

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: [www.elsevier.com/locate/radcr](http://www.elsevier.com/locate/radcr)

## Case Report

# Ectopic mediastinal parathyroid: A case report of recurrent secondary hyperparathyroidism <sup>☆</sup>

Stephen Kwak, MD<sup>1,\*</sup>, Elliot K. Fishman, MD

Johns Hopkins University, 1800 Orleans St, Baltimore, MD 21287, USA

### ARTICLE INFO

#### Article history:

Received 2 March 2023

Revised 14 March 2023

Accepted 16 March 2023

#### Keywords:

Hyperparathyroidism

Ectopic parathyroid

Sestamibi

Parathyroidectomy

Secondary

Tertiary

### ABSTRACT

Ectopic mediastinal parathyroid is a common cause of recurrent and persistent hyperparathyroidism. Patients with recurrent and persistent hyperparathyroidism have elevated parathyroid hormone, which results in bone, vascular, and soft tissue abnormalities. While CT and MRI can be used to investigate ectopic parathyroid tissue, nuclear medicine Technetium-99m Sestamibi scan is the preferred method of imaging with sensitivity of 80%–90% and specificity of nearly 90%. Once identified, ectopic mediastinal parathyroid is treated with surgical resection though less invasive methods have gained popularity. We present a case of a 62-year-old female with recurrent secondary hyperparathyroidism that was localized to an ectopic mediastinal parathyroid gland.

© 2023 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

## Introduction

Secondary hyperparathyroidism occurs due to normal physiological response to hypocalcemia, hyperphosphatemia, and vitamin D deficiency, all of which are commonly found in the setting of chronic kidney disease (CKD) or end-stage renal disease (ESRD). Long standing secondary hyperparathyroidism results in prolonged stimulation of parathyroid cells and subsequent nodular hyperplasia, leading to tertiary hyperparathyroidism. Most parathyroid glands are in eutopic locations. However, patients can have parathyroid gland in ectopic locations with the anterior mediastinum being a

common ectopic location, resulting in persistent or recurrent hyperparathyroidism after parathyroidectomy [1].

We report a case of recurrent secondary hyperparathyroidism in a patient with ESRD after subtotal parathyroidectomy due to an ectopic mediastinal parathyroid gland.

## Case report

A 62-year-old female with history of ESRD and tertiary hyperparathyroidism status posts subtotal parathyroidectomy presents with recurrent elevated parathyroid hormone (PTH)

<sup>☆</sup> Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

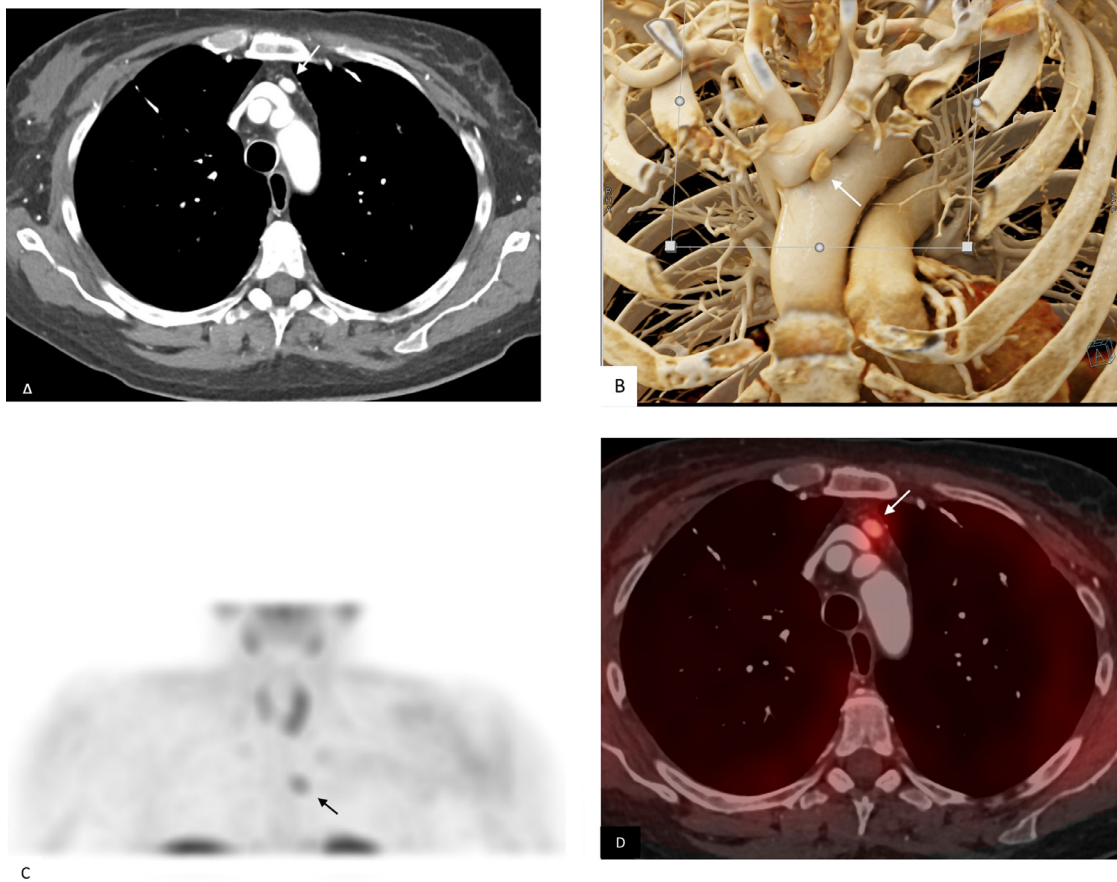
\* Corresponding author.

E-mail address: [skwak4@jhmi.edu](mailto:skwak4@jhmi.edu) (S. Kwak).

<sup>1</sup> Present address: 601 North Caroline Street, JHOC 3235A Radiology, Baltimore, MD 21287.

<https://doi.org/10.1016/j.radcr.2023.03.032>

1930-0433/© 2023 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)



**Fig. 1 – A 62-year-old female with history of ESRD and tertiary hyperparathyroidism status post-subtotal parathyroidectomy present with recurrent elevated PTH. A chest CT scan with IV contrast (A) demonstrates a small enhancing nodule in the anterior mediastinum adjacent to the aorta and left brachiocephalic vein. Cinematic rendering (B) demonstrates the proximity to the vessels. Early phase nuclear medicine Tc99m-Sestamibi SPECT/CT scan with IV contrast (C, D) demonstrates avid radiotracer uptake.**

of 836 pg/mL (reference range: 14–64 pg/mL) and calcium of 7.1 mg/dL (reference range: 8.4–10.5 mg/dL), compatible with recurrent secondary hyperparathyroidism. CT chest with intravenous (IV) contrast demonstrates an enhancing anterior mediastinal nodule adjacent to the aorta and left brachiocephalic vein (Figs. 1A and B). Technetium-99m (Tc99m) Sestamibi single-photon emission computed tomography (SPECT/CT) demonstrates a Sestamibi-avid nodule in the anterior mediastinum, confirming diagnosis of an ectopic mediastinal parathyroid gland (Figs. 1C and D). The nodule was partially ablated via trans-sternal cryoablation due to proximity to the aorta. Subsequently, the patient's PTH decreased to 254 pg/mL.

## Discussion

Ectopic mediastinal parathyroid is defined as parathyroid gland below the level of the clavicle [2]. The prevalence of ectopic parathyroid gland ranges from 28% to 42% in autopsy series though the reported prevalence in surgical work up for

primary hyperparathyroidism ranges between 6.3% and 16% [1].

Ectopic mediastinal parathyroid tissue results from aberrant migration of parathyroid gland during embryogenesis. The endoderm forms the third and fourth branchial pouches. The dorsal wing of the third and fourth branchial pouch develops into the inferior and superior parathyroid glands, respectively, while the ventral wing of the third branchial pouch forms the thymus. Typically, the parathyroid glands remain in close proximity to the thyroid gland. However, when the dorsal wing of the third branchial pouch migrates caudally with the ventral wing of the third branchial pouch, ectopic mediastinal parathyroid gland forms [3].

Patients with ectopic parathyroid tissue can develop persistent or recurrent secondary hyperparathyroidism, which, if left unresolved, will result in tertiary hyperparathyroidism. We report a 62-year-old woman with history of ESRD who developed recurrent secondary hyperparathyroidism after subtotal parathyroidectomy. Secondary hyperparathyroidism occurs in the setting of CKD or ESRD, both of which result in downregulation of renal  $1\alpha$ -hydroxylase and subsequent hypocalcemia, hyperphosphatemia, and vitamin D defi-

ciency. In response to these metabolic disorders, parathyroid glands undergo hyperplasia to increase PTH, which in turn increases  $1\alpha$ -hydroxylase to correct the metabolic abnormalities [4]. Prolonged secondary hyperparathyroidism causes parathyroid glands to autonomously secrete PTH, resulting in tertiary hyperparathyroidism. Elevated PTH results in skeletal, vascular, and soft tissue abnormalities, including osteodystrophy, osteitis cystica, arterial calcifications, and soft tissue calcifications.

Imaging modalities to investigate ectopic mediastinal parathyroid gland include CT and MRI. However, CT and MRI are insensitive for ectopic parathyroid gland with a sensitivity of 65% and 75%-78%, respectively [1]. On CT and MRI, parathyroid gland appears as a non-specific enhancing nodule. For confirmation of parathyroid gland, nuclear medicine study with Tc99m-Sestamibi is the preferred imaging modality with a sensitivity of 95% and specificity of 89% [5]. Recently, multiphase CT, also known as 4-dimensional (4D) CT, has had increasing utility in localizing parathyroid gland, especially in the setting of inconclusive nuclear medicine study, unsuccessful initial surgery, or atypical neck anatomy [6]. Unlike single phase CT, 4D CT uses both morphological and enhancement patterns to differentiate parathyroid tissue from other enhancing nodules such as lymph nodes or thyroid glands. As a result, 4D CT has improved sensitivity and specificity [7,8]. However, protocols for 4D CT vary between institutions, which may provide opportunities for improved uniformity and accuracy.

Parathyroidectomy is indicated if medical management fails to prevent hypersecretion of PTH or if the patient has severe symptomatic hyperparathyroidism. Surgical parathyroidectomy has been a successful and safe approach with an overall success rate of up to 98%-100% [2]. However, less invasive procedures such as transsternal ablation have gained recent popularity [9].

---

### Patient consent

The patient reported in the manuscript signed the informed consent/authorization for participation in research, which in-

cludes the permission to use data collected in future research projects including presented case details and images used in this manuscript.

---

### REFERENCES

- [1] Noussios G, Anagnostis P, Natsis K. Ectopic parathyroid glands and their anatomical, clinical and surgical implications. *Exp Clin Endocrinol Diabetes* 2012;120(10):604–10. doi:10.1055/s-0032-1327628.
- [2] Hu J, Ngiam KY, Parameswaran R. Mediastinal parathyroid adenomas and their surgical implications. *Ann R Coll Surg Engl* 2015;97(4):259–61. doi:10.1308/003588415X14181254789088.
- [3] Mohebati A, Shaha AR. Anatomy of thyroid and parathyroid glands and neurovascular relations. *Clin Anat* 2012;25(1):19–31. doi:10.1002/ca.21220.
- [4] Lau WL, Obi Y, Kalantar-Zadeh K. Parathyroidectomy in the management of secondary hyperparathyroidism. *Clin J Am Soc Nephrol* 2018;13(6):952–61. doi:10.2215/CJN.10390917.
- [5] Woods AM, Bolster AA, Han S, Poon FW, Colville D, Shand J, et al. Dual-isotope subtraction SPECT-CT in parathyroid localization. *Nucl Med Commun* 2017;38(12):1047–54. doi:10.1097/MNM.0000000000000765.
- [6] Morris MA, Saboury B, Ahlman M, Malayeri AA, Jones EC, Chen CC, et al. Parathyroid imaging: past, present, and future. *Front Endocrinol (Lausanne)* 2022;12:760419. doi:10.3389/fendo.2021.760419.
- [7] Cheung K, Wang TS, Farrokhyar F, Roman SA, Sosa JA. A meta-analysis of preoperative localization techniques for patients with primary hyperparathyroidism. *Ann Surg Oncol* 2012;19(2):577–83. doi:10.1245/s10434-011-1870-5.
- [8] Tian Y, Tanny ST, Einsiedel P, Lichtenstein M, Stella DL, Phal PM, et al. Four-dimensional computed tomography: clinical impact for patients with primary hyperparathyroidism. *Ann Surg Oncol* 2018;25(1):117–21. doi:10.1245/s10434-017-6115-9.
- [9] Smirniotopoulos J, Pua BB, Abbey-Mensah G, Zarnegar R, Barclay J, Winokur RS. CT-guided cryoablation of a substernal mediastinal ectopic parathyroid adenoma. *J Vasc Interv Radiol* 2017;28(4):614–16. doi:10.1016/j.jvir.2016.11.039.