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Lateral ectopic thyroid mimics carotid body tumor on Indium-111 pentetreotide scintigraphy

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ABSTRACT

A 34-year old woman with past history of anxiety, depression, and hypothyroidism resulting from prior total thyroidectomy for multinodular goiter presented with complaints of palpitations, sweating, and tachycardia. Clinical examination revealed a painless right lateral neck mass. USG/CT of the neck revealed the soft tissue mass located at the right carotid bifurcation. A subsequent Indium-111 pentetreotide somatostatin receptor scintigraphy (SRS) demonstrated tracer uptake in the mass. Hence, secretory carotid body tumor/paraganglioma was strongly suspected. However, post-surgical histopathological specimen revealed only benign thyroid follicles indicative of lateral ectopic thyroid with no evidence of neuroendocrine cells or malignancy. This case highlights the importance of considering lateral ectopic thyroid, a very rare entity, in the differential diagnosis for carotid bifurcation masses. Also highlighted is the false positivity from normal but ectopic thyroid tissue on Indium-111 pentetreotide SRS mimicking a paraganglioma.

1. Introduction

Lateral ectopic thyroid gland (LET) is a very rare entity and constitutes only 1–3% of all ectopic thyroid locations [1]. It is defined as thyroid tissue in the submandibular region or lateral to the carotid sheath, or superficial to the infrahyoid strap muscles [2]. The origin of LET is controversial but one theory is its possible origin from ultimobranchial body which is derived from the lateral anlagen of the embryological thyroid [3]. LET can present as the only thyroid tissue or can coexist with normal eutopic thyroid gland in an affected individual [4,5]. Among the reported LET in literature, submandibular space involvement is more common than carotid space involvement [3]. A right sided predominance has also been suggested [3,6]. To our knowledge, only 4 cases of surgically proven LET mimicking carotid body tumor or paraganglioma have been reported in the literature, with all 4 being on the right side [6–9]. None of the previously reported cases underwent somatostatin receptor scintigraphy (SRS). Here, we report a right sided LET in a young woman that mimicked a paraganglioma clinically as well as on imaging with ultrasound (US), computed tomography (CT) and Indium-111(In-111) pentetreotide SRS.

2. Case presentation

A 34-year old female with past history significant for anxiety and depression requiring pharmacotherapy, polycystic ovarian disease and hypothyroidism presented complaining of palpitations, sweating, and tachycardia. She had undergone total thyroidectomy 4 years earlier for multinodular goiter, and was maintained on thyroid hormone replacement. She was being managed with doxepin, nortriptyline and quetiapine for her depression. On physical examination, her vitals were stable and BMI was 53. There was a palpable, non-pulsatile, right lateral neck mass which was suspected to be a lymph node. Her free T3 was 3.4 (normal values −2.3–4.2 pg/mL), free T4 was 0.7 (normal values −0.7–1.5 ng/mL) and TSH was 6.54 (normal values −0.45–4.5 mIU/L). A neck US revealed a 3.2 × 2.4 × 2.1 cm mass at the right common carotid bifurcation, splaying the internal carotid (ICA) and external carotid (ECA) arteries, and without significant internal vascularity on color Doppler US (Fig. 1A). This was again confirmed on a contrast enhanced CT neck which revealed a heterogeneously enhancing soft tissue mass at the right carotid bifurcation (Fig. 1B and C). A differential diagnosis of carotid paraganglioma, lateral ectopic thyroid tissue and metastatic lymph node were suggested from imaging findings. Plasma free metanephrine was < 0.20 nmol/L (normal values < 0.50 nmol/L, mayo lab), plasma free normetanephrine was 0.66 nmol/L (normal values < 0.90 nmol/L, mayo lab) and urine metanephrine was 177μg/24 h (normal values −30–180μg/24 h in normotensives and < 400μg/24 h in hypertensives). However, urine normetanephrine was elevated at 956μg/24 h (normal values −111–419μg/24 h in

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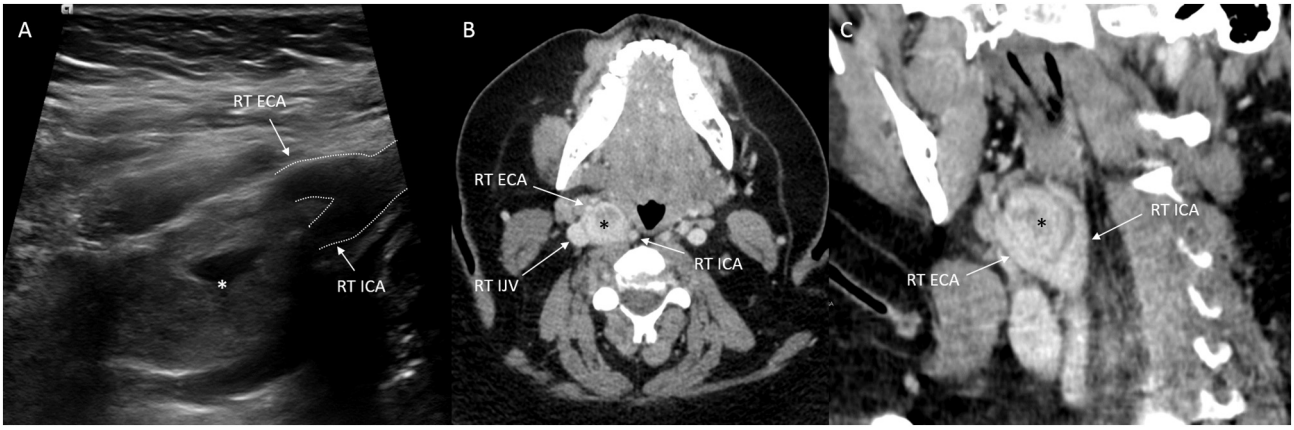

Fig. 1. (**A**) Neck ultrasound demonstrates a 3.2 × 2.4 × 2.1 cm mass* at the carotid bifurcation between right internal carotid artery (RT ICA) and external carotid artery (RT ECA), a location typical for paraganglioma; Axial (**B**) and sagittal oblique (**C**) contrast neck CT images confirms the presence of a soft tissue mass* at the right carotid bifurcation splaying ICA and ECA. The mass shows heterogeneous enhancement with a central hypodensity.

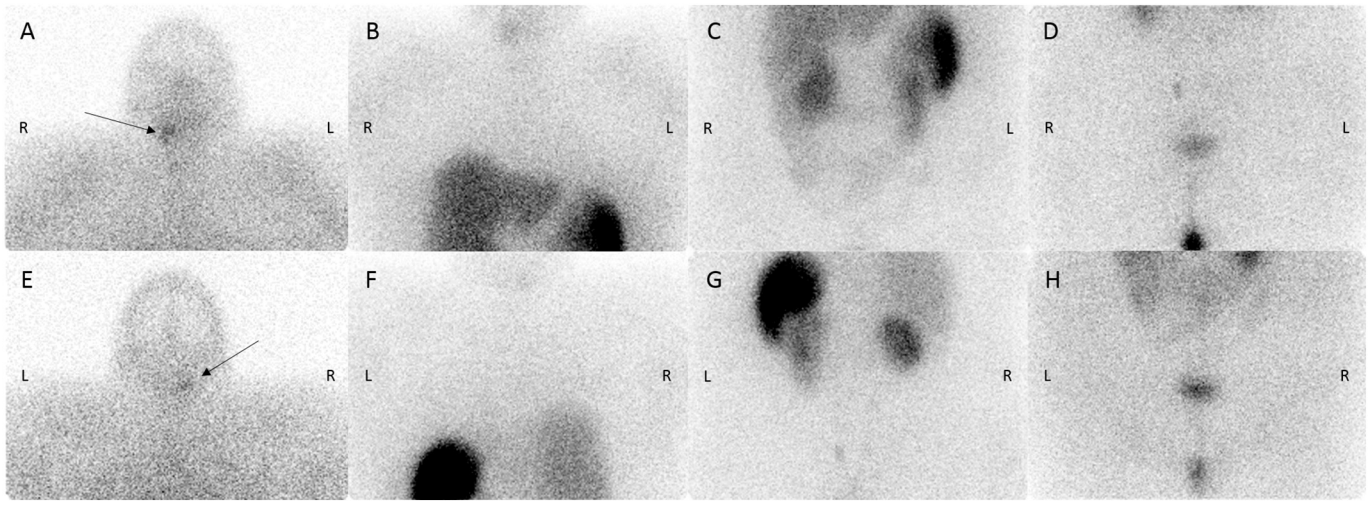

Fig. 2. In-111 pentetreotide SRS was performed; planar anterior (**A**, **B**, **C**, **D**) and posterior (**E**, **F**, **G**, **H**) images are displayed from vertex to upper thighs show focal uptake (arrow) in the right side of the neck (A, E).

normotensives and < 900μg/24 h in hypertensives). Family history was negative for neuroendocrine tumors (NET). On the basis of reported symptoms (sweating and palpitations), typical location of the mass, bright contrast enhancement, and mildly elevated urinary normetanephrine, a clinical diagnosis of secretory carotid paraganglioma was strongly considered. A nuclear scintigraphy study was requested. The patient was on nortriptyline, doxepin (tricyclic antidepressants) and quetiapine (anti-psychotic), and her psychiatrist did not want to hold her medications. Both these class of drugs are known to affect the result of Iodine-123 (I-123) metaiodobenzylguanidine (MIBG) scintigraphy [10], and hence SRS study using In-111 pentetreotide was chosen. The SRS planar images revealed focal uptake in the right side of the neck (Fig. 2). For better localization, SPECT/CT of the neck was performed which confirmed uptake related to the soft tissue mass at the carotid bifurcation, and supported the clinical diagnosis of carotid paraganglioma (Fig. 3). The patient wanted surgical excision over wait-and-scan approach or radiotherapy. Prior to surgery she was treated with a two-week course of phenoxybenzamine for alpha receptor blockade. At surgery, the mass was seen located within the carotid sheath at the carotid bifurcation and was easily dissected off the carotid vessels and lower cranial nerves (X, XII). A limited lymph node dissection (right level IIA) was also performed. The pathology report indicated the tumor was composed of thyroid tissue with enlarged follicles and there was no evidence of neuroendocrine cells or malignancy. The right level IIA lymph node was negative for abnormality.

3. Discussion

The differential diagnosis for a carotid artery bifurcation mass includes paragangliomas (carotid body tumor, glomus vagale), nerve sheath tumors (vagal schwannoma, sympathetic chain schwannoma, neurofibromas), lymph nodal mass (metastases, lymphoma), vascular mass (dissection, pseudo-aneurysm), salivary gland tumors, branchial cleft cyst, and other soft tissue tumors like sarcomas [11]. LET at this location is very rare. Among the few LET's reported in the carotid space in the English literature [4,6–9,12], only two were clearly documented on imaging to be present at the carotid bifurcation splaying the ICA and ECA like a carotid body tumor [6,7]. In both cases, LET was present on the right side with a normally functioning eutopic midline thyroid tissue. On histopathology, one was a thyroid adenoma [6] and the other was normal accessory thyroid tissue [7]. To our knowledge, this is likely the third such surgico-pathologically documented LET at the carotid bifurcation and incidentally was also on the right side with a previously documented but surgically removed midline eutopic thyroid.

On imaging, there are potential clues for differentiating LET at the carotid bifurcation from more common entities like carotid body paraganglioma or nerve sheath tumor. On non-contrast CT, ectopic thyroid tissue is hyperdense (70 HU ± 10) due to its inherent higher

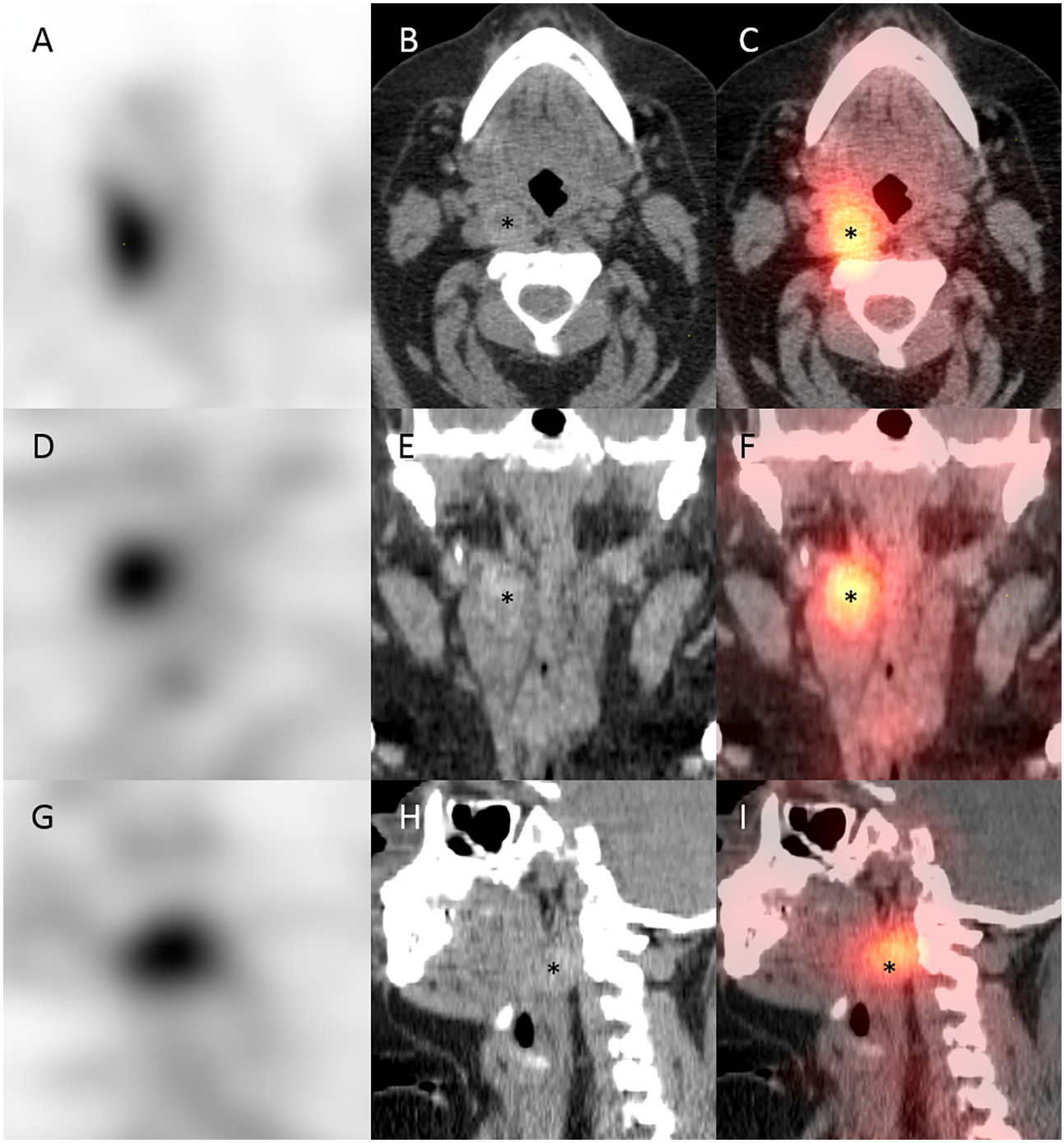

Fig. 3. For better localization, SPECT/CT of the neck was performed; SPECT, CT, fused images respectively in axial (**A**, **B**, **C**), coronal (**D**, **E**, **F**) and sagittal (**G**, **H**, **I**) planes demonstrate uptake in the mass* at the right carotid bifurcation. Note the hyperattenuation (> 70HU) in the mass lesion in the non-contrast CT images, a clue that this could be thyroid tissue. Normal thyroid tissue or neoplasms can show uptake in SRS like paragangliomas due to variable expression of the receptor, an important pitfall.

iodine content [2]. The hyperattenuation was also present in our index case in the non-contrast CT images of SRS SPECT-CT (Fig. 3). On MRI (not performed on our patient), LET does not show flow voids or the typical 'salt and pepper sign' on T2-weighted image typical of carotid body paraganglioma [11]. Nerve sheath tumors are typically hypoattenuating on non-contrast CT with heterogeneous enhancement and demonstrate oblong or fusiform morphology. It would be indeed difficult to differentiate a carotid bifurcation LET from metastatic lymph node except on the basis of non-contrast CT attenuation.

When in doubt, imaging with SRS studies including In-111 pentetreotide scintigraphy are useful to differentiate paragangliomas from other head and neck masses including carotid bifurcation lesions with some specificity [11,13]. SRS for demonstration of paragangliomas is based on the high expression of somatostatin type 2 receptors by these tumors [14]. However, it is a fact that normal thyroid tissue, thyroid neoplasms like Hurthle cell carcinoma, parafollicular C cells which can be present in eutopic thyroid tissue, and medullary thyroid carcinoma (MTC) arising from parafollicular C cells can also show uptake on SRS due to the variable expression of somatostatin receptors [13,15,16]. Thyroid uptake has been reported in

approximately 70% of patients undergoing In-111 pentetreotide SRS [17], with variations between individuals [18]. In-111 pentetreotide SRS is also used for detecting MTC metastasis and recurrence [19] but MTC in an ectopic thyroid is extremely rare [20]. Aside from paragangliomas and primary thyroid neoplasms, thyroid pathology such as Hashimoto's and Graves can also show uptake [15]. This pitfall of false positivity is clearly demonstrated in our case and radiologists should be aware of this caveat. If LET is suspected on initial CT or MRI, then I-123 scintigraphy would be an appropriate next step to confirm presence of thyroid tissue [21]. Other nuclear exams, such as I-123 MIBG scintigraphy and more recently Gallium-68 1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid–octreotate (Ga-68 DOTATATE) PET/CT are also used for identifying paragangliomas but can equally suffer from false positivity due to physiological uptake by normal thyroid tissue [22,23].

The presenting symptoms in our patient partly had a role in the bias towards the clinical diagnosis of secretory carotid body paraganglioma. We do not have a confirmed explanation for her reported palpitations and sweating in the setting of post-surgical hypothyroidism but believe that the symptoms were likely related to anxiety. Her reported symptoms significantly reduced after the removal of LET. Her surgically induced hypothyroidism and suboptimal thyroid replacement as evidenced by elevated TSH could have contributed to the enlargement of the ectopic thyroid tissue at the carotid bifurcation. The other red herring in our case was the presence of elevated urinary normetanephrines. In subjects on tricyclic anti-depressants, elevated plasma or urinary metanephrines and normetanephrines should always be interpreted with caution [24].

4. Conclusion

Ectopic thyroid tissue is usually in the midline with lingual location in 70–90% of cases. LET constitutes only 1–3% of all ectopic thyroid locations with an unusual right sided predominance [3], which if not by chance may have an unknown embryological explanation. Even rarer is LET close to the carotid bifurcation with only 5 cases previously reported in literature [4,6–9]. It is important to differentiate LET at this location from paraganglioma based on subtle imaging clues to potentially avoid surgery. When LET is suspected prospectively, imaging with I-123 would be appropriate. An important pitfall to remember is that LET can show uptake like carotid body paraganglioma on SRS scintigraphy (whether radiotracer is labeled with In-111 for gamma imaging or with Ga-68 for PET imaging) due to variable expression of somatostatin receptors.

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