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PET/CT 18F-Fluorocholine Localization of Ectopic Intra-Vagal Parathyroid Adenoma

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1 | Case Description

A 62-year-old man presented with renal stones and bony pains; biochemistry demonstrating hypercalciuria (24-h urinary calcium 12.1 mmol/L), hypercalcemia (calcium 2.78 mmol/L), and borderline-elevated parathyroid hormone (PTH 6.1 pmol/L). Preoperative localization with ultrasound and sestamibi was negative. He underwent four-gland exploration with resection of three parathyroids for presumed hyperplasia, leaving the left inferior gland intact. Postoperatively, calcium (2.66 mmol/L) and PTH (7.6 pmol/L) remained elevated, with histology demonstrating normal parathyroid tissue. Further imaging with 4D CT and ultrasound revealed a right-sided vagal lesion, initially suspected to be a schwannoma.

He was referred to our specialist endocrine surgery unit and subsequent 18F-fluorocholine PET/CT demonstrated an avid lesion within the right carotid sheath [Figure 1]. Multidisciplinary review favored an ectopic parathyroid adenoma. Re-exploration confirmed a 1.5 cm right intravagal parathyroid adenoma. Enucleation was performed via longitudinal vagal perineurium incision, preserving nerve integrity under intraoperative monitoring [Figure 2]. Intraoperative PTH dropped appropriately, and postoperative recovery was uneventful, with normalization of calcium (2.3 mmol/L), PTH (3.5 pmol/L), and preserved vocal cord function.

2 | Discussion

Primary hyperparathyroidism (PHPT) is characterized by excessive parathyroid hormone secretion, resulting in hypercalcemia. The most common etiology is a solitary parathyroid adenoma (89%), followed by parathyroid hyperplasia (6%), double adenomas (4%), and, rarely, parathyroid carcinoma [1]. Surgical excision remains the mainstay of treatment; however, persistent disease occurs in approximately 3%–6% of cases, often due to undetected ectopic or supernumerary glands.

The superior and inferior parathyroid glands develop from the fourth and third pharyngeal pouches, respectively, and migrate to lie adjacent to the thyroid. Aberrations during descent may result in ectopic parathyroids, located anywhere from the carotid sheath to the mediastinum. Inferior glands are most often found near the inferior thyroid pole (57%), intrathymically (41%), or along the carotid artery (2%) [2].

Intravagal parathyroid adenomas are exceedingly rare, with fewer than 25 cases reported in the literature globally [3–5]. This anomaly likely arises from parathyroid elements destined for the inferior glands becoming attached to the vagus nerve during embryogenesis [6].

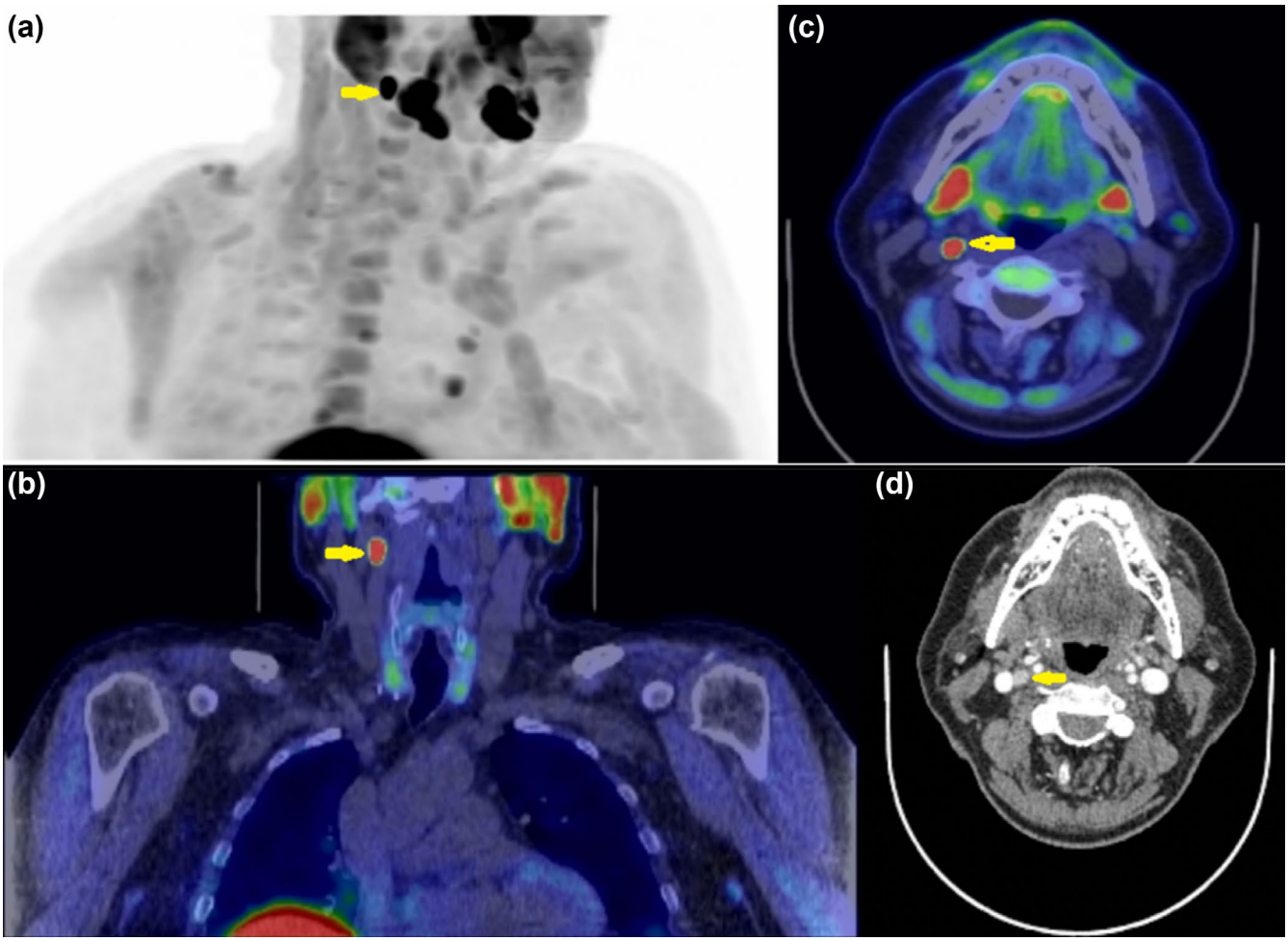

FIGURE 1 | Digital Fluorine-18-fluorocholine PET/CT with 3D reconstruction (a), demonstrating a 16 mm right parathyroid adenoma with high fluorine-18-fluorocholine uptake (SUV Max 17.8) (b and c). Contrast-enhanced CT (d) illustrating the unusual location of the parathyroid adenoma between the right internal carotid artery and the jugular vein.

FIGURE 2 | Excised specimen from the right carotid sheath consisting of vagal nerve fibres (b) within which contains the right parathyroid adenoma (a).

Accurate pre-operative localization improves the cure rate after a parathyroidectomy. Standard modalities include neck ultrasound and technetium-99 m sestamibi or SPECT (single photon emission computed tomography) imaging. 18F-fluorocholine PET/CT has emerged as a valuable alternative, utilising the increased uptake of choline by parathyroid adenomas. By combining both functional (PET) and anatomical (CT) information, it provides superior spatial resolution and improves localization accuracy in small or ectopic glands [7, 8]. Limitations include cost, restricted tracer availability, and limited access to PET facilities [7].

Surgical excision of intravagal parathyroid adenomas requires meticulous dissection, often involving a longitudinal split of the vagus nerve to enucleate the lesion while preserving nerve integrity. Despite careful technique, transient recurrent laryngeal nerve palsy may occur [4].

Intravagal parathyroid adenomas are rare and challenging to diagnose. Recognition of this ectopic location, especially in

patients with negative conventional imaging or failed prior surgery, is essential. This case emphasizes the diagnostic value of 18F-fluorocholine PET/CT in improving preoperative localization, and the need for meticulous surgical management to ensure both cure and preservation of nerve function.

Author Contributions

Roneil Parikh: writing – original draft, writing – review and editing, resources, conceptualization. **Priy Silva:** supervision, writing – review and editing, conceptualization. **Shad Khan:** conceptualization, supervision, writing – review and editing.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

1. J. M. Ruda, C. S. Hollenbeak, and B. C. Stack, Jr., "A Systematic Review of the Diagnosis and Treatment of Primary Hyperparathyroidism From 1995 to 2003," *Otolaryngology-Head and Neck Surgery* 132 (2005): 359–372.

2. R. D. Bliss, P. G. Gauger, and L. W. Delbridge, "Surgeon's Approach to the Thyroid Gland: Surgical Anatomy and the Importance of Technique," *World Journal of Surgery* 24 (2000): 891–897.

3. U. de Andres Olabarria, A. M. Roldán, A. B. Amuchastegui, E. del Pozo Andrés, and F. I. Aguirre, "Adenoma paratiroideo intravagal con cirugía de abordaje directo," *Cirugía española: Organo Oficial de la Asociación Española de Cirujanos* 96 (2018): 175–176.

4. M. A. List, B. J. Boyce, and P. T. Dziegielewski, "Intravagal Parathyroid Adenomas: Case Report and Literature Review," *Clinical Case Reports* 8 (2020): 1156–1161.

5. D. C. Shonka, Jr. and D. Danan, "An Intravagal Parathyroid Adenoma in the Poststyloid Parapharyngeal Space," *Laryngoscope* 131 (2021): 453–456.

6. J. R. Gilmour, "The Embryology of the Parathyroid Glands, the Thymus and Certain Associated Rudiments," *Journal of Pathology and Bacteriology* 45 (1937): 507–522.

7. W. A. Broos, F. M. van der Zant, R. J. Knol, and M. Wondergem, "Choline PET/CT in Parathyroid Imaging: A Systematic Review," *Nuclear Medicine Communications* 40 (2019): 96–105.

8. I. C. Mainta, M. L. Gié, F. Triponez, and M. A. Walter, "Intra-Vagal Parathyroid Adenoma on Digital PET/CT With 18F-Fluorocholine," *European Journal of Nuclear Medicine and Molecular Imaging* 48 (2021): 4521–4522.