “metastasis to the sternum” unless all soft tissues adjoining the area of sternal involvement are free of the tumor.

Ibrahimasic and colleagues⁴ reported that the majority of patients with PDTC presenting with gross extrathyroidal extension (ETE) underwent extended total thyroidectomy and extrathyroidal resection with organ preservation, either by shaving the tumor off the trachea, larynx or both, or by partial thickness esophagectomy. None of their patients with ETE, however, presented with direct sternal invasion.

Most authors agree that surgical resection of bulky sternal metastases is a palliative measure, intended to improve quality of life. Furthermore, a debulking operation may also improve the efficacy of subsequent radioiodine treatment.^{6,10}

Several methods of reconstruction after sternal resection have been reported, most of which consist of prosthetic material in combination with viable muscle flaps. According to Lequaglie and associates¹¹ long-term results after treatment of sternal tumors by means of broad sternal resection and plastic reconstruction using prosthetic material and myocutaneous flaps is safe and effective.

4. Conclusion

Only 4 previous case reports of thyroidectomy and concomitant resection of sternal metastases and chest wall reconstruction have been published in the literature. The unique aspect of our case is the fact that there was evidence of direct extension between the thyroid tumor and the sternal mass. In our patient, total thyroidectomy and resection of the manubrium with sternal reconstruction, combined with adjuvant radioactive iodine ablation and external beam radiation therapy was associated with prolonged survival after 5 years, despite local recurrence of tumor.

5. Consent

Ethics committee approval was obtained for publication of this case report.

Also, a fully informed written and signed consent was obtained from the patient for publication of this case report and accompanying images in the International Journal of Surgery Case Reports. A copy of the written and signed consent is available for review by the Editor-in-Chief of the International Journal of Surgery Case Reports on request.

Conflict of interest statement

The authors have no conflicts of interest to disclose.

Funding

The authors have not received any payments or services, either directly or indirectly from a third party in support of any aspect of this work.

Ethical approval

Ethics committee approval was obtained for publication of this case report by the institutional Human Research Review Committee.

Author contributions

Quaratulain Sabih, MD—data collection, data analysis, drafting the manuscript, acquisition of images, and final approval of the version to be submitted.

Michael F. Spafford, MD—study design, data analysis and interpretation, revising the manuscript, and final approval of the version to be submitted.

Charles A. Dietl, MD—study design, data collection, data analysis and interpretation, revising the manuscript, and final approval of the version to be submitted.

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