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Case Report

Brachial plexus compression: a rare sequelae of malignant papillary thyroid carcinoma

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Abstract: Invasive papillary thyroid carcinoma (PTC) can rarely invade adjacent vital structures. There has been one report on secondary brachial plexopathy associated with locally invasive PTC. Here we report a patient with a large locally invasive PTC associated with secondary neoplastic brachial plexopathy. The case exhibits an extremely rare occurrence that has substantial impact on surgical planning and management.

Keywords: Thyroid, papillary, brachial plexus, plexopathy, carcinoma

Introduction

Neoplastic brachial plexopathy occurs in a small percentage of cancer patients. It is most often associated with breast and lung malignancy [1]. To our knowledge, there has been one previous report of a papillary thyroid carcinoma (PTC) associated with secondary compressive brachial plexopathy [2]. Our case is unique from the previous report in that there was direct local invasion of the brachial plexus from tumor, making this a challenging process to manage. Here we report an unusual presentation of brachial plexopathy associated with a sizeable and aggressive PTC.

Case presentation

A 30-year-old Caucasian male was referred for surgical evaluation of a left neck mass. The patient was unaware of the mass until it was brought to his attention by a co-worker two weeks prior to his referral. Interestingly, the patient's only complaint was a one month history of radiating sharp pain in to his left shoulder and arm. Physical examination revealed a large 8 cm left neck mass at levels III-V in the left neck. There was a sensory deficit present over his left shoulder and arm without any motor deficit in neurological examination of the extremities. Flexible laryngoscopy demonstrated normal vocal cord function. Computed Tomography (**Figure 1**) revealed an 8 x 6 cm heterogeneous mass in the left thyroid lobe with substernal extension causing tracheal deviation to the right side. The mass contained cystic and solid components as well as microcalcifications. Comprehensive neck ultrasound examination showed suspicious lymphadenopathy in central, lateral and posterior compartments of the left neck with largest lymph node measuring 13.5 x 4.5 cm. Fine needle aspiration biopsies were positive for papillary thyroid carcinoma. Gadolinium enhanced MRI of neck and chest (**Figure 2**) revealed a 13.5 x 4.6 x 3.1 cm left cervical mass with brachial plexus compression. The patient underwent total thyroidectomy, bilateral central lymph node dissection and left, modified radical neck dissection. The tumor involved the left recurrent laryngeal nerve and significant dissection was performed to dissect the tumor of the nerve, however, despite all the efforts, we were unable to stimulate the nerve at the end of the operation. Secondary to local tumor burden, the neurosurgeon participating in the case performed decompression of the left vertebral artery and left superior and middle trunks of the brachial plexus. The tumor was found to invade the adventitia of these structures. Additionally, an un-resectable portion of tumor at the skull base near the jugular foramen was encountered intraoperatively. From a total of 40 collected

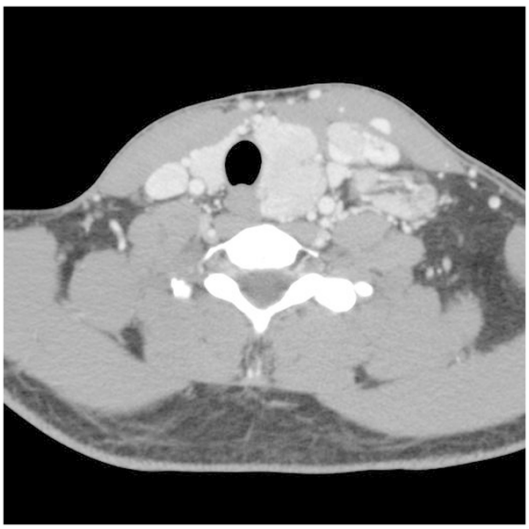

Figure 1. Axial contrasted enhanced CT shows a 8 x 6 cm complex left thyroid mass.

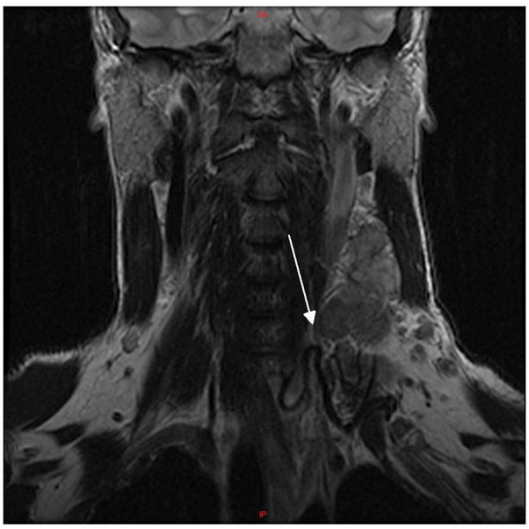

Figure 2. Coronal fat suppressed T2 MRI – the arrow demonstrates a 13.5 x 4.6 x 3.1 cm left cervical mass compressing the brachial plexus.

lymph nodes, pathology found 19 to have metastatic PTC. The tumor was positive for BRAF-V600E mutation. Postoperative flexible laryngoscopy revealed complete left vocal cord immobility with intact right vocal cord movement and complete cord approximation and glottic closure.

The patient reported resolution of arm, shoulder, and deltoid symptoms postoperatively. Patient underwent post-operative radioactive iodine (I-131) therapy and had no evidence of recurrence at the 18-month follow-up period.

Discussion

Papillary carcinoma is the most common cancer of the thyroid accounting for 80-85% of cases. Fortunately, most cases of PTC carry a favorable prognosis with survival rates exceeding 95% at 25 years [3]. However, the behavior of PTC is dependent on several factors including-local invasion, nodal metastasis and BRAF mutation – which negatively impact prognosis [4]. A Memorial Sloane-Keterring Cancer Center study found that 10-year survival rates in patients without extra thyroidal spread (ETS) more than doubled those of patients with ETS [5]. Estimated to occur in 15% of cases, local invasion affects the recurrent laryngeal nerve (8-11% of thyroid cancers), carotid artery, internal jugular vein, phrenic nerve, the strap muscles, esophagus and trachea. The strap muscles are the most often invaded structures, followed by the recurrent laryngeal nerve and trachea. Anterior invasion is associated with less mortality and morbidity as compared to posterior invasion [5]. Although death from thyroid cancer is uncommon, tracheal and esophageal invasion remains responsible for a large portion of thyroid cancer mortality [1, 5, 6]. Our lit-erature review resulted in a single similar case report [2] describing brachial plexus neuropathy secondary to a massively enlarged PTC, suggesting the scarcity of such a finding.

The brachial plexus is responsible for communicating motor, sensory, and sympathetic innervation to and from the upper extremities. It originates in spinal nerve roots C5-T1 and courses to the axilla before giving rise to the peripheral nerves of the upper extremities. Injuries to the brachial plexus can result in considerable morbidity and present in a myriad of ways including: weakness, asthenia, sensory loss, paresthesia, pain, and vasomotor abnormalities [2]. Brachial plexopathy secondary to neoplastic compression is a relativity rare complication of malignancy, with 0.43% of cancer patients being affected. Cancers originating from the breast and lung are most commonly the culprits, accounting for 32% and 37% of cases respectively [1]. Primary head and neck cancers tend to invade inferiorly, most likely affecting the superior and middle brachial trunks. Lymph node metastasis can also contribute to brachial plexopathy. This may pro-

duce a scattered symptomology; clouding the clinical picture while making it more difficult to localize lesions. Among patients with neoplastic brachial plexopathy, the most common presenting symptom is pain, often localized to the axilla and shoulder. Motor and reflex findings were appreciated in a large portion of individuals while lymphedema only affected 15% of patients. Sensory deficits in the submandibular area, the mandibular angle, and anterosuperior and lateral neck region are not uncommon findings [1].

MRI is the imaging modality of choice if there is concern for tumor involvement of the brachial plexus. The use of conventional gadolinium enhanced 2D MRI is the standard when assessing initial tumor invasion and potential osseous involvement of the neoplasm. 3D STIR SPACE MRI sequence can be added to study the brachial plexus on both sides allowing for determination of: origin of the tumor, infiltration pattern and degree of perineural dissemination [7].

When treating a patient with aggressive PTC, it seems prudent to weigh the extent of aggressiveness of the cancer to individualize the optimal surgical plan [8]. This patient differs from the previously reported case of invasive PTC with brachial plexus compression [2] in that there was direct local invasion of the brachial plexus from tumor. There are no current guidelines that dictate treatment of locally invasive PTC with brachial plexus invasion. In this scenario, the goals of surgery are complete gross tumor removal with maximal preservation of function. Patients with microscopic or gross residual tumor should have radioactive iodine ablation or even external beam radiation therapy. These tumors are often poorly differentiated and have low radioactive iodine uptake [5, 9].

Conclusion

Locally, invasive PTC can manifest with secondary neoplastic brachial plexopathy in the arm, deltoid, and shoulder. Clinicians must be cognizant of this in their management of thyroid cancer. Neurological symptoms related to extrathyroidal invasion/impingement of the brachial plexus can be treated by sound oncologic resection.

Disclosure of conflict of interest

All co-authors have reviewed and agree with the contents of the manuscript. There are no financial interests to disclose. We certify that the submission is original work and is not under review at any other publications.

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