

2025 City of Hope Multidisciplinary Thyroid Cancer Symposium

Surgical Approaches to Parathyroid Tumors

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City of Hope



Disclosures

- I do not have any relevant financial relationships.

This presentation and/or comments will provide a balanced, non-promotional, and evidence-based approach to all diagnostic, therapeutic and/or research related content.

Cultural Linguistic Competency (CLC) & Implicit Bias (IB)

STATE LAW:

The California legislature has passed Assembly Bill (AB) 1195, which states that as of July 1, 2006, all Category 1 CME activities that relate to patient care must include a cultural diversity/linguistics component. It has also passed AB 241, which states that as of January 1, 2022, all continuing education courses for a physician and surgeon **must** contain curriculum that includes specified instruction in the understanding of implicit bias in medical treatment.

The cultural and linguistic competency (CLC) and implicit bias (IB) definitions reiterate how patients' diverse backgrounds may impact their access to care.

EXEMPTION:

Business and Professions Code 2190.1 exempts activities which are dedicated solely to research or other issues that do not contain a direct patient care component.

The following CLC & IB components will be addressed in this presentation:

- *Commonalities and differences among individuals in this population.*
- *Groups who frequently experience disparities in care.*



Right Superior Parathyroid

Left Superior Parathyroid

Right Inferior Parathyroid

Left Inferior Parathyroid

3 Special Features of Endocrine Tumors (Thyroid, Parathyroid, and Adrenal)

- Indeterminate Biopsies - Even with today's technology endocrine tumors can be indeterminate on needle biopsy, requiring diagnostic excision
- Functional Tumors - Endocrine tumors may need to be resected because they are functional rather than malignant
- Frequently Indolent but Occasionally Deadly – The large majority of endocrine cancers have excellent prognosis, but the very rare anaplastic thyroid cancers and adrenocortical cancers and parathyroid cancers can have poor prognosis

Minimally Invasive Parathyroid Surgery

- Primary Hyperparathyroidism – A single tumor 80-90% of the time
- Localization studies may miss an extra tumor 5-10% of the time. **This missed multigland rate is almost certainly less with a good 4D Parathyroid CT.**
- Rapid intraoperative PTH can predict cure by a drop in PTH within 10 minutes
- We call an open parathyroid exploration using rapid intraoperative PTH “concise parathyroid exploration”
- When we use a scope to assist exploration with a smaller incision, we call this “videoscope assisted parathyroid exploration”

Functional Parathyroid Tumors

- Functional parathyroid tumors (primary hyperparathyroidism) are benign >99% of the time
- Diagnosis most frequently by incidental finding of hypercalcemia
- The mainstay of diagnosis of primary hyperparathyroidism is serum PTH level
- Treatment is either monitoring if asymptomatic with minimally elevated levels and surgical
- Symptoms include fatigue, depression, bone pain, kidney stones, and constipation; the most important asymptomatic indication for surgery is osteopenia or osteoporosis (bone density scan)
- For minimally invasive surgery localization is key!

Guidelines from the Fifth International Workshop (2022) on Evaluation and Management of Primary Hyperparathyroidism

- “The key decision to be made in PHPT is whether the patient should undergo curative PTX”
- “In the hands of experienced surgeons, surgery should be used to achieve a biochemical cure, if there are no contraindications (high quality evidence)”
- “all symptomatic patients should be offered parathyroid surgery unless medically contraindicated”
- Asymptomatic PHPT
 - Serum calcium > 1mg/dL above upper limit of normal
 - Fracture... or BMD T score < or = to -2.5
 - Renal involvement: ...eGFR < 60 mL/min..., ...nephrolithiasis..., ...hypercalciuria...
 - Age < 50 years
 - **“If no aforementioned guidelines are met, PTX is still an option with concurrence of the patient and physician and if there are no contraindications”**

Disparities in Surgical Care of Primary Hyperparathyroidism

- While there have not been confirmed differences among individuals with primary hyperparathyroidism other than gender (female to male ratio of approximately 3:1), there have been multiple studies documenting differences in surgical treatment.
- Disparities have been seen primarily in African-Americans. In one study, time from index high calcium to surgical treatment was longest for African-American men, who waited a median of 13.6 months (interquartile range IQR 2-28), compared with 2.9 months (IQR 1-8) for Caucasian males ($p < 0.05$).
- African-American women waited a median of 6.7 months (IQR 2-16) versus 3.5 months (IQR 2-14) for Caucasian women ($p < 0.05$).
- At 1 year after the index abnormal calcium, only 6% of black men underwent surgery compared with 20% of white males ($p < 0.05$). Similarly, 13% of black women underwent surgery versus 20% of white women ($p < 0.05$). These differences remained significant after adjusting for age, calcium levels, insurance, and comorbidities.

Mallick R, Xie R, Kirklin JK, Chen H, Balentine CJ. Race and Gender Disparities in Access to Parathyroidectomy: A Need to Change Processes for Diagnosis and Referral to Surgeons. *Ann Surg Oncol*. 2021;28(1):476-483. doi:10.1245/s10434-020-08707-z

Localization: Sestamibi



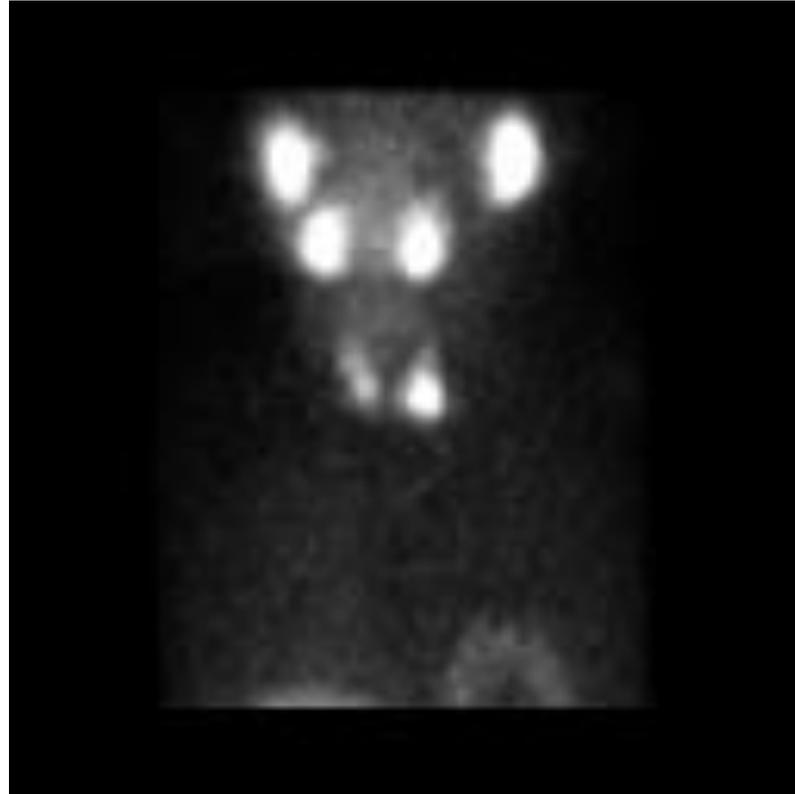
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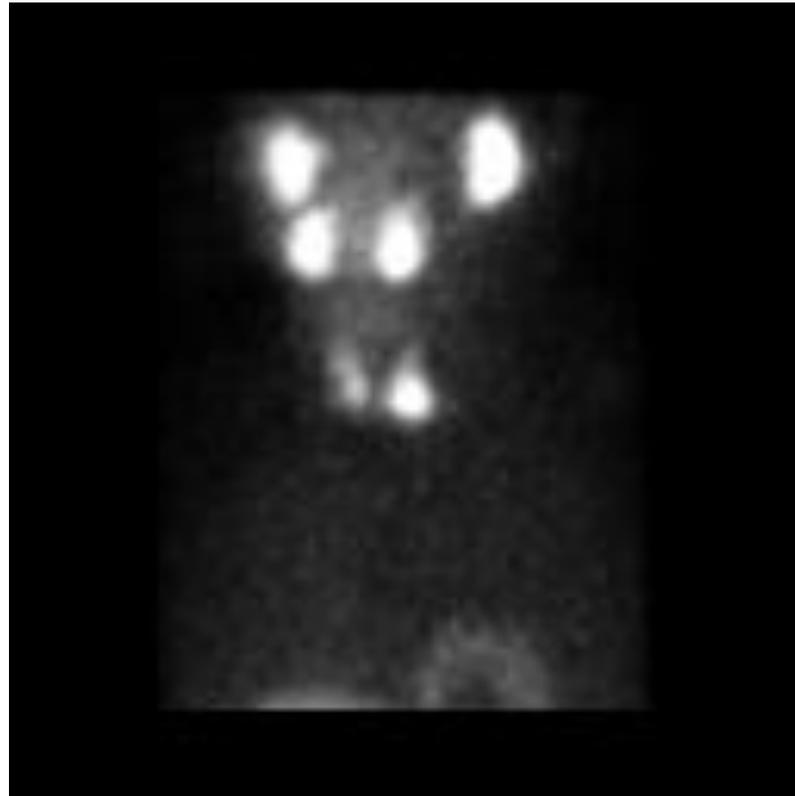
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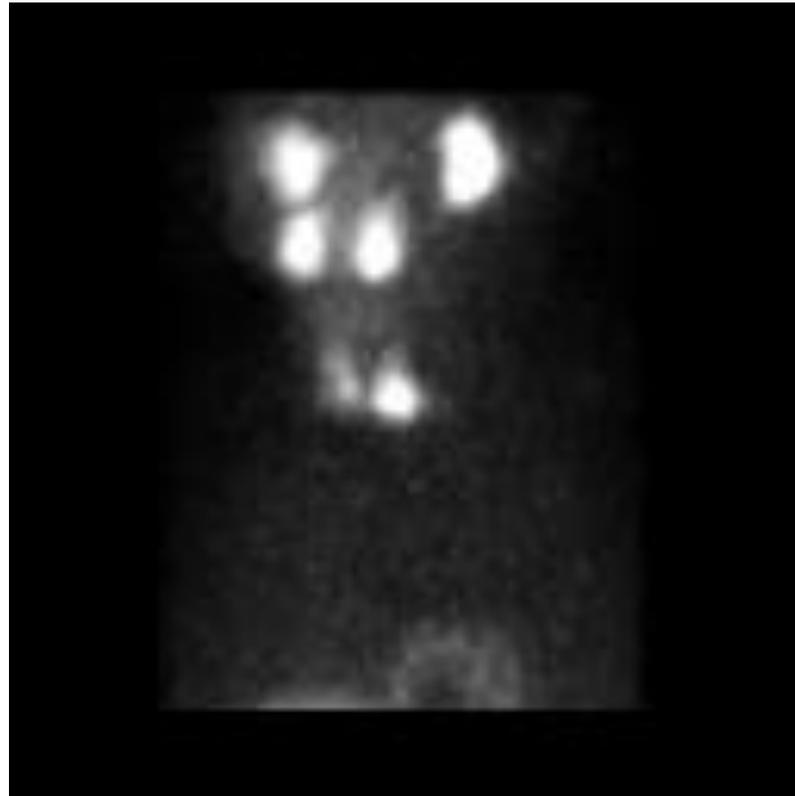
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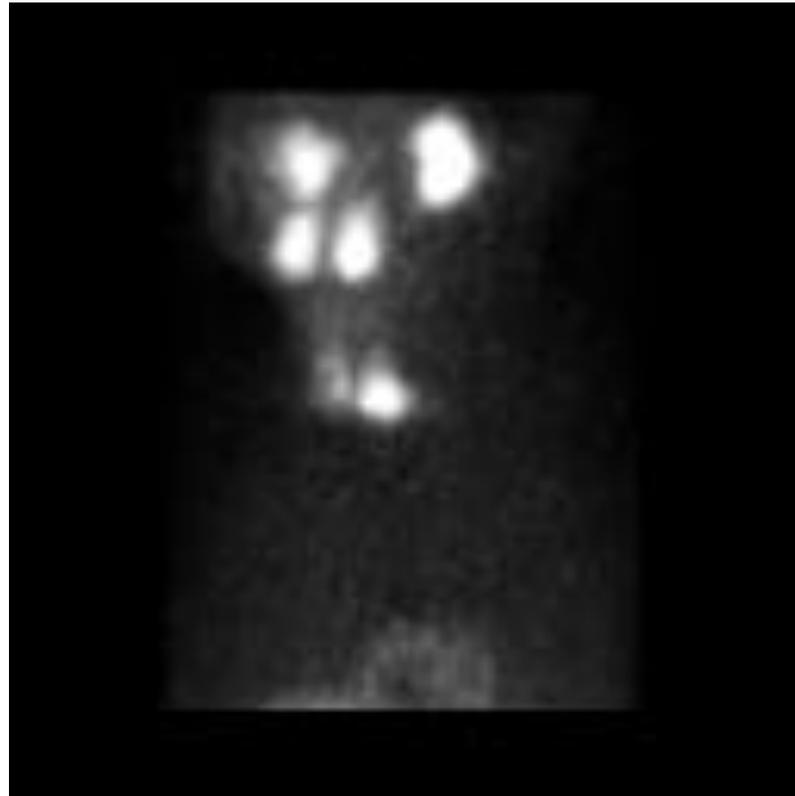
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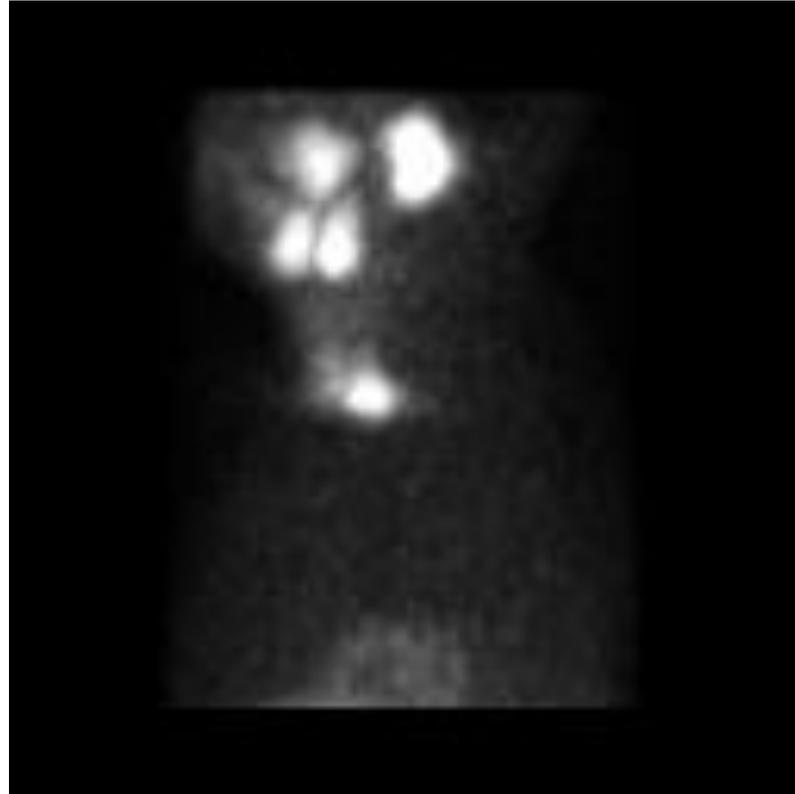
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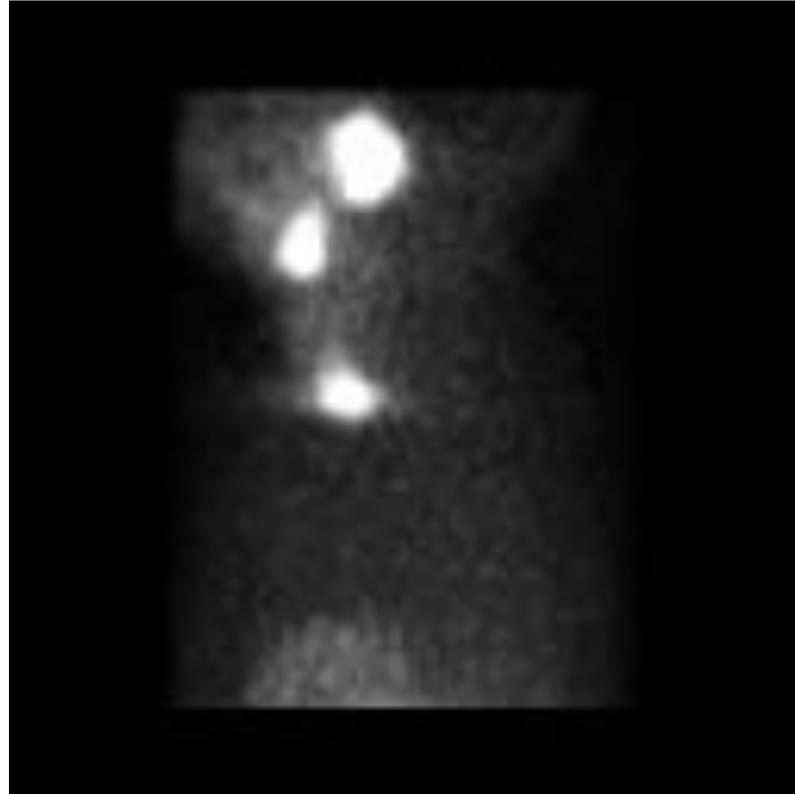
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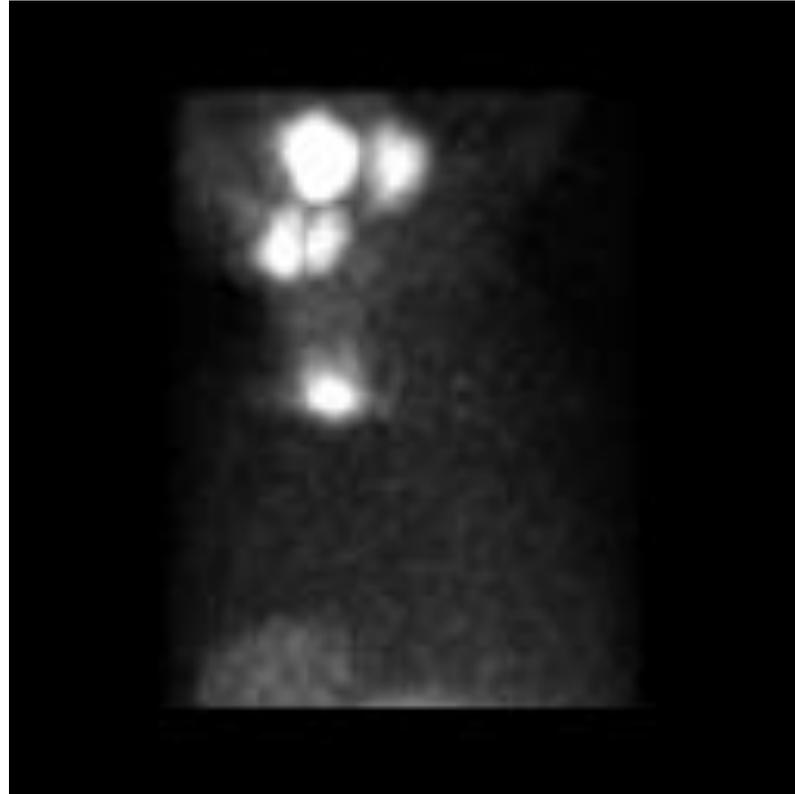
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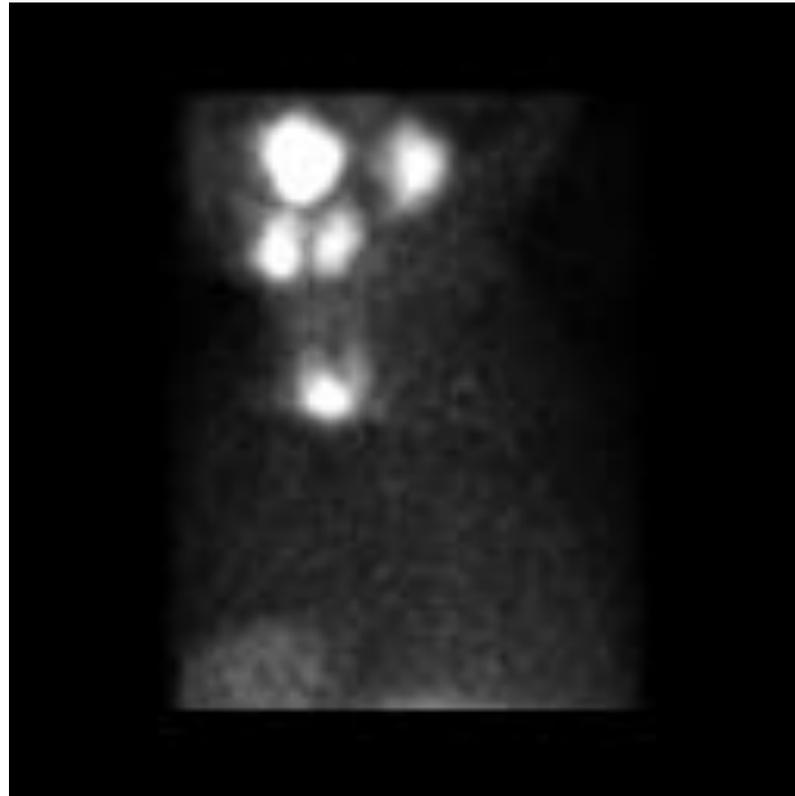
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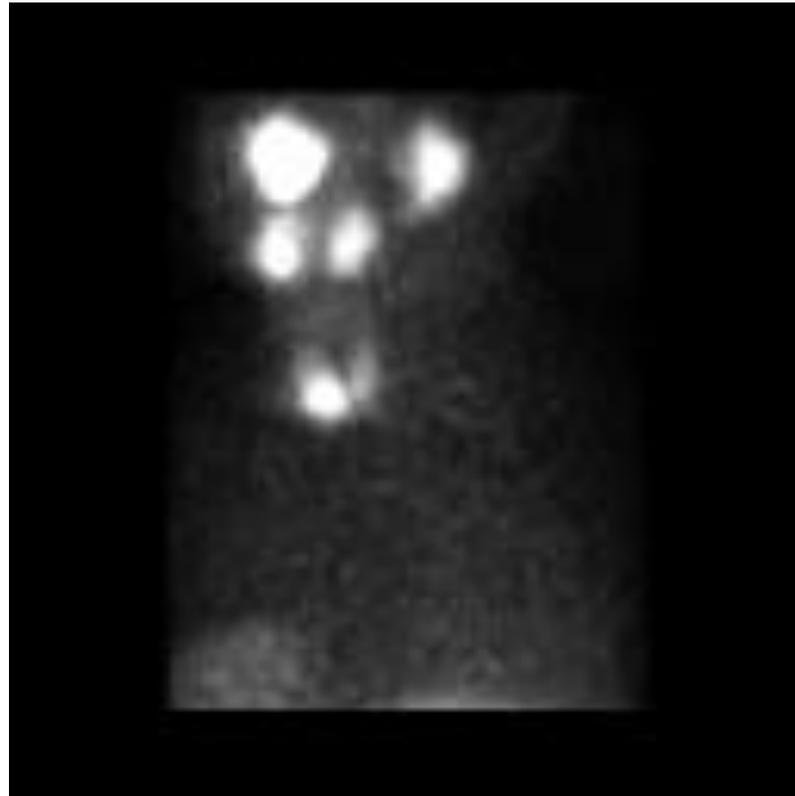
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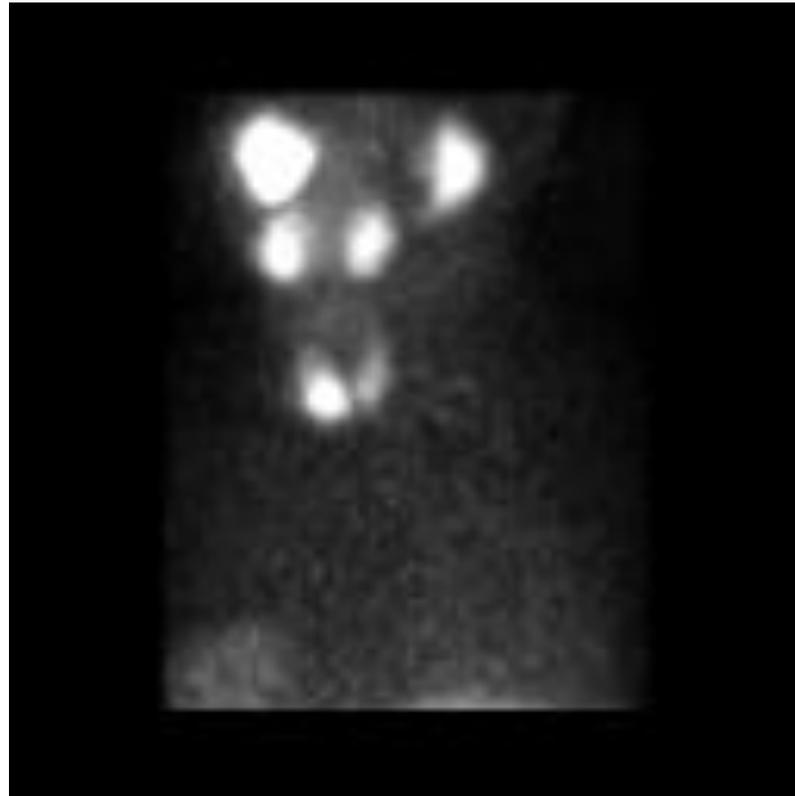
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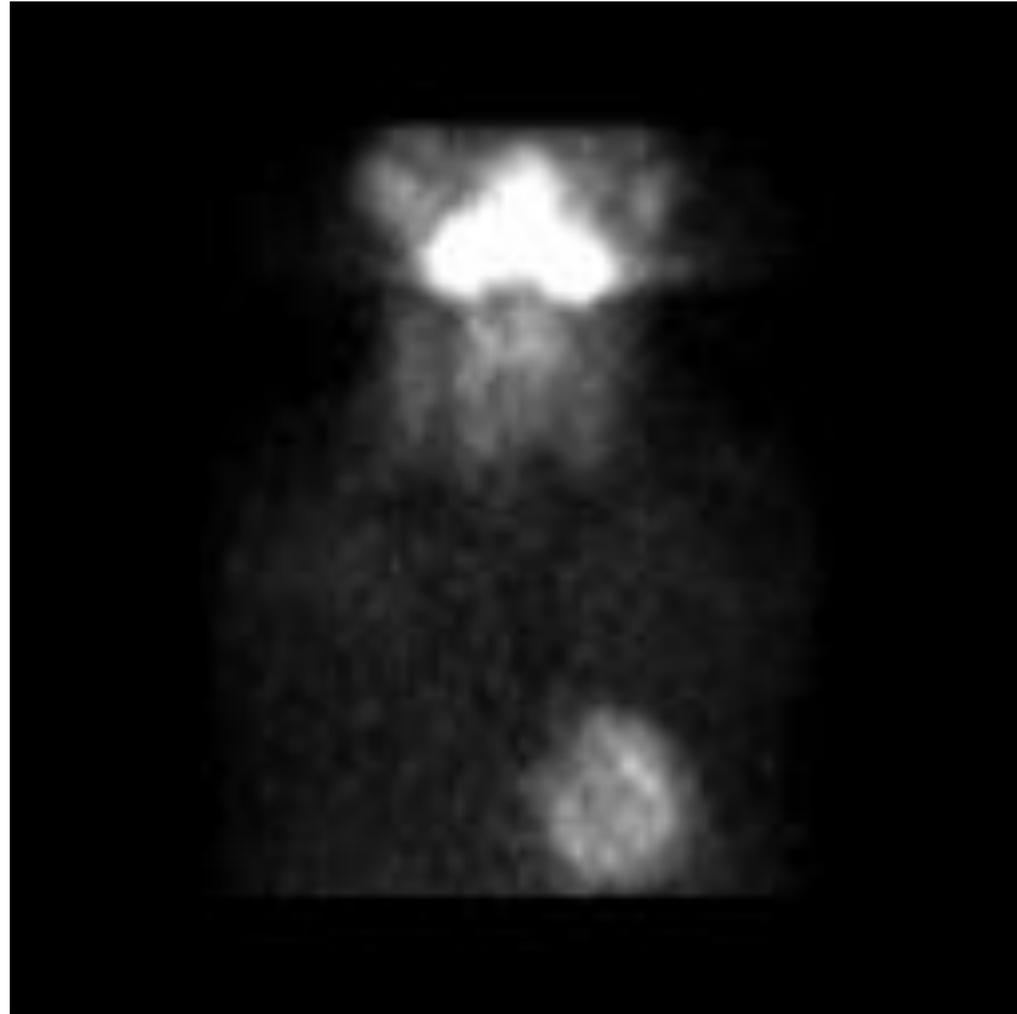
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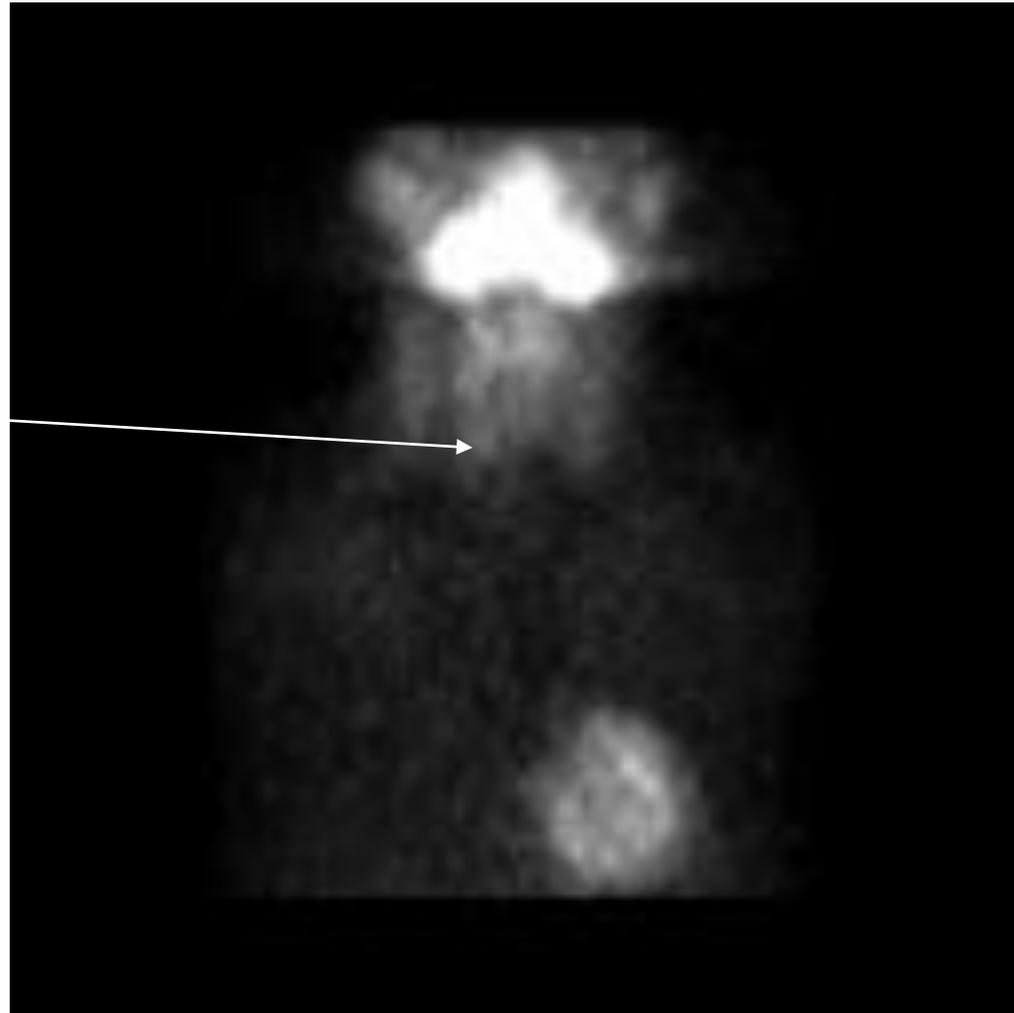


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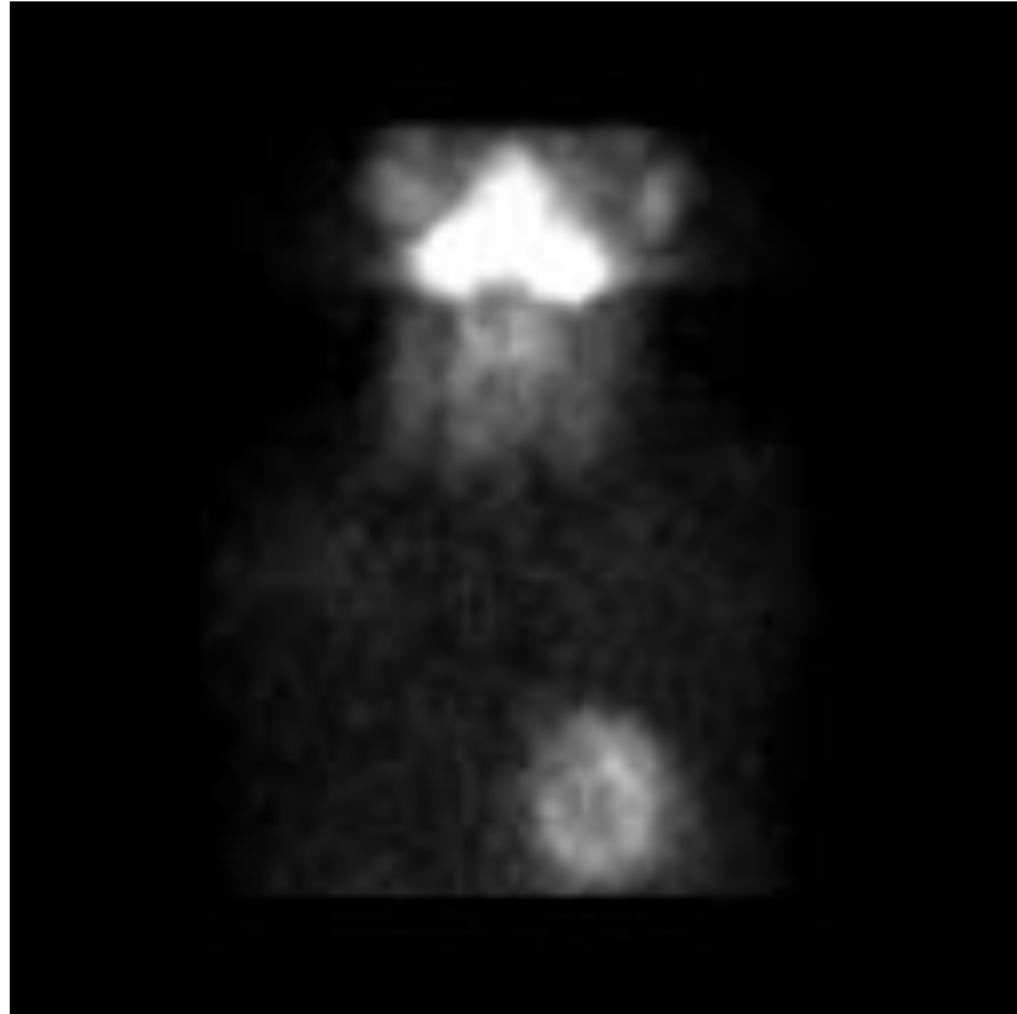


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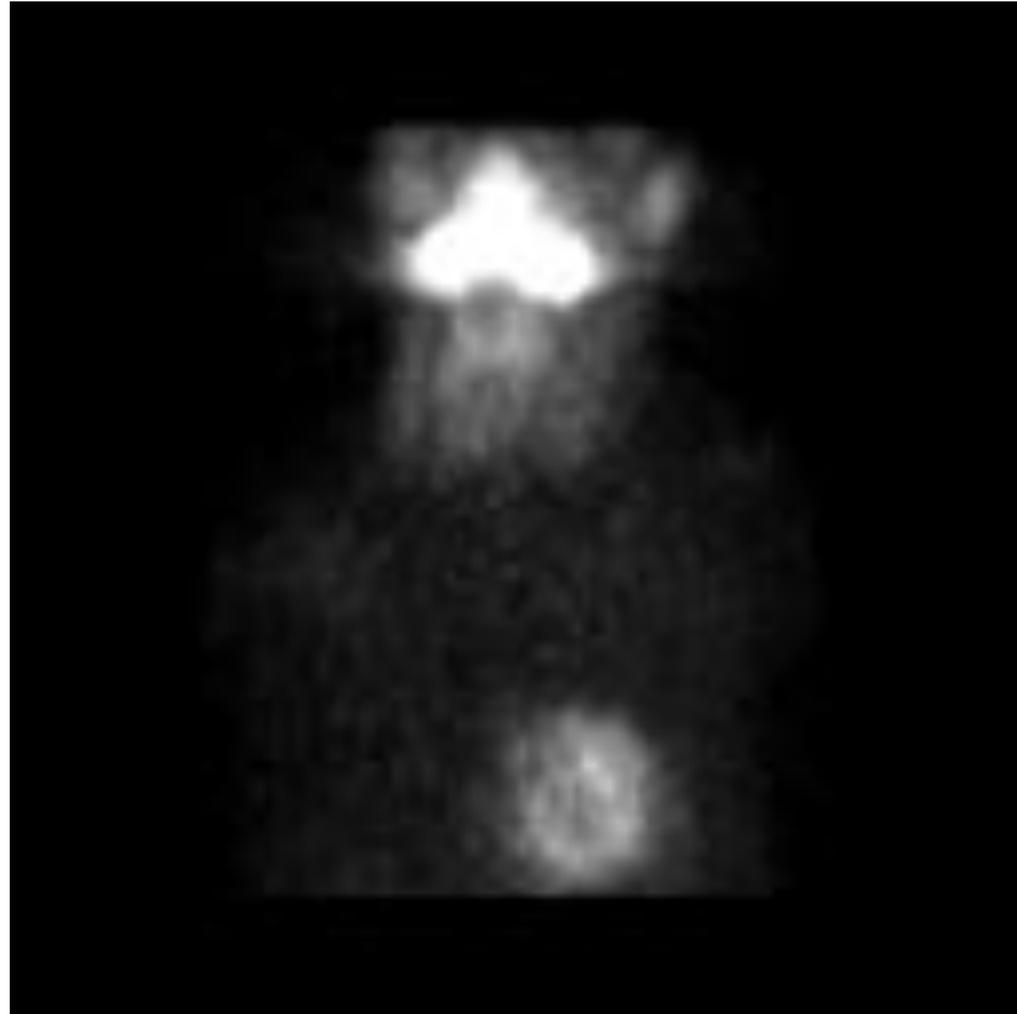
Right Inferior
Parathyroid
Adenoma?



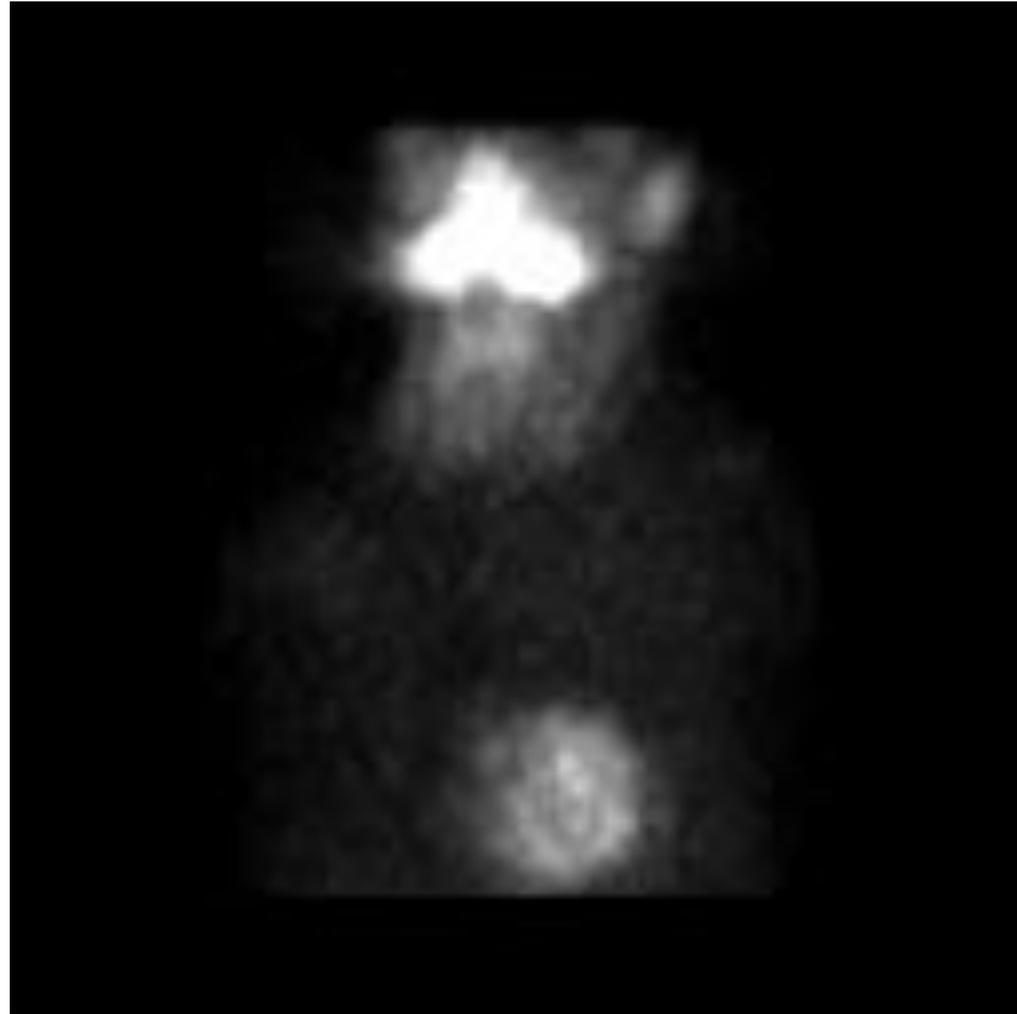
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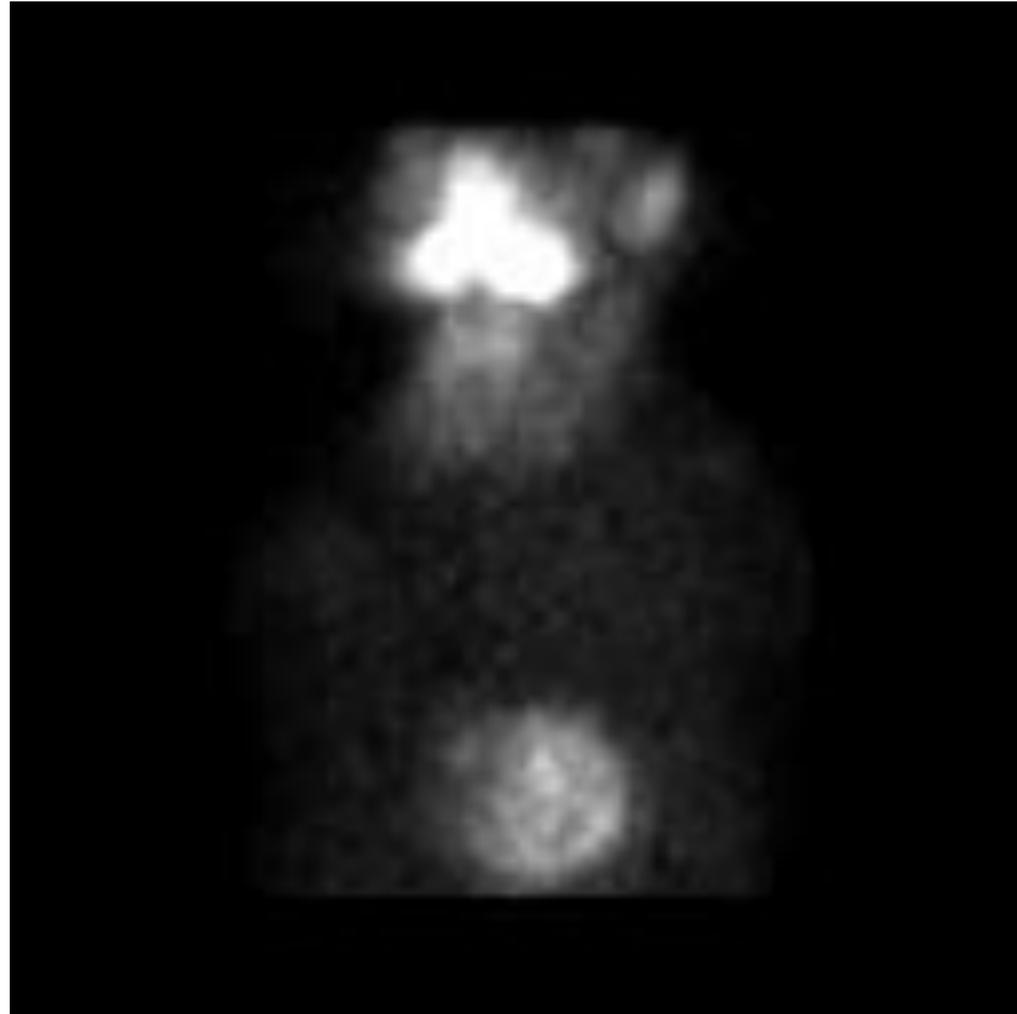
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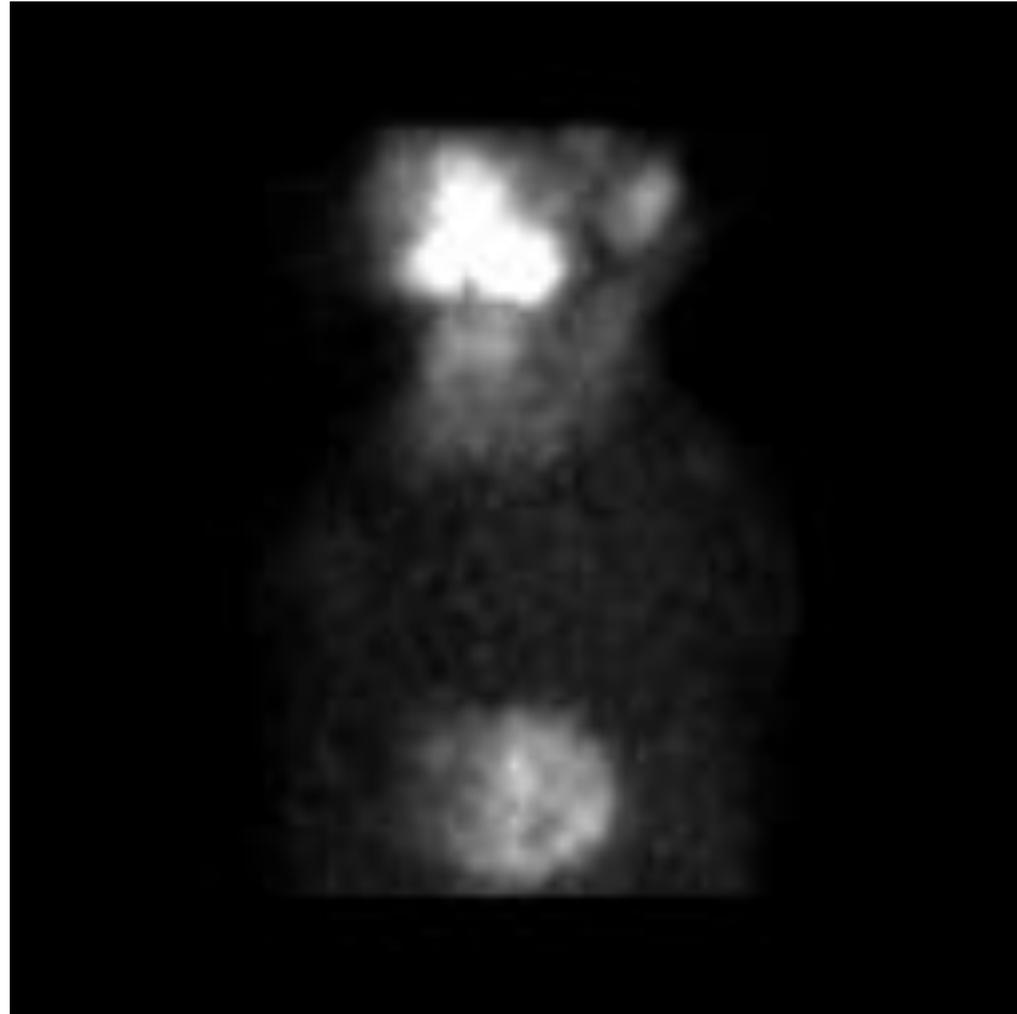
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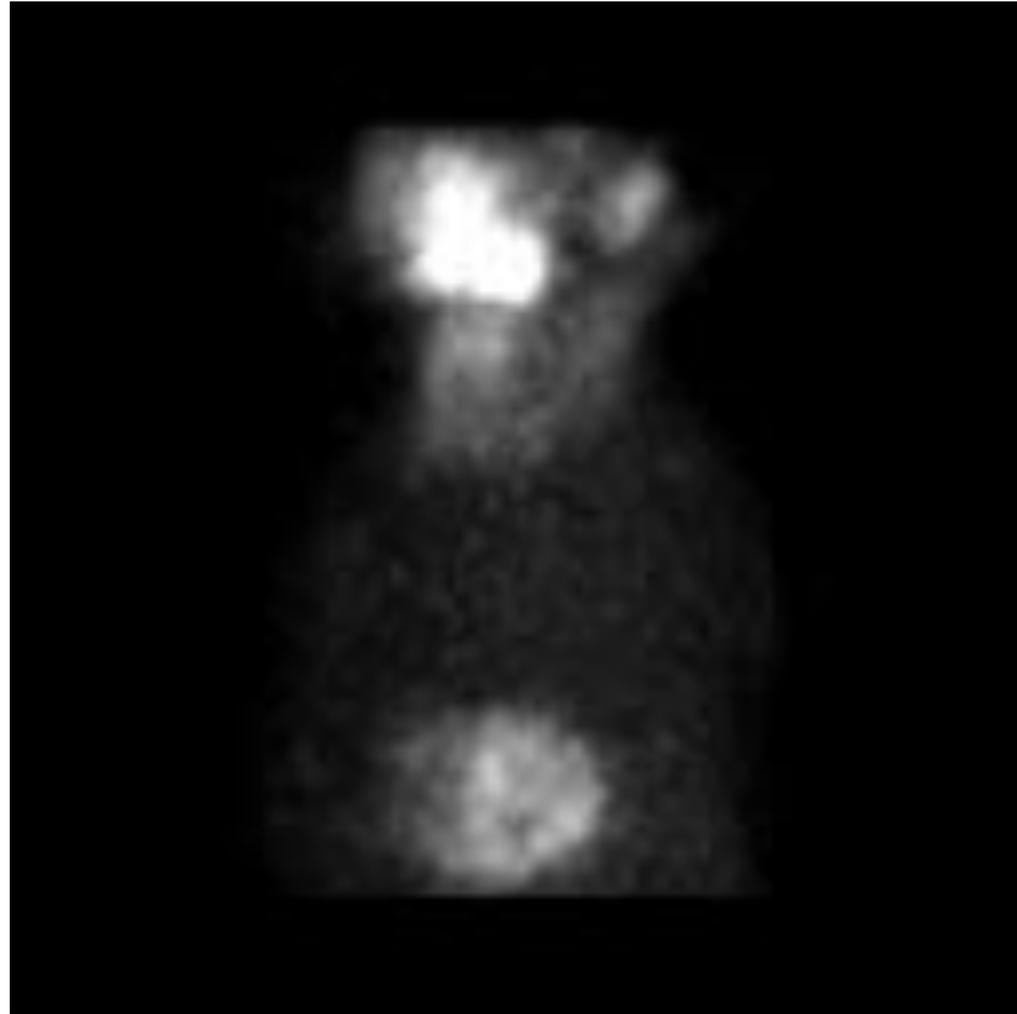
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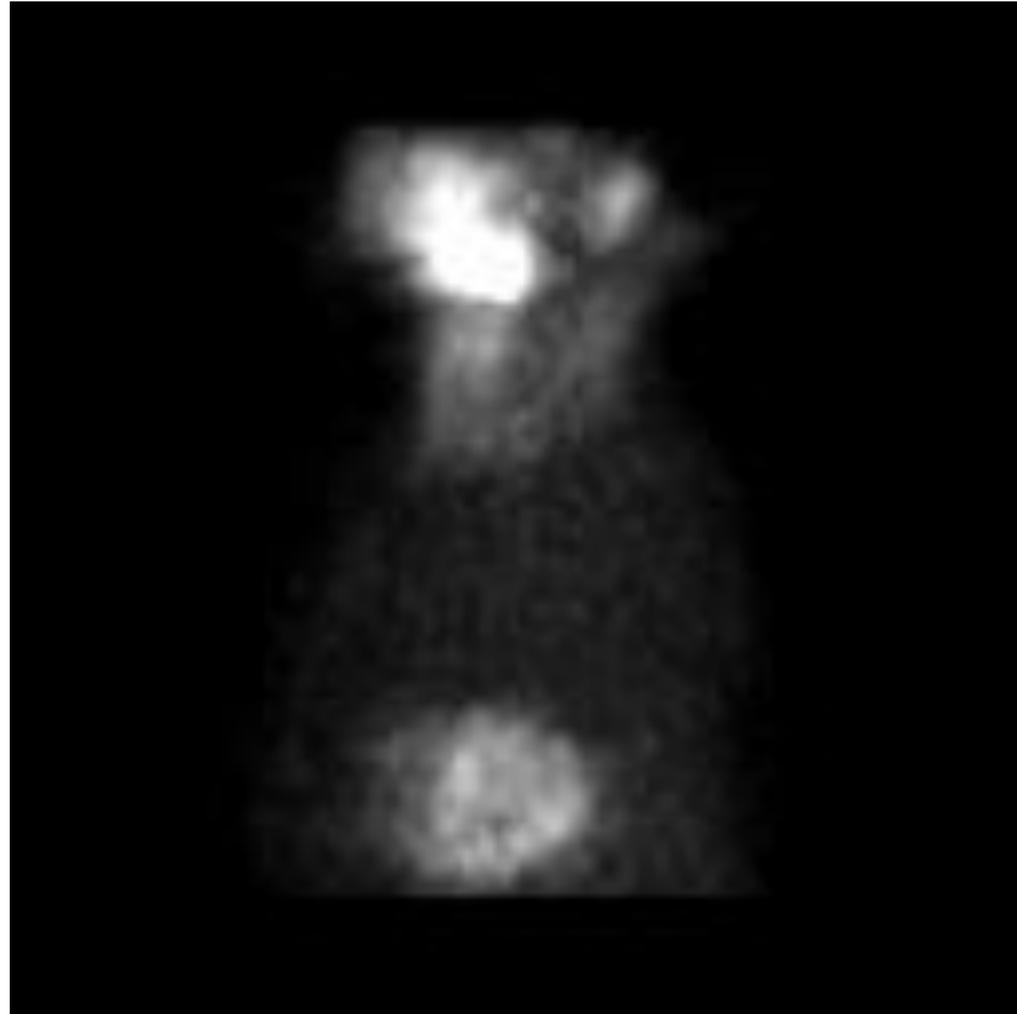
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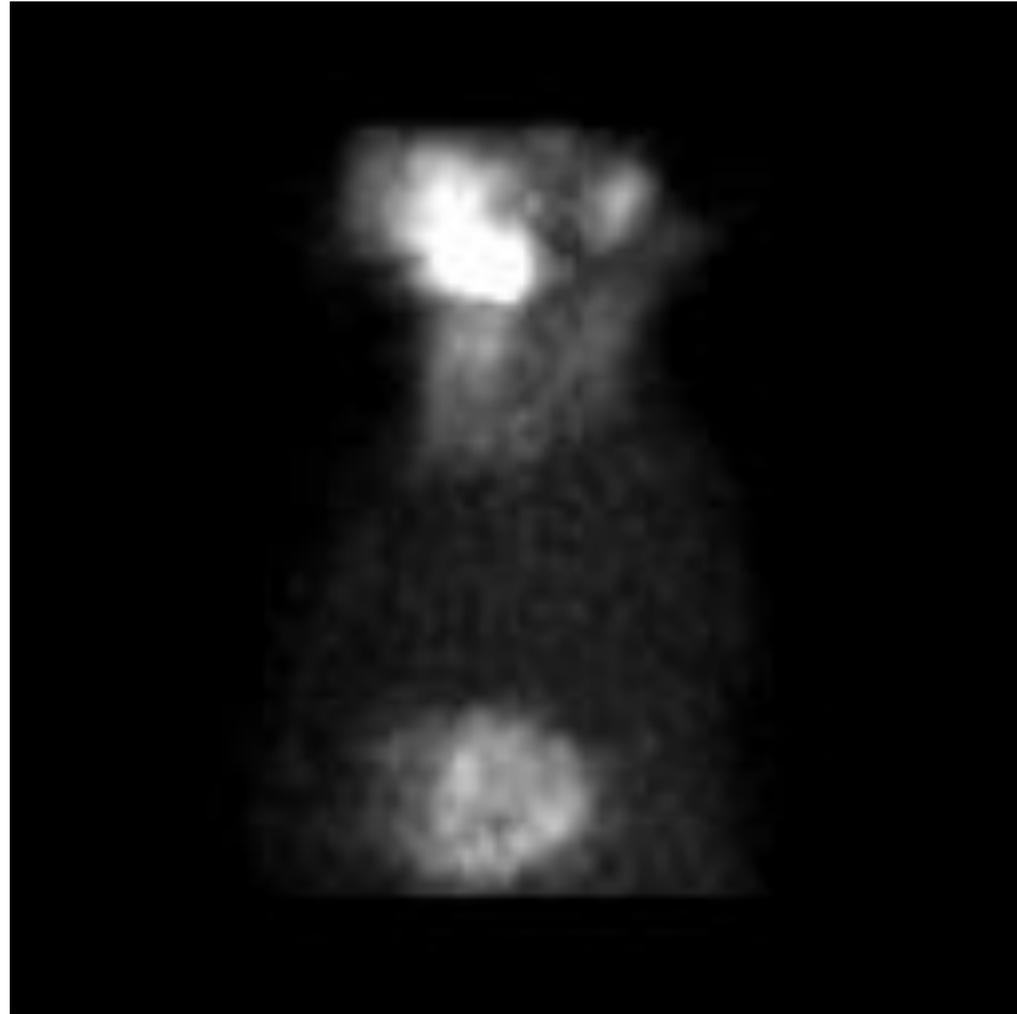
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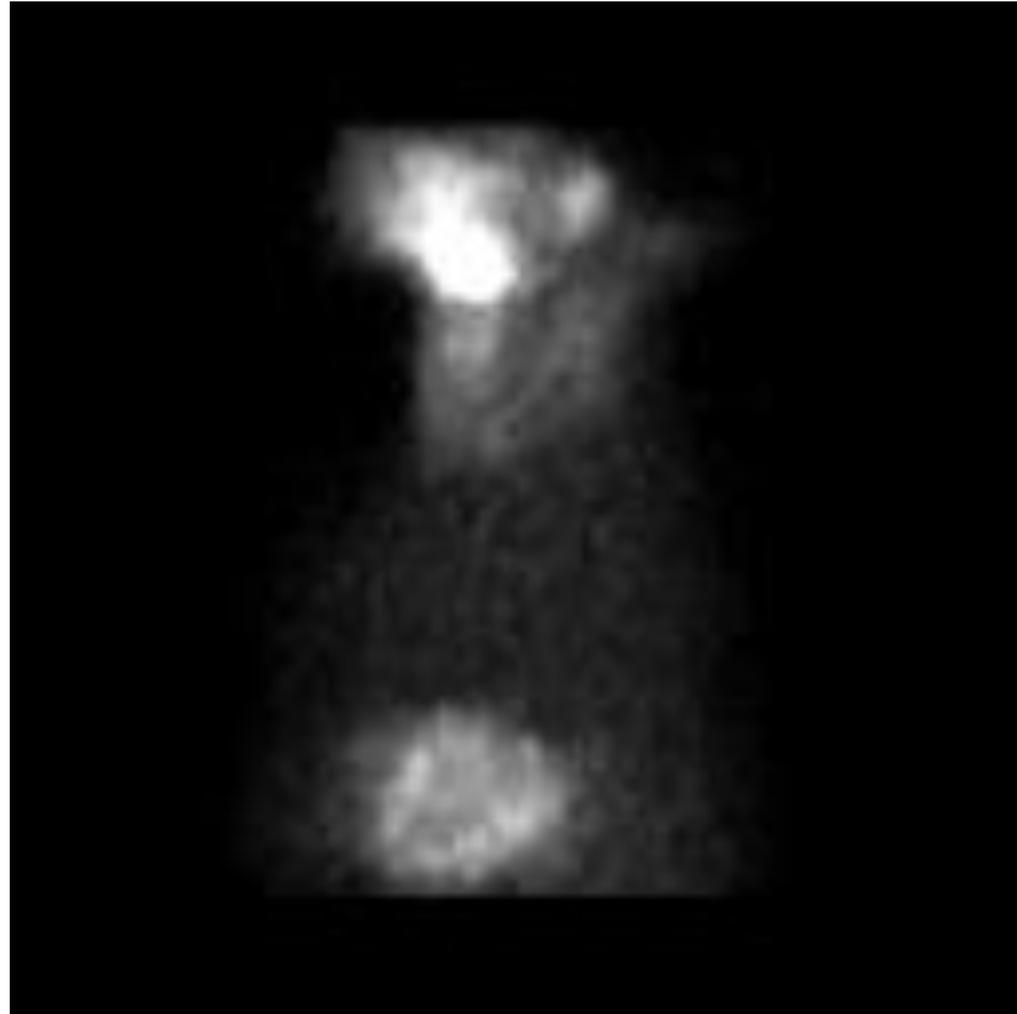
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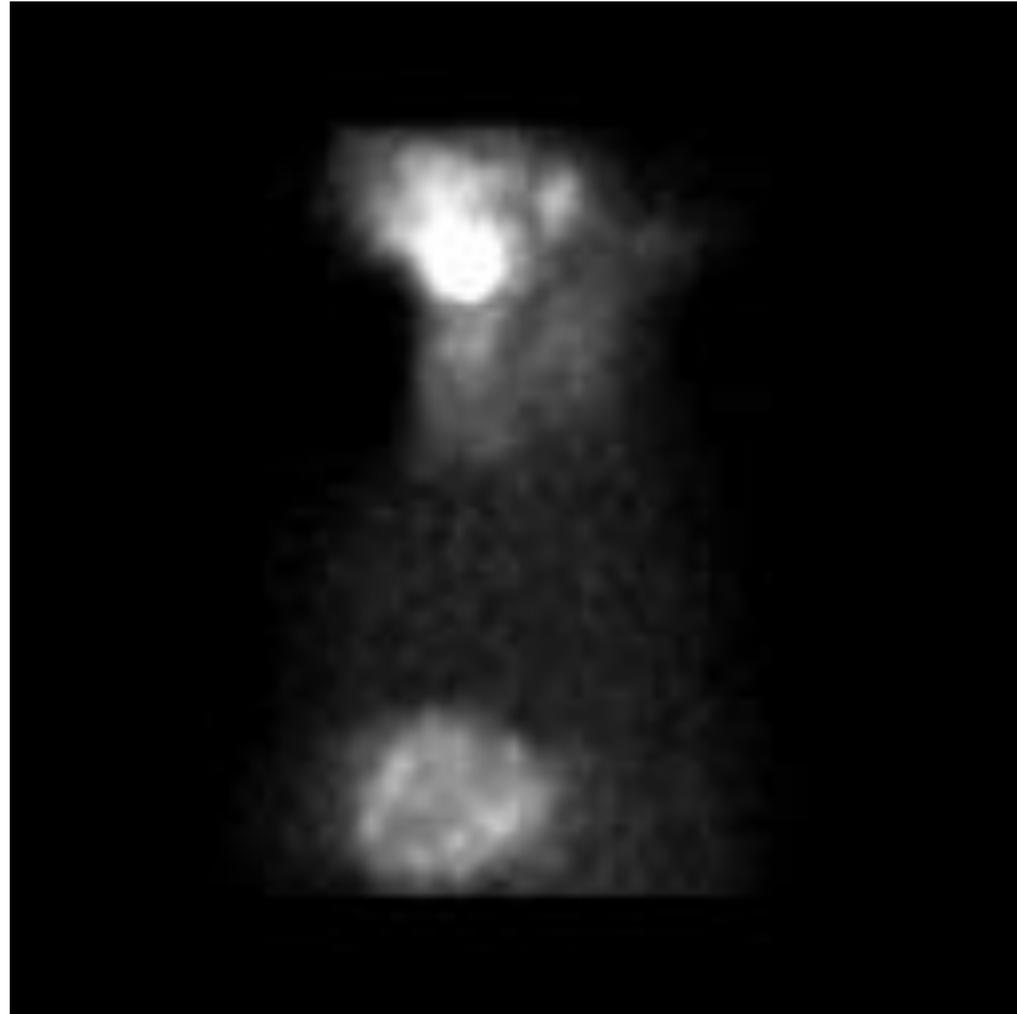
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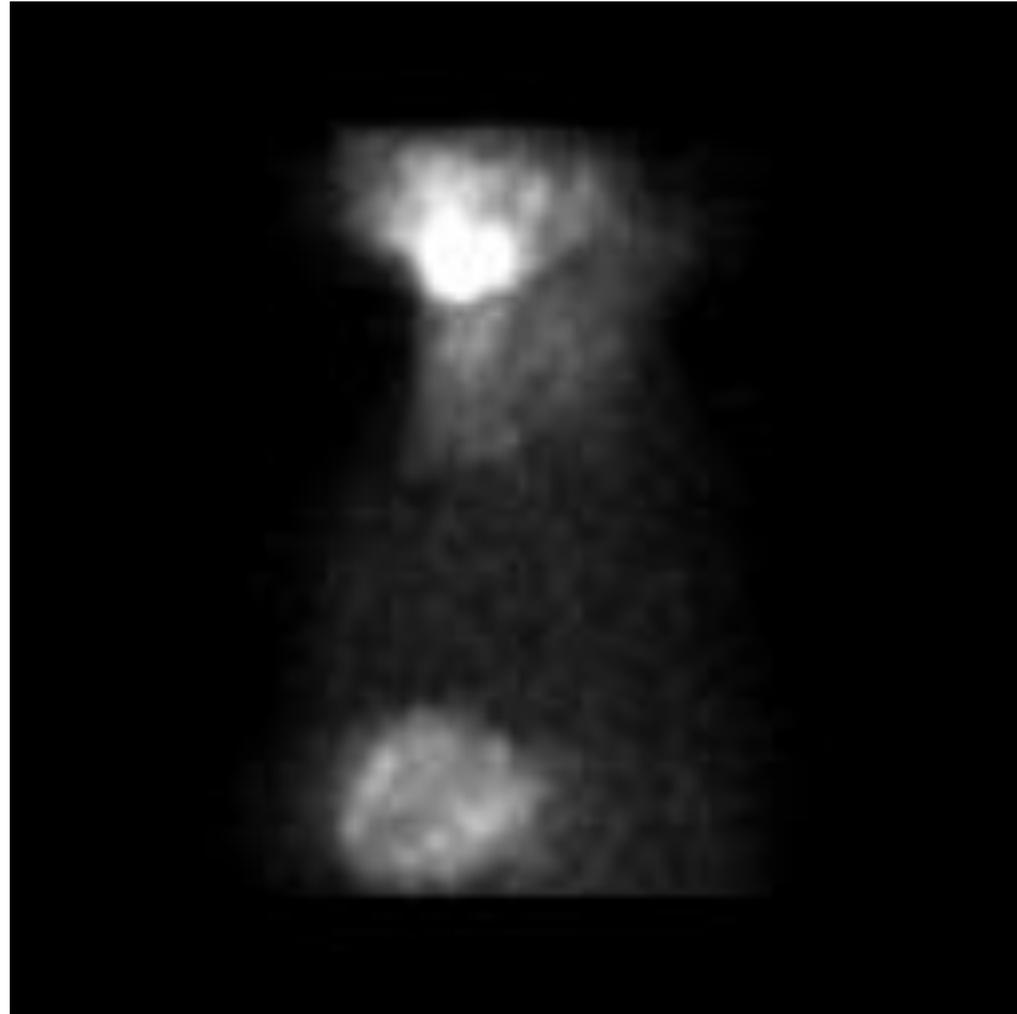
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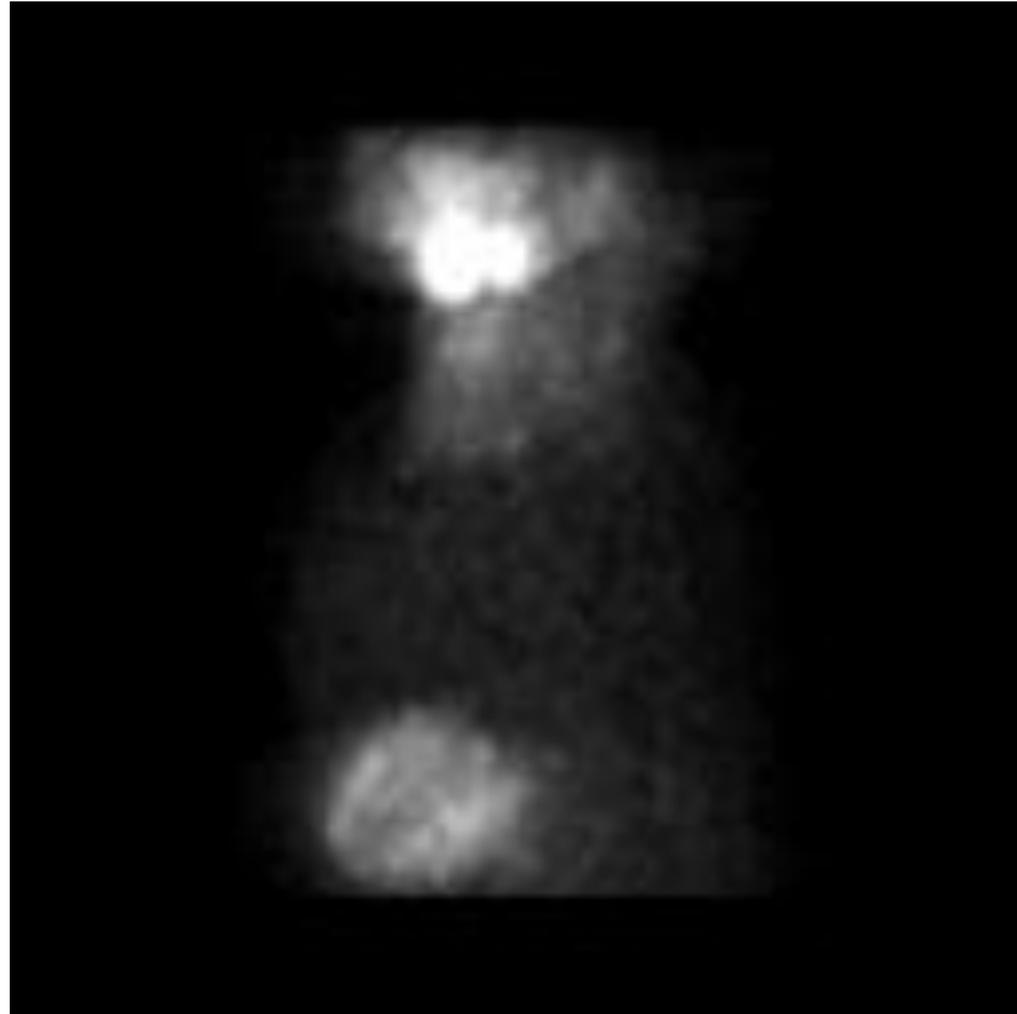
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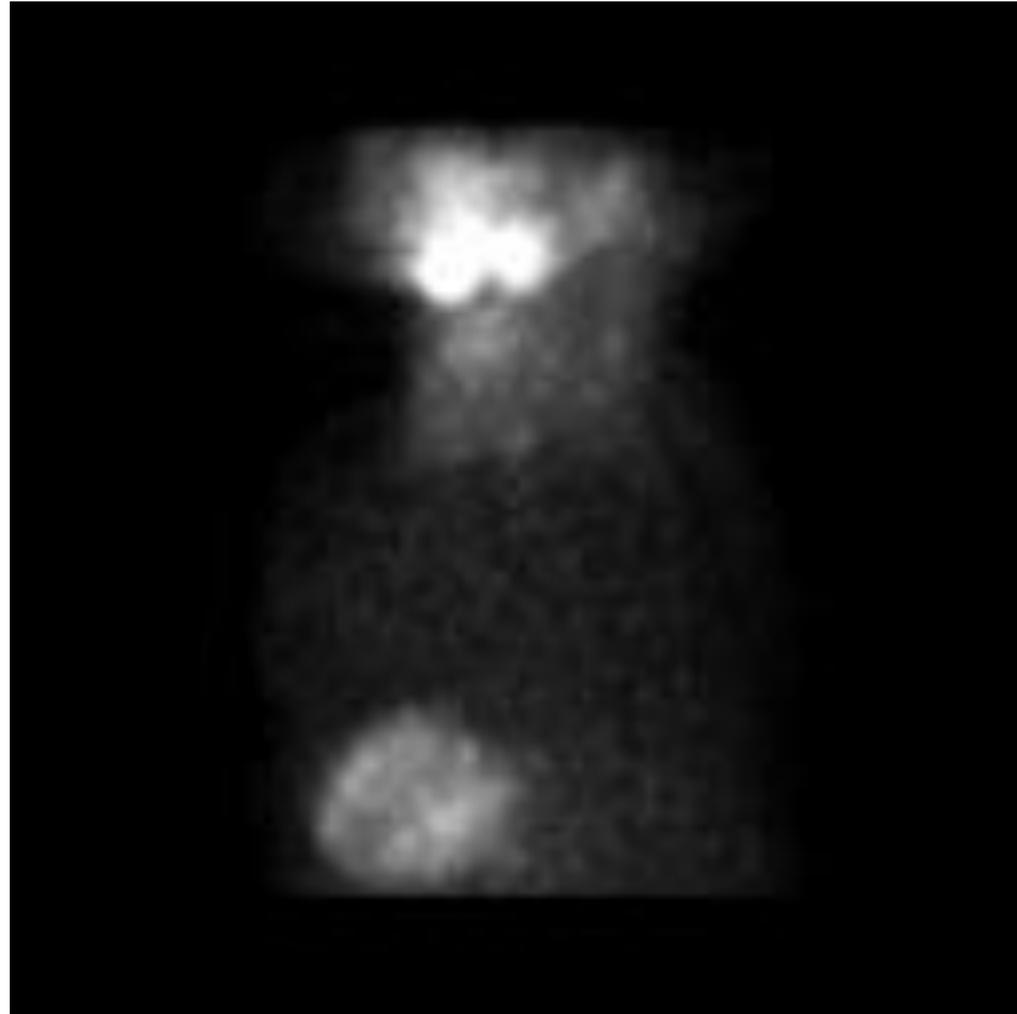
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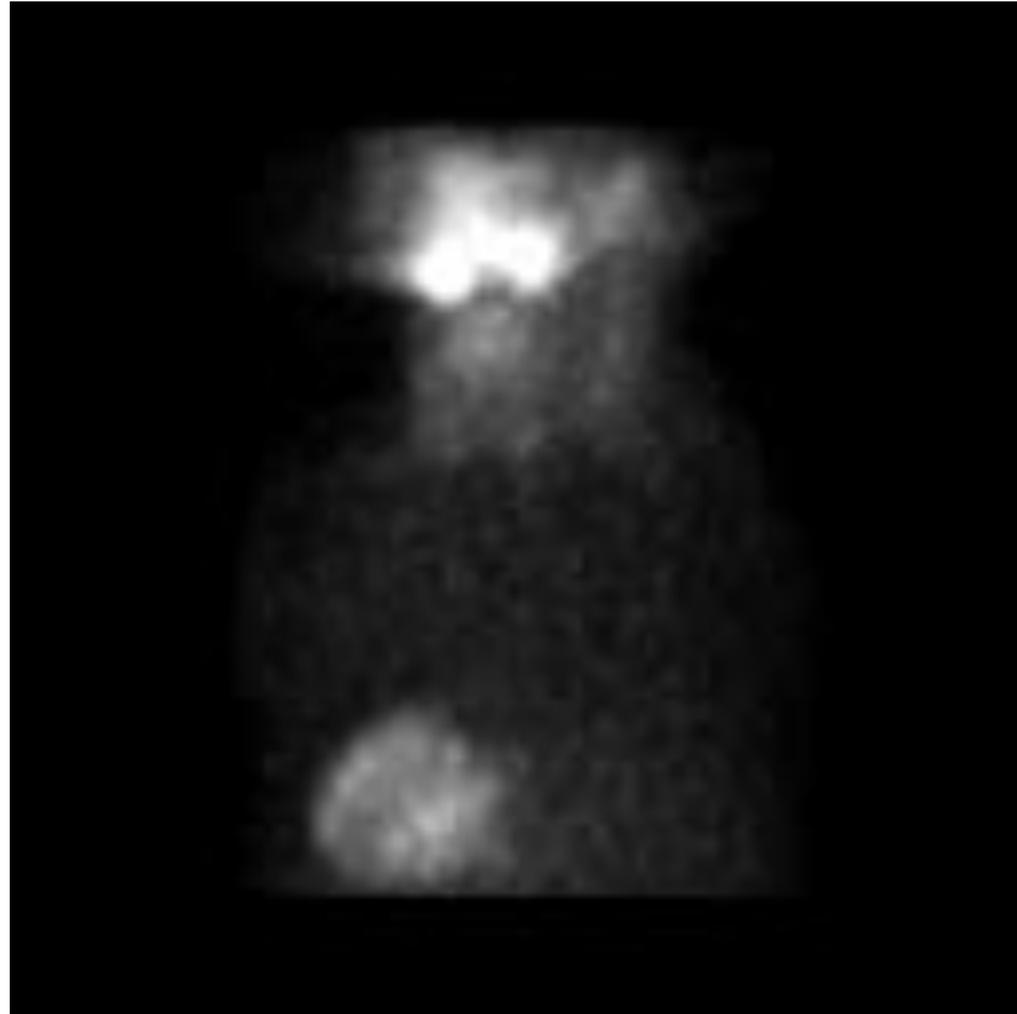
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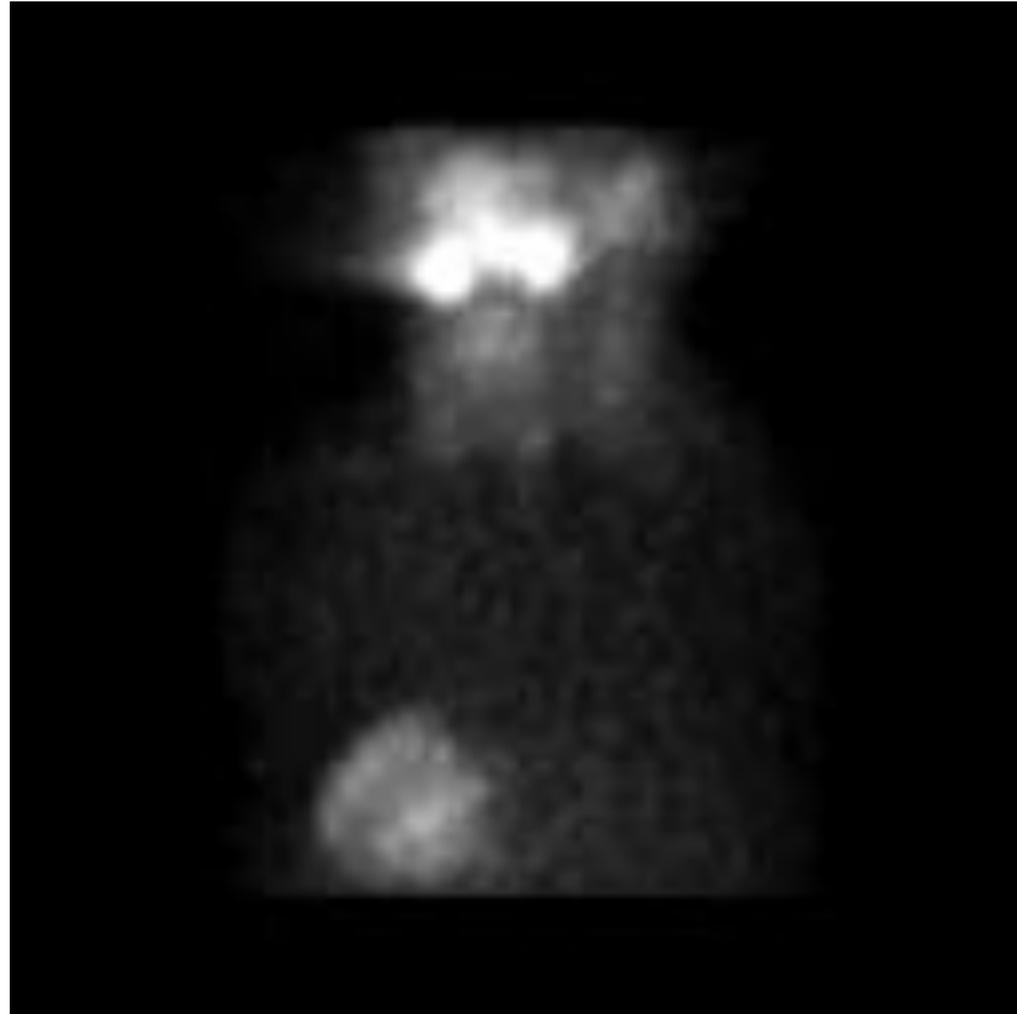
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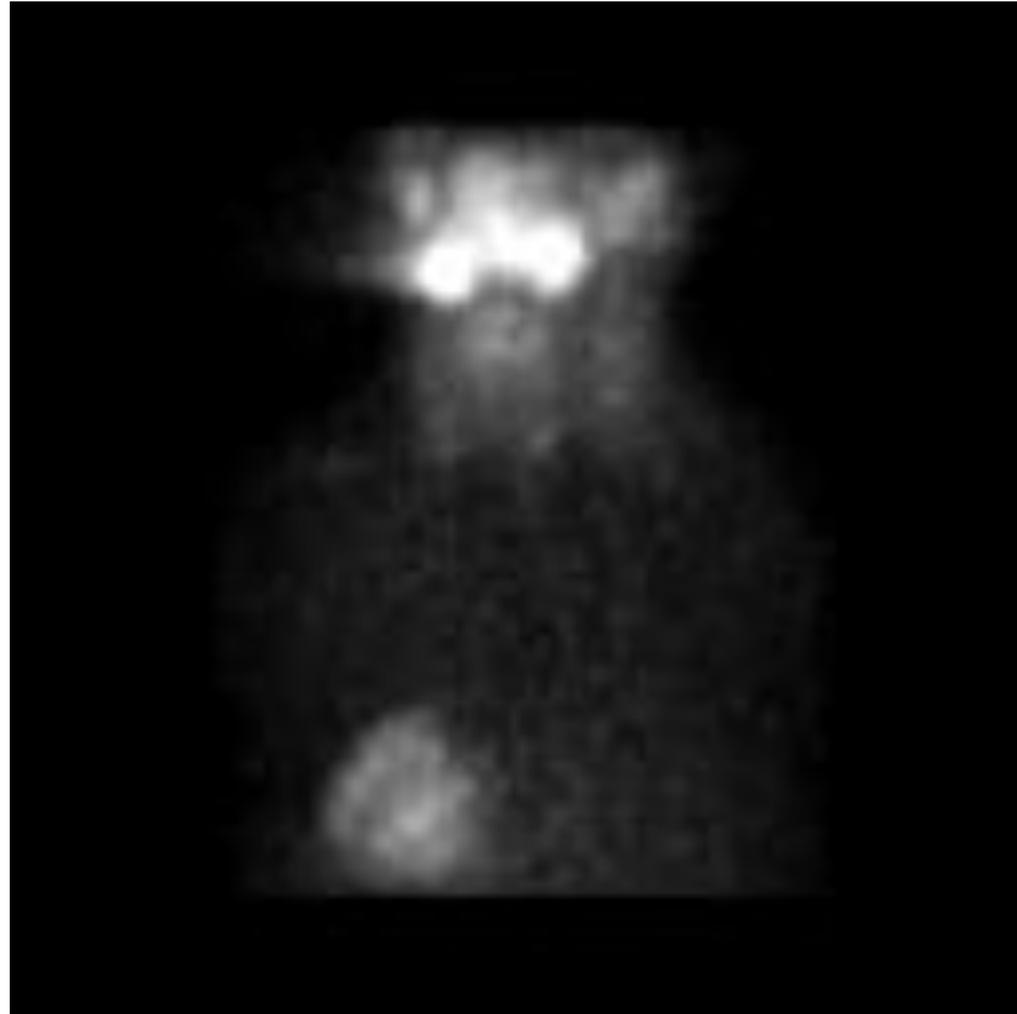
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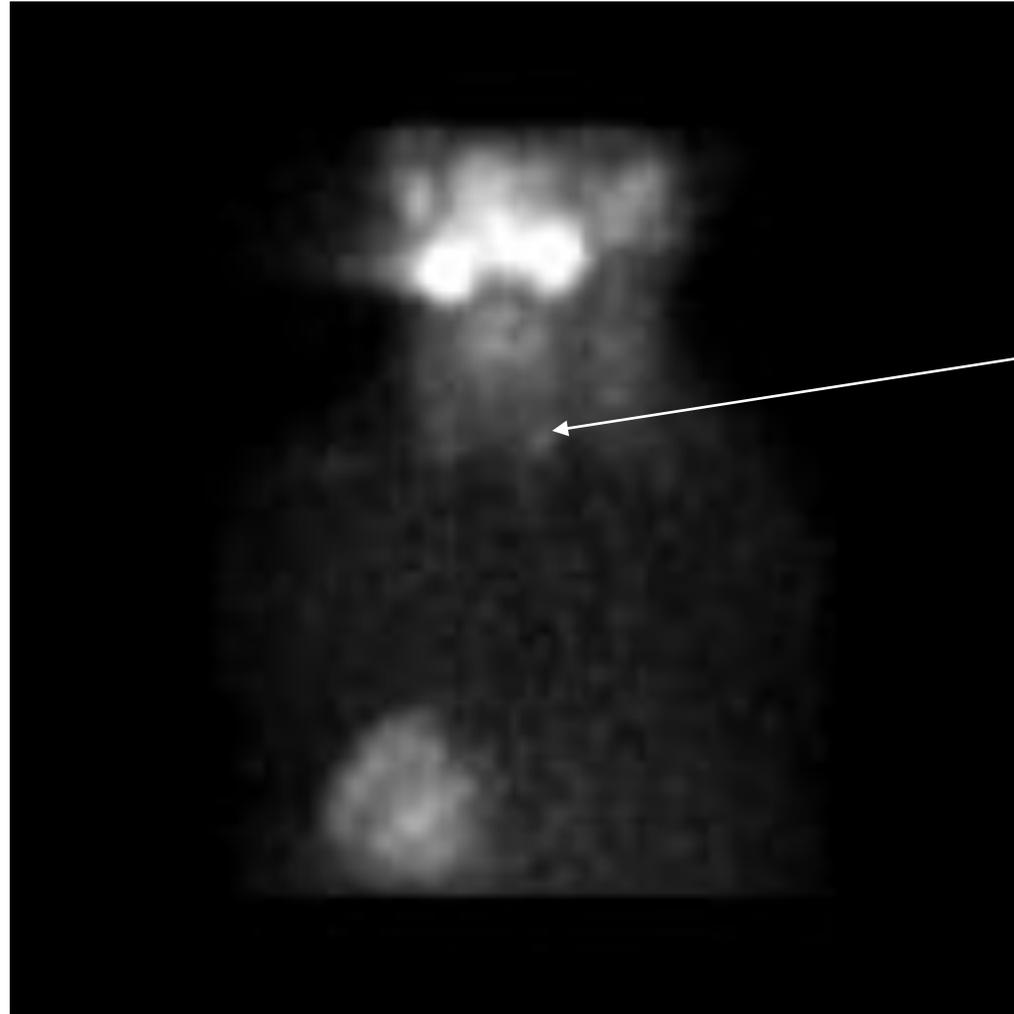
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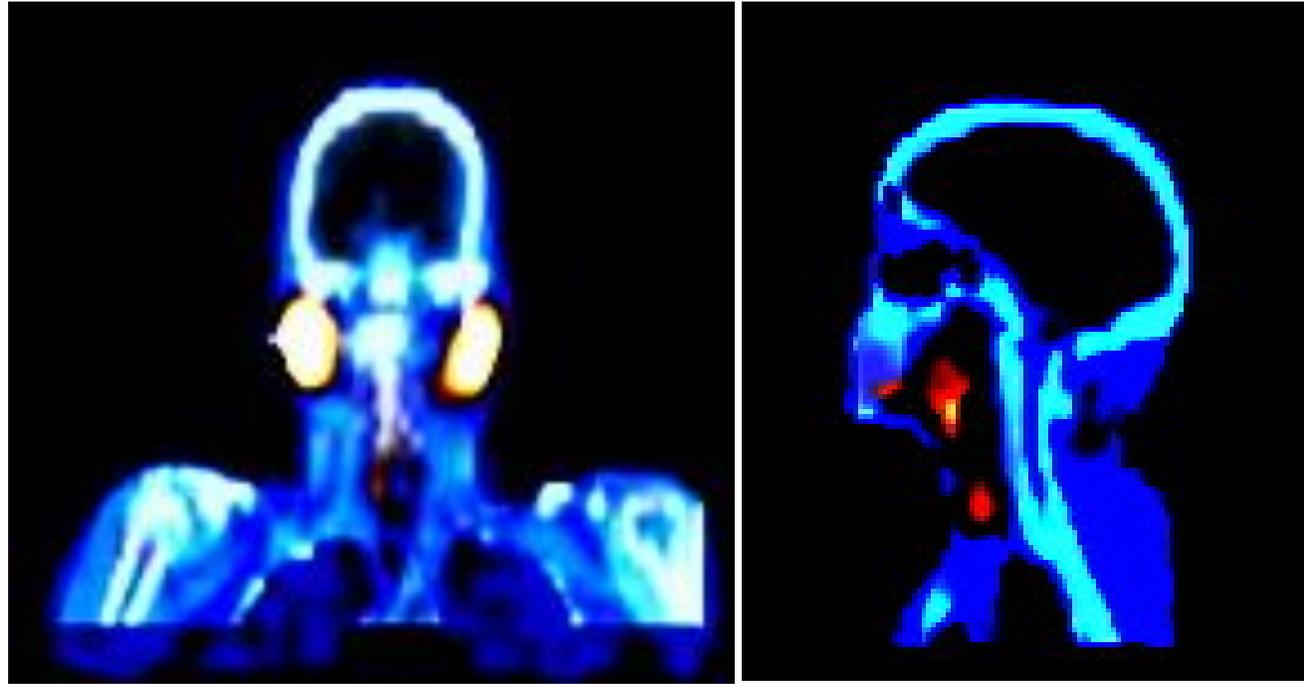


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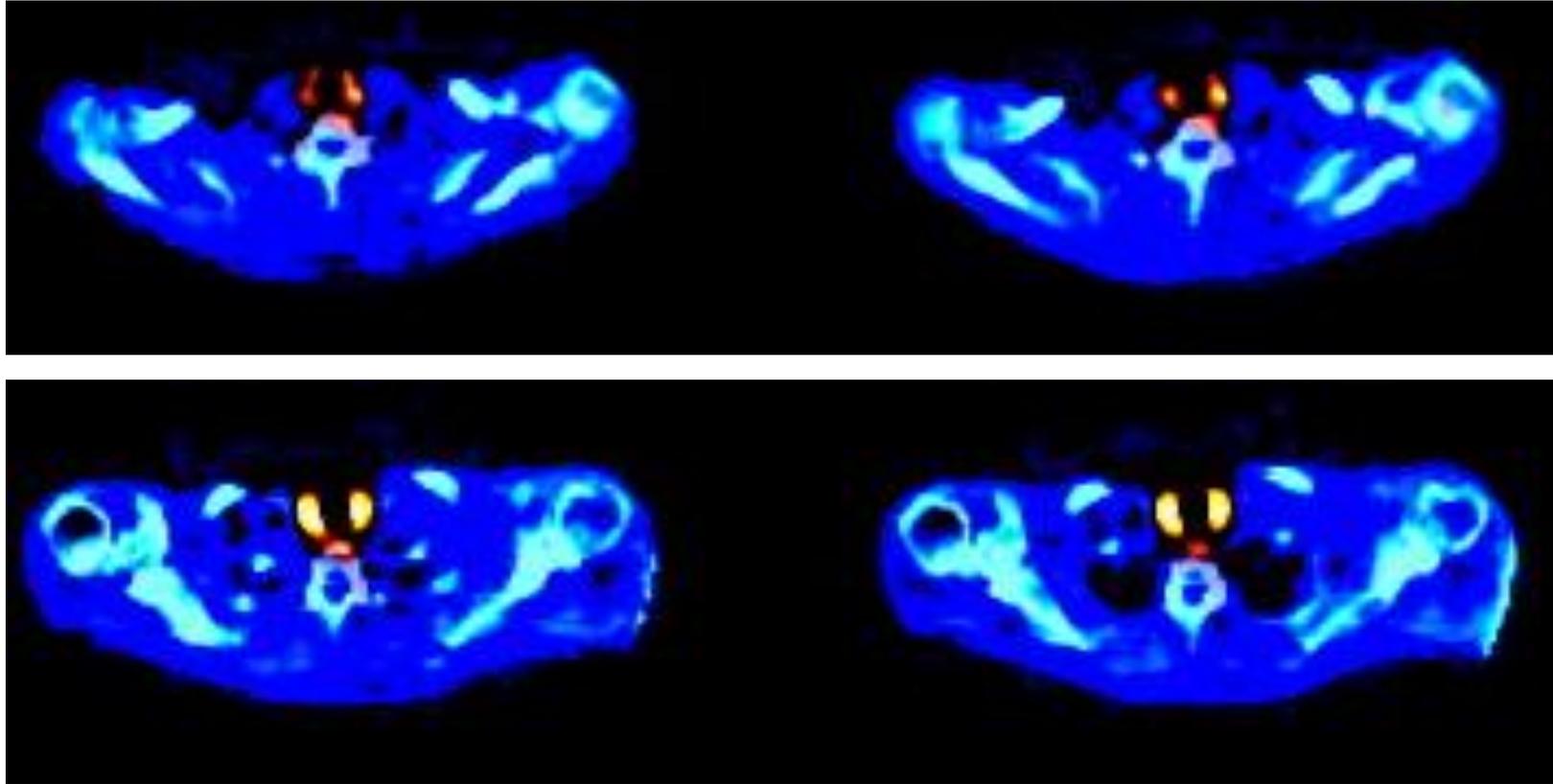


Right Superior
Parathyroid
Adenoma
Extending
Posteriorly and
Inferiorly

Localization: SPECT Sestamibi



Localization: SPECT Sestamibi



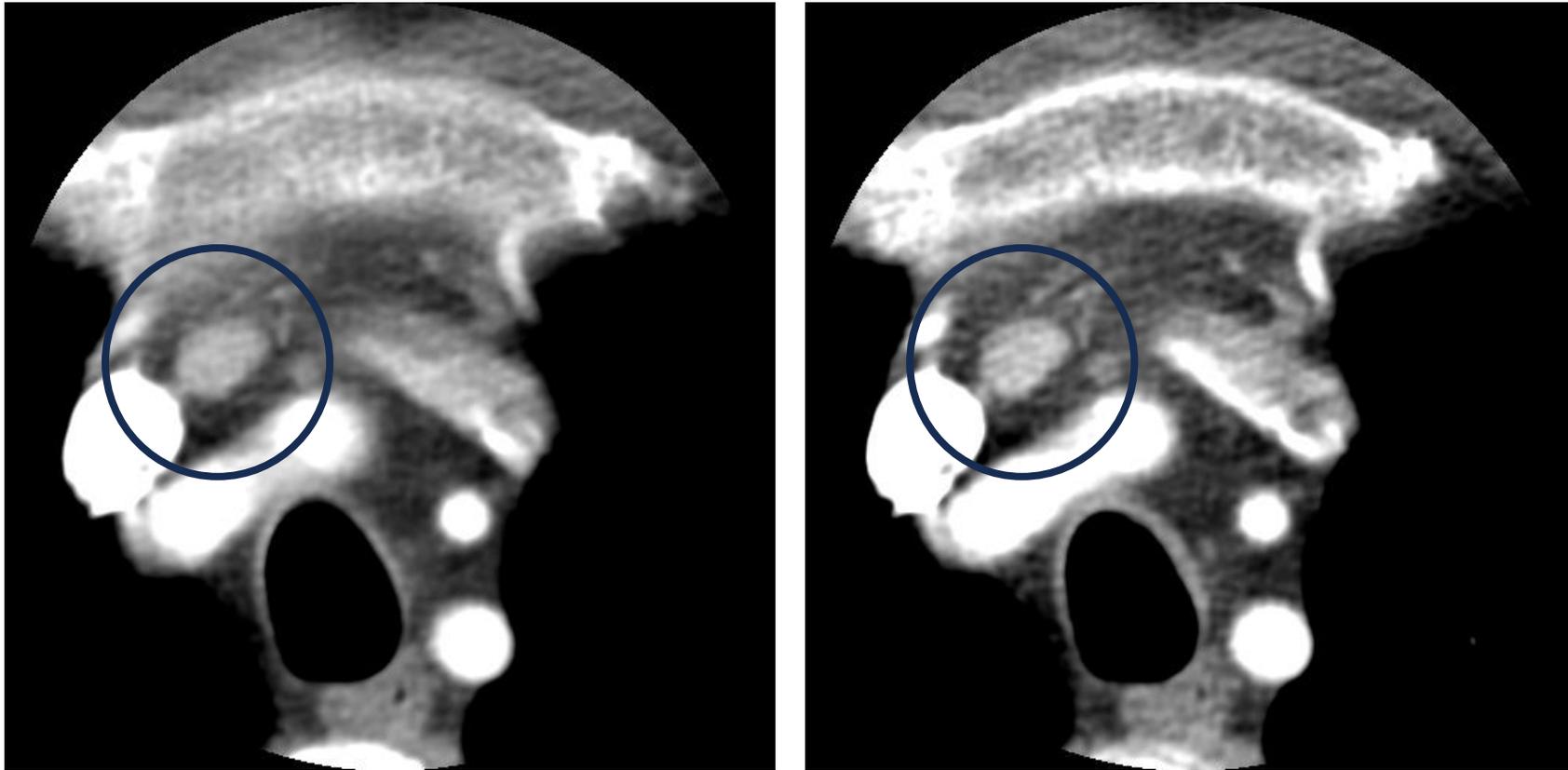
Localization: Parathyroid US



Localization: Parathyroid US



Localization: 4D Parathyroid CT Ectopic Parathyroid Adenoma



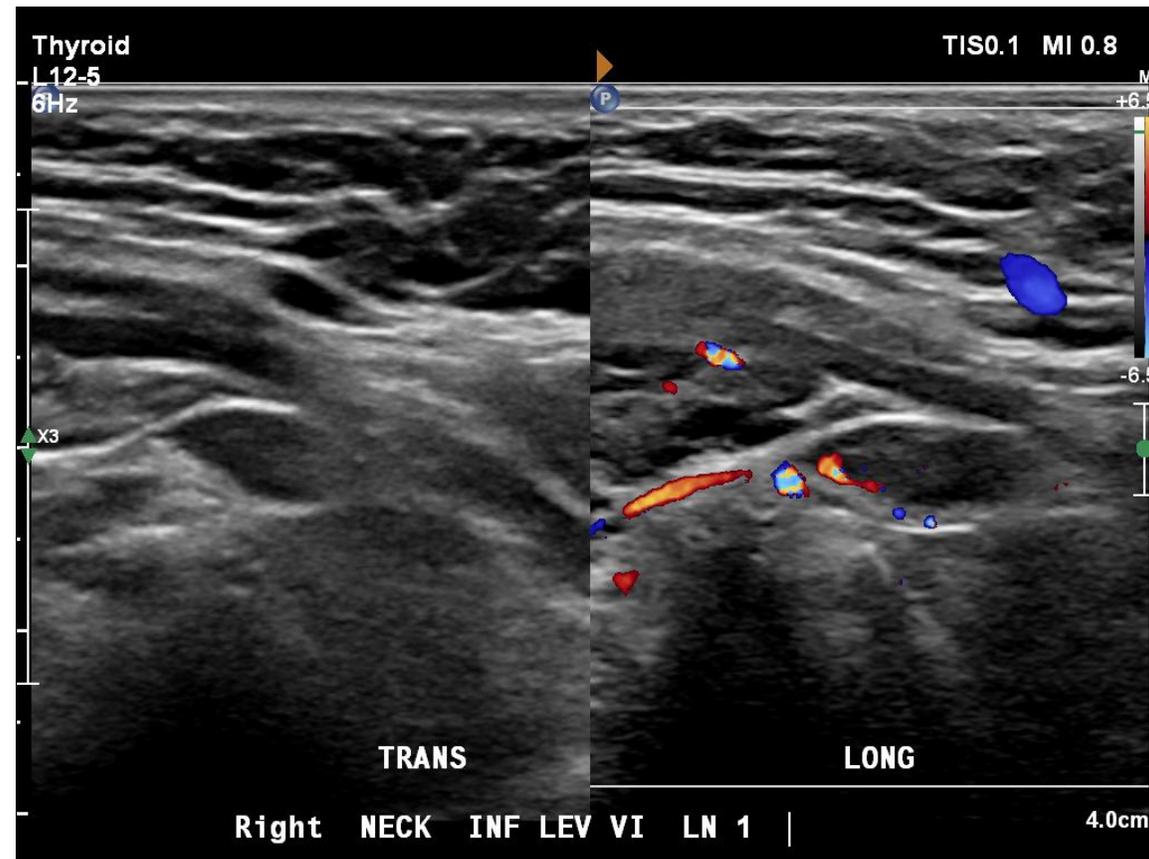
Localization: 4D Parathyroid CT Ectopic Parathyroid Adenoma



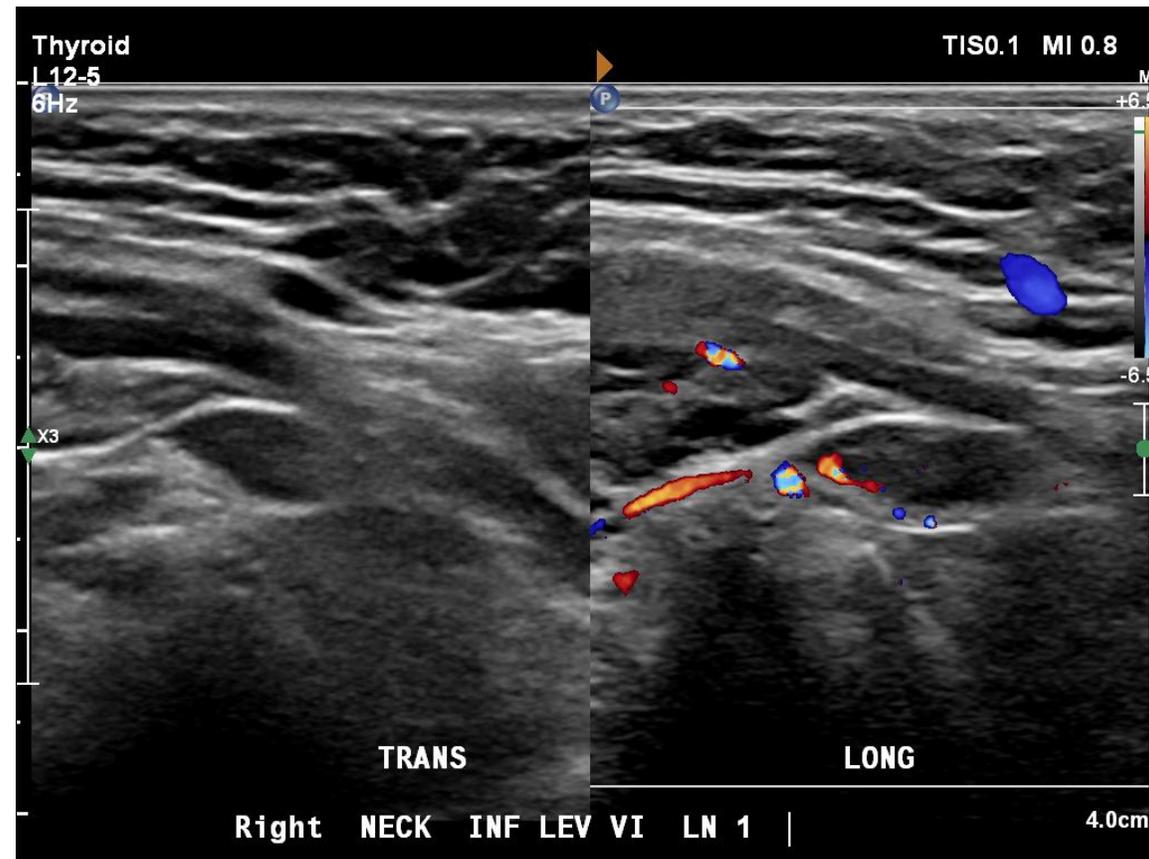
Localization: 4D Parathyroid CT Ectopic Parathyroid Adenoma



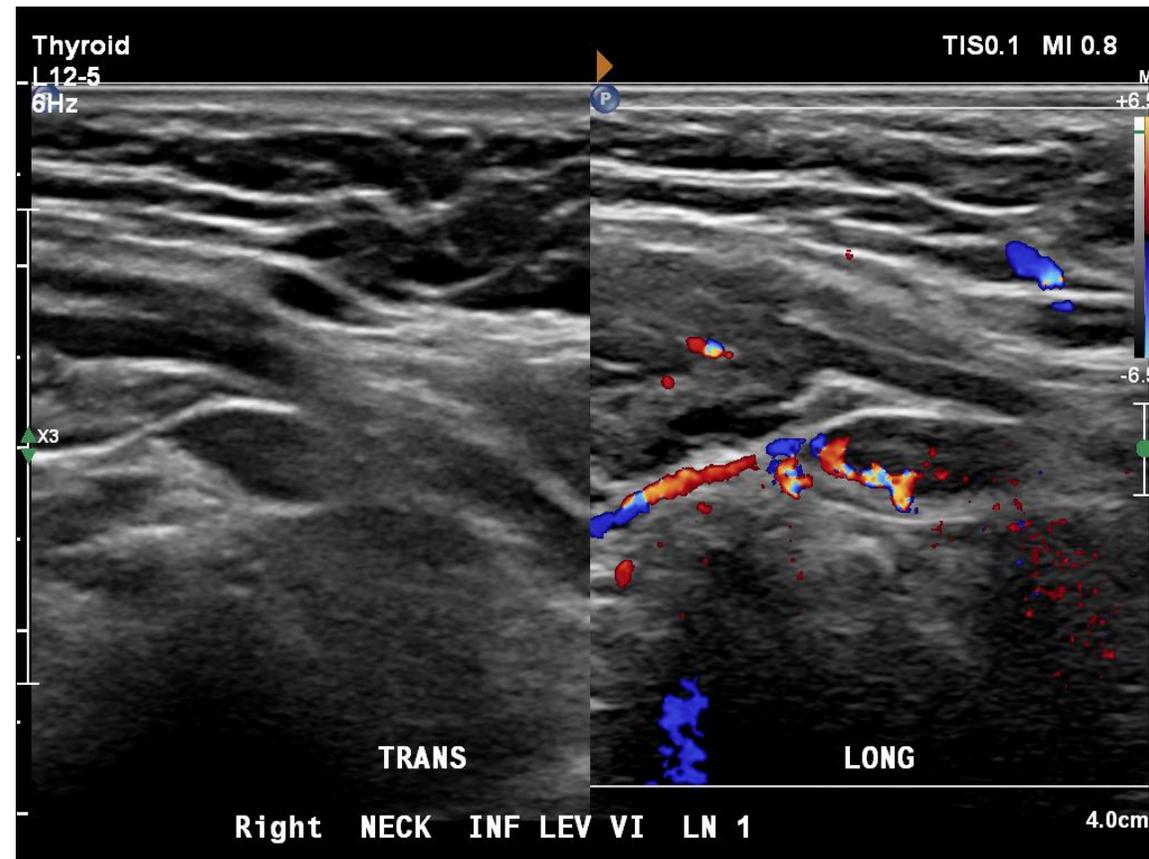
Localization: 4D Parathyroid CT Ectopic Parathyroid Adenoma



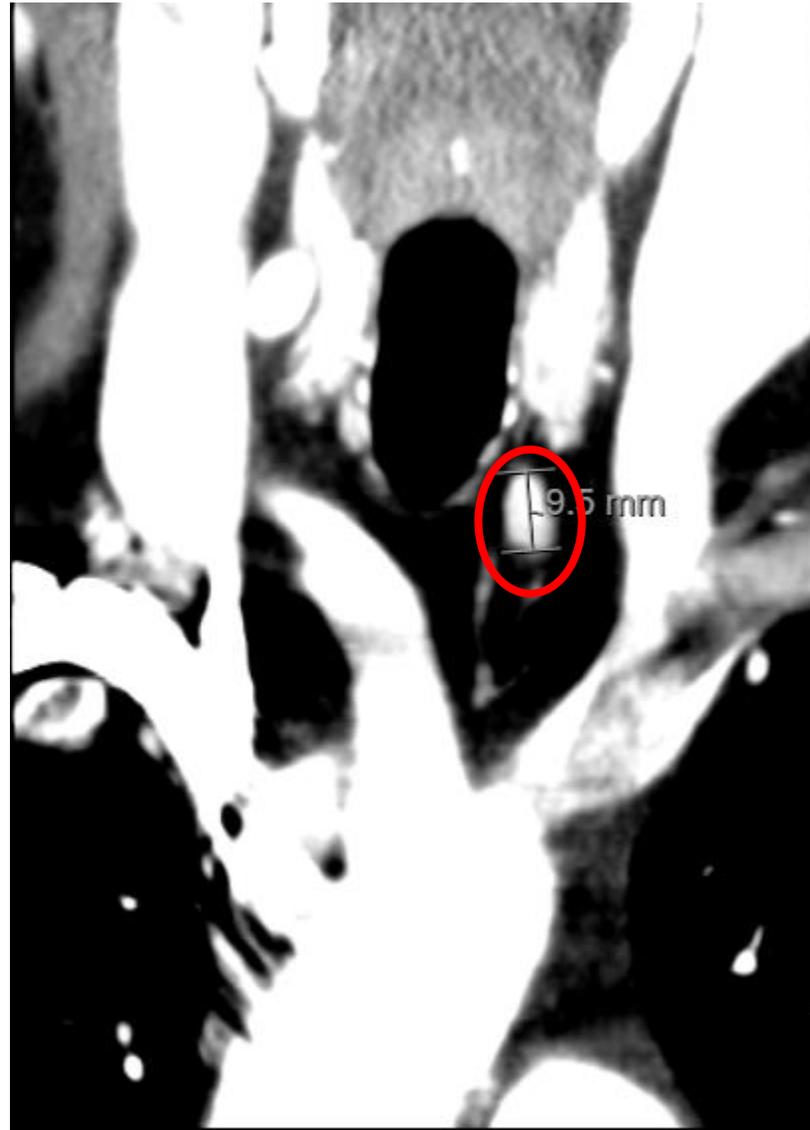
Localization: 4D Parathyroid CT Ectopic Parathyroid Adenoma



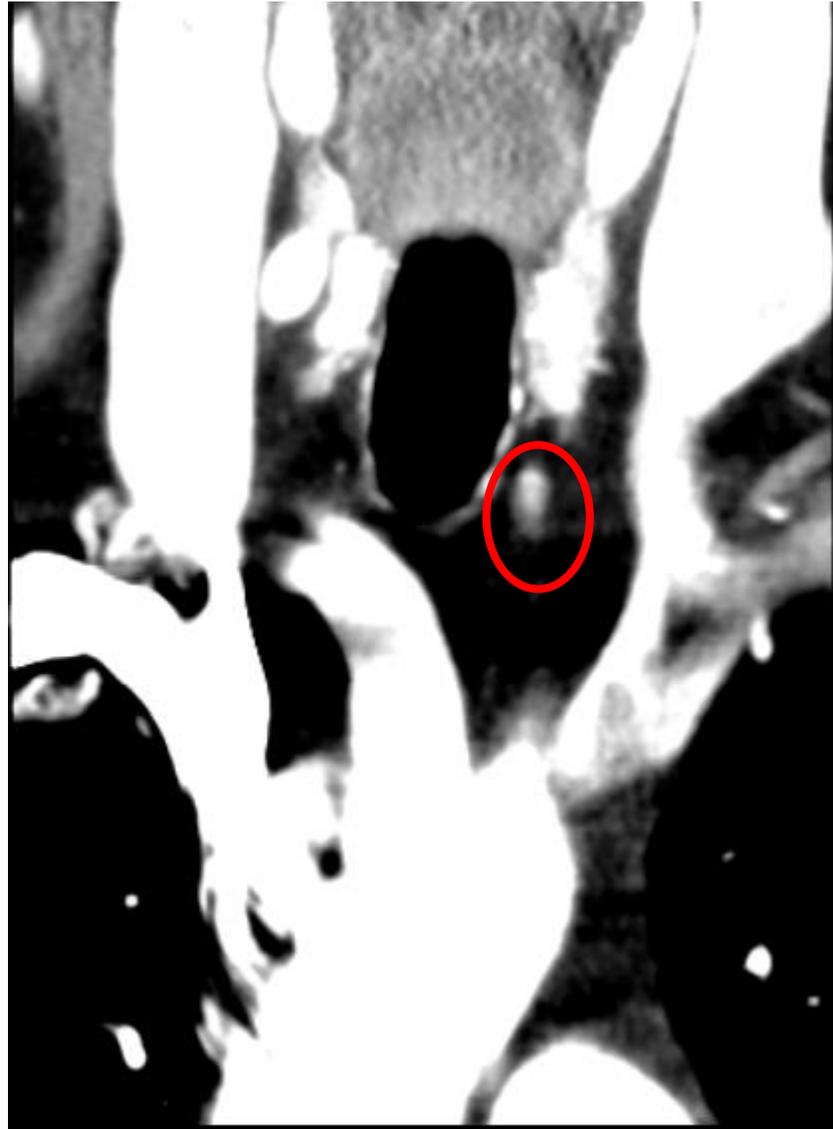
Localization: 4D Parathyroid CT Ectopic Parathyroid Adenoma



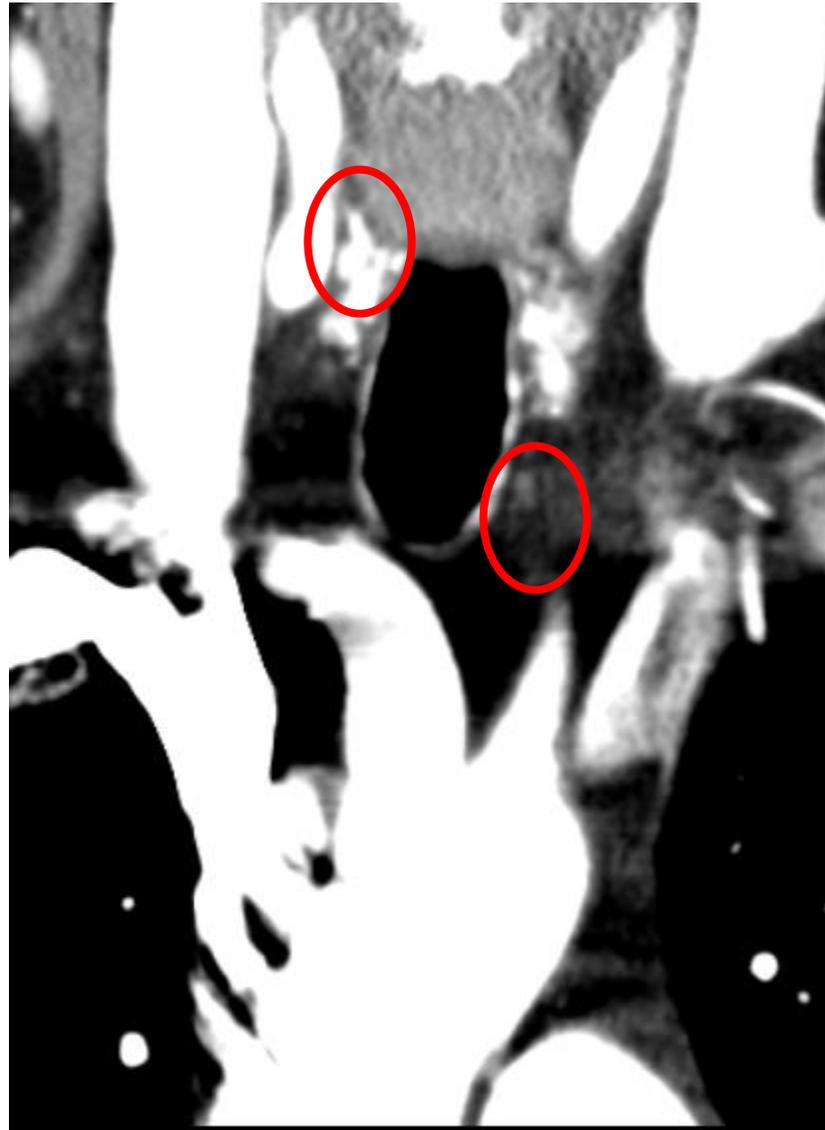
Localization: 4D Parathyroid CT Multiple Parathyroid Adenomas



Localization: 4D Parathyroid CT Multiple Parathyroid Adenomas



Localization: 4D Parathyroid CT Multiple Parathyroid Adenomas



Localization: 4D Parathyroid CT Multiple Parathyroid Adenomas



Localization: 4D Parathyroid CT Multiple Parathyroid Adenomas



Localization: 4D Parathyroid CT Multiple Parathyroid Adenomas









Concise Parathyroid Exploration



5 wks post-op bilateral parathyroid exploration, LN, cervical thymectomy

Concise Parathyroid Exploration

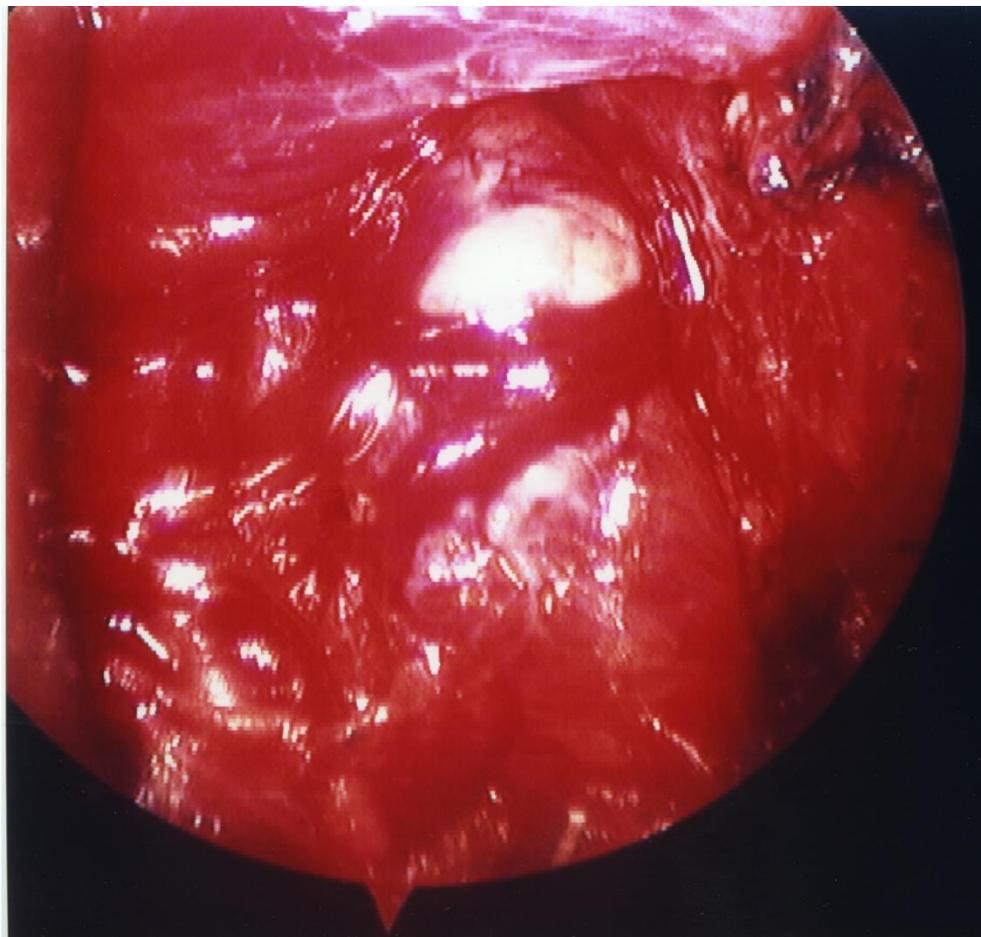


6 mo post-op Bilateral exploration double adenoma 1.5 cm

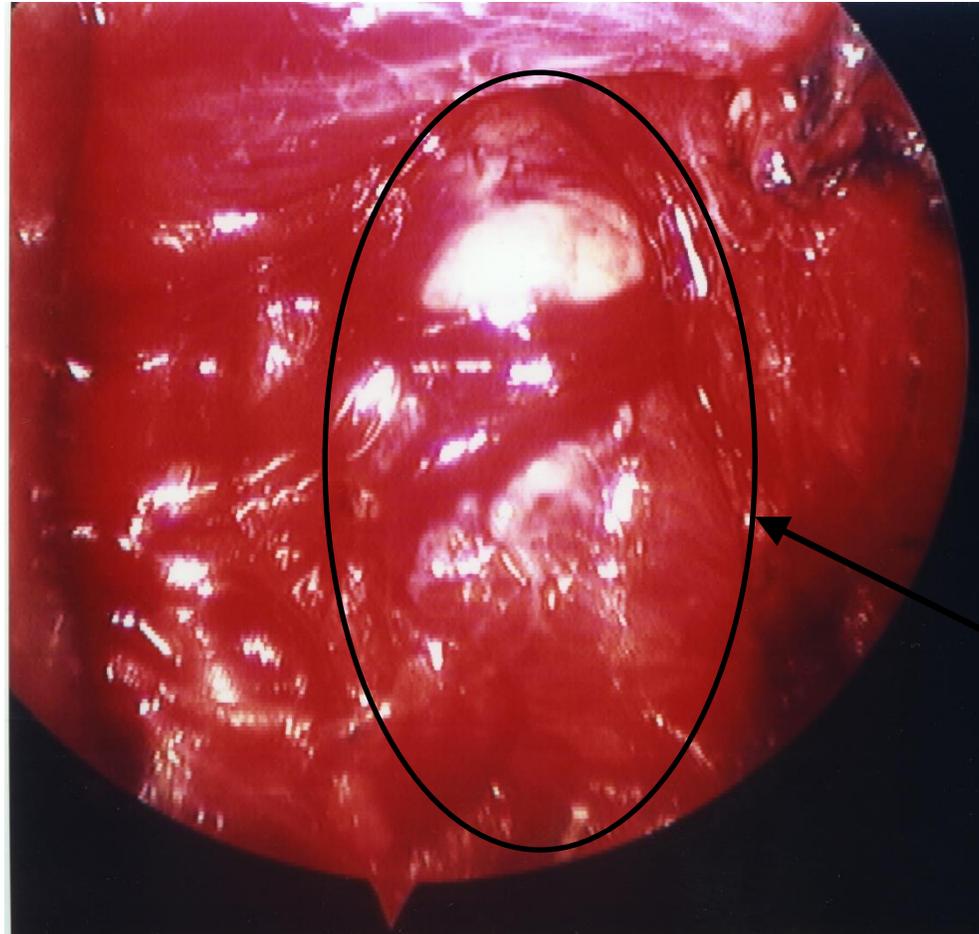


From P. Miccoli

Videoscope Assisted Parathyroid Exploration

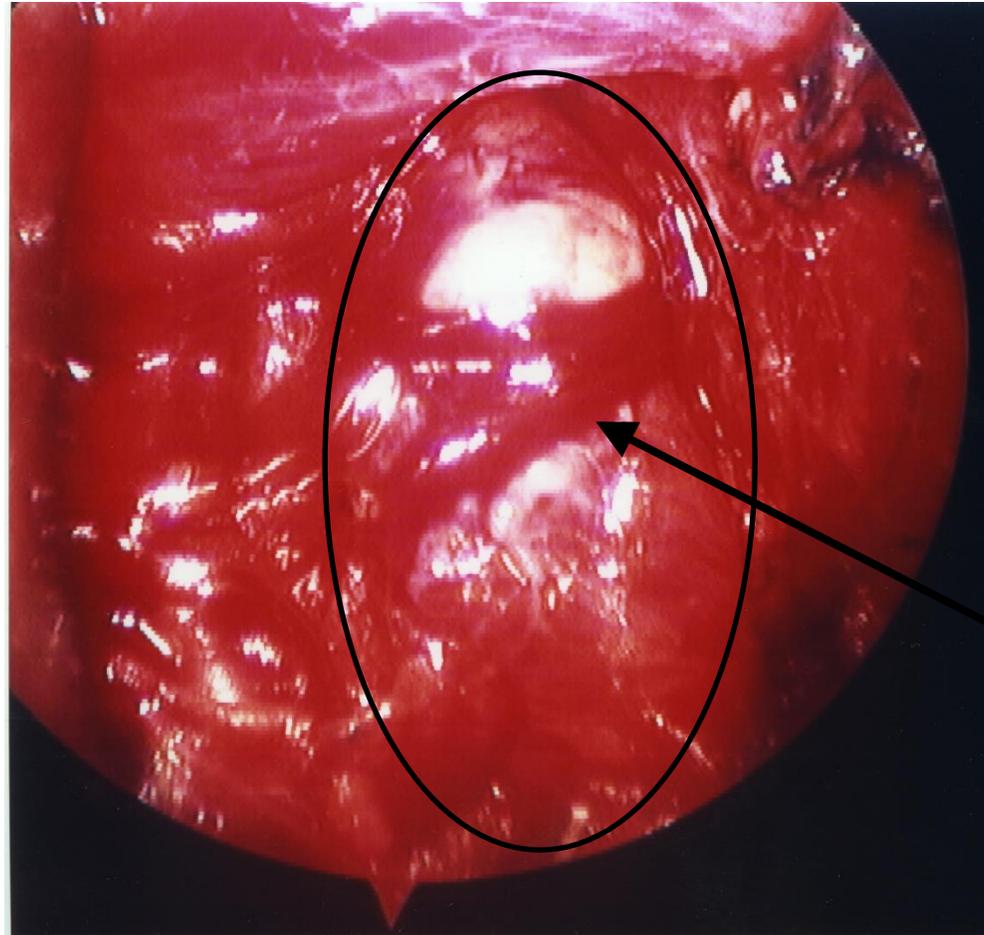


Videoscope Assisted Parathyroid Exploration



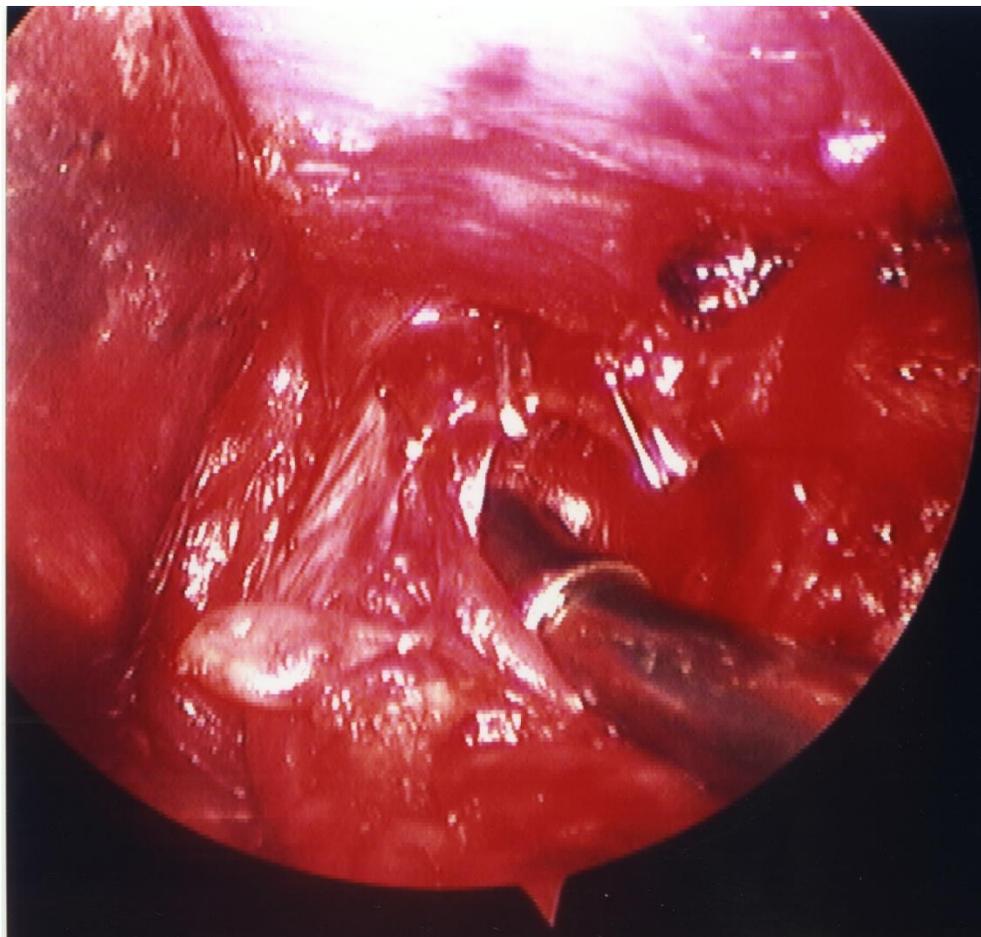
Parathyroid
Adenoma

Videoscope Assisted Parathyroid Exploration

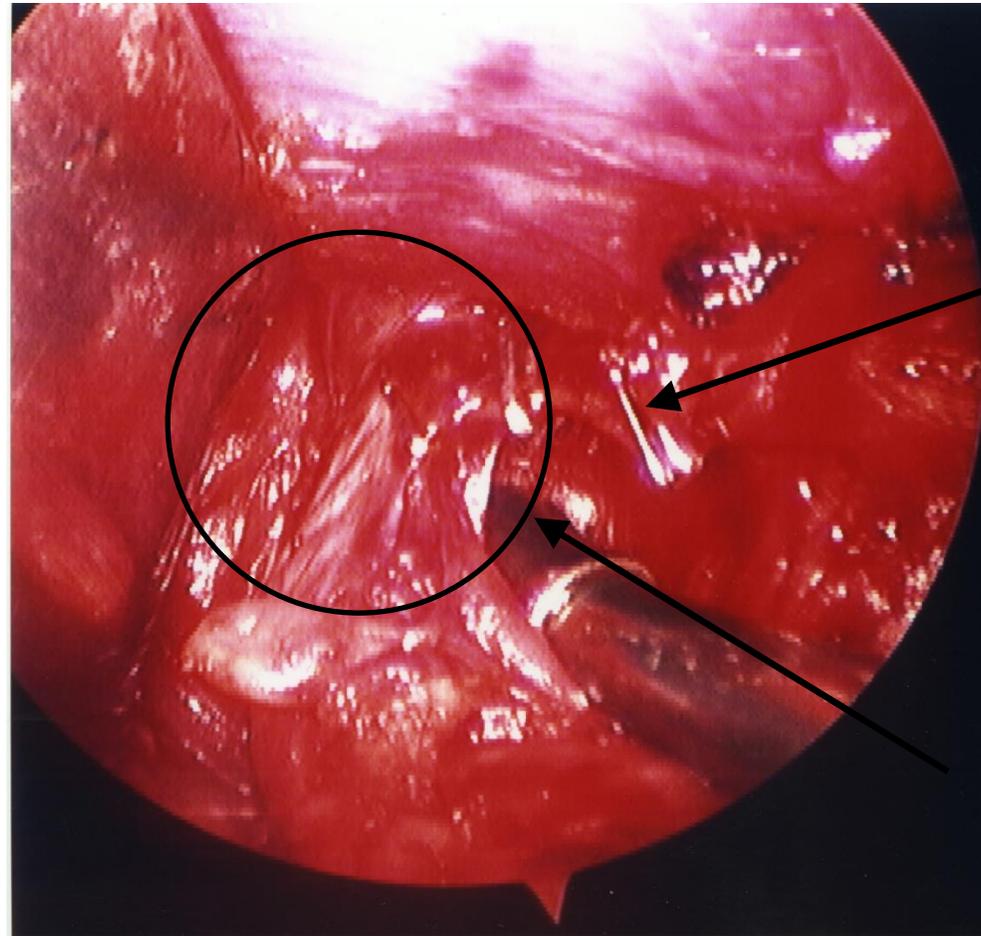


Crossing
Thyroid
Vein

Videoscope Assisted Parathyroid Exploration



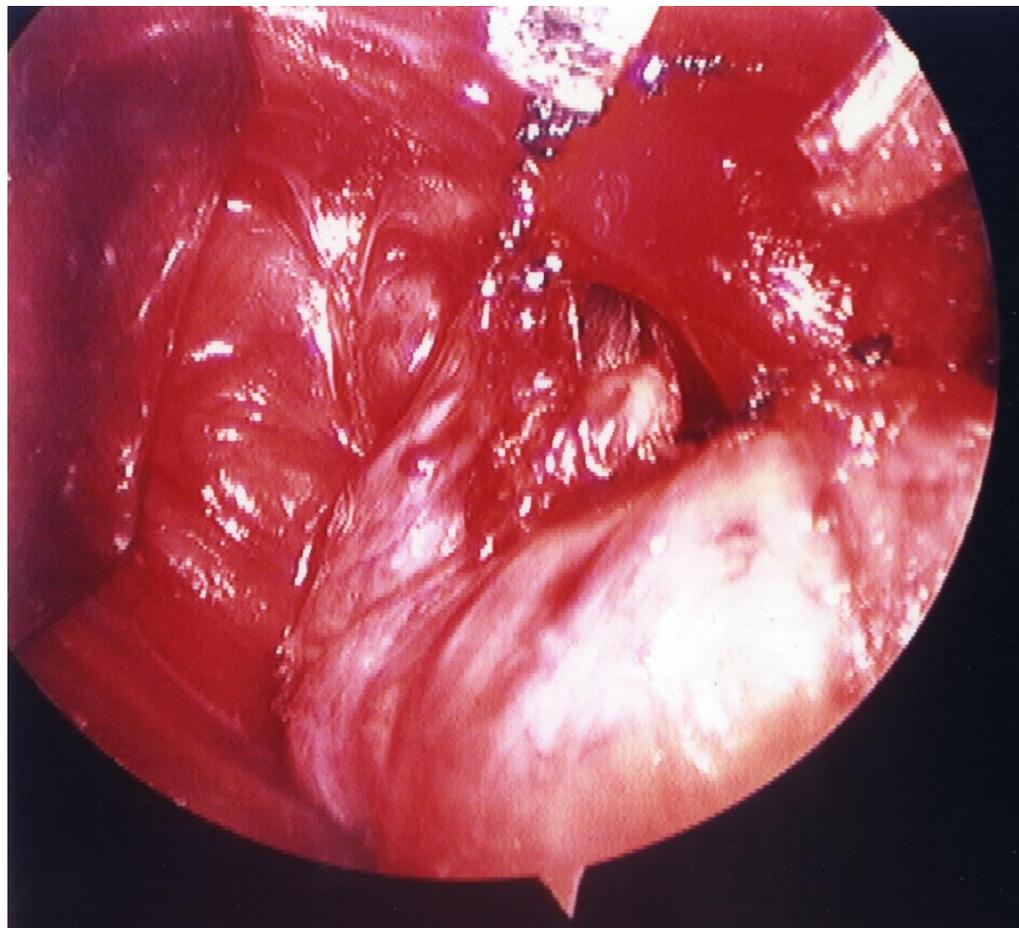
Videoscope Assisted Parathyroid Exploration



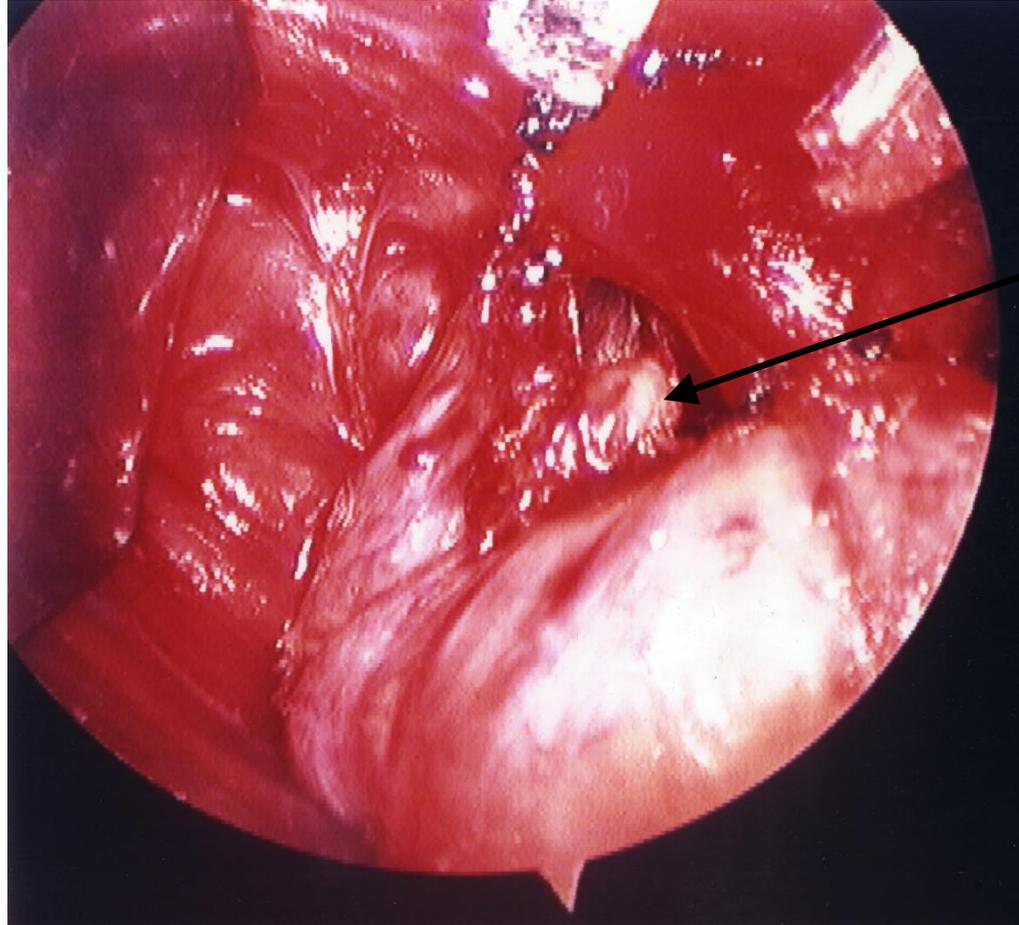
Clips

Parathyroid
Adenoma
Pedicle

Videoscope Assisted Parathyroid Exploration

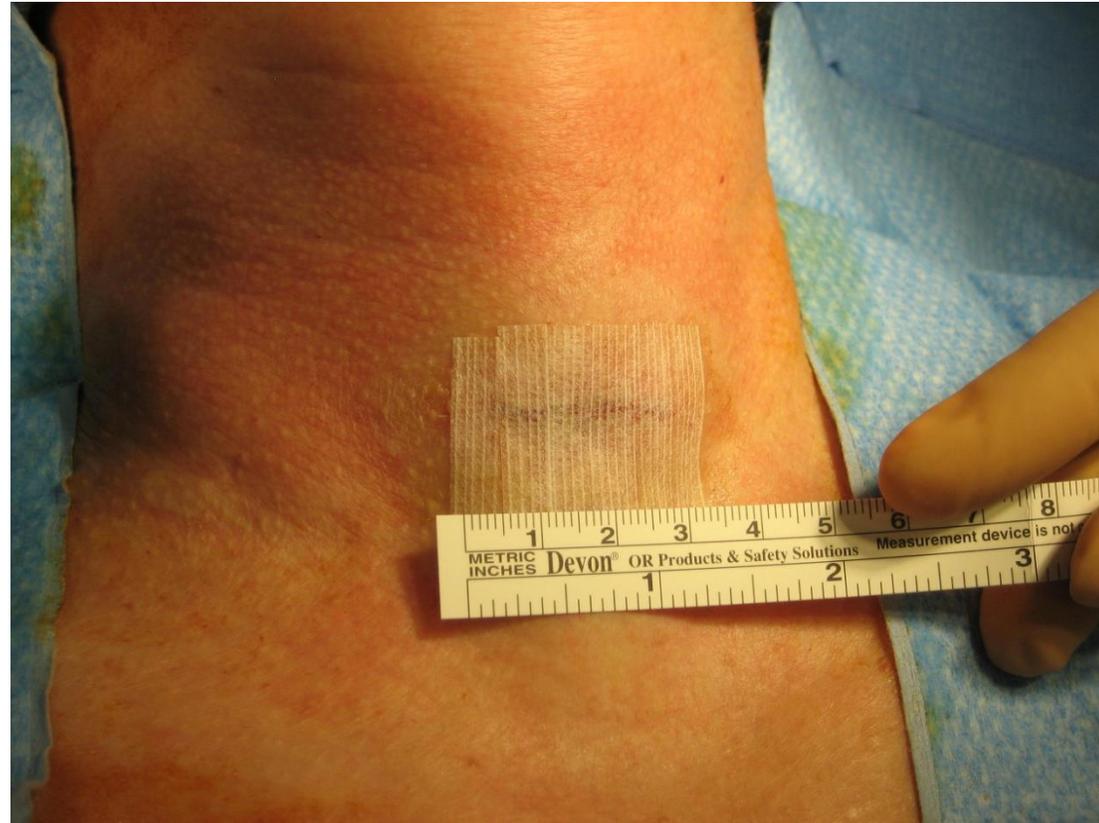


Videoscope Assisted Parathyroid Exploration



Recurrent
Laryngeal
Nerve

Videoscope Assisted Parathyroidectomy



Immediate post-op

Videoscope Assisted Parathyroidectomy



2 wks post-op 2.2 cm

Parathyroid Cancer

- Rare - less than 1% of parathyroid tumors are parathyroid cancer
- Annual incidence approximately 3.5 to 5.7 cases per 10,000,000
- To compare, adrenocortical cancer annual incidence is 50 to 200 cases per 10,000,000
- After resection the biologic behavior can be indolent with 10 yr survival ranging from 50 - 70%
- If identified intraoperatively en bloc resection of thyroid lobe and central neck dissection should be performed
- Recent studies have questioned the efficacy of routine central lymph node dissection

Parathyroid Cancer

- Dogma is diagnosis is clinical, classically hard white tumors invading local structures in the clinical setting of high PTH and severe hypercalcemia
- However, diagnosis of parathyroid cancer on final pathology does occur
- Pathologically diagnosed by fibrous bands in trabecular pattern, capsular invasion, vascular invasion, and mitotic activity (Ki67).
- Parafibromin staining is a common adjunct. It is negative in parathyroid cancer. Other markers include APC, PGP9, and Galectin 3. Analysis of somatic mutation of CDC73 can be performed.

Parathyroid Cancer

- Morbidity and mortality caused by intractable hypercalcemia rather than tumor burden
- In the presence of metastases treatment is with the calcimimetic cinacalcet (Sensipar)
- Local and distant surgical control has been the mainstay of treatment to reduce tumor burden, thus reducing PTH and intractable hypercalceimia
- Combinations of cyclophosphamide, FU, dacarbazine, or methotrexate, doxorubicin, cyclophosphamide and lomustine no improvement in survival.
- No studies showing benefit or even studying the efficacy of tyrosine kinase inhibitors on parathyroid cancer.

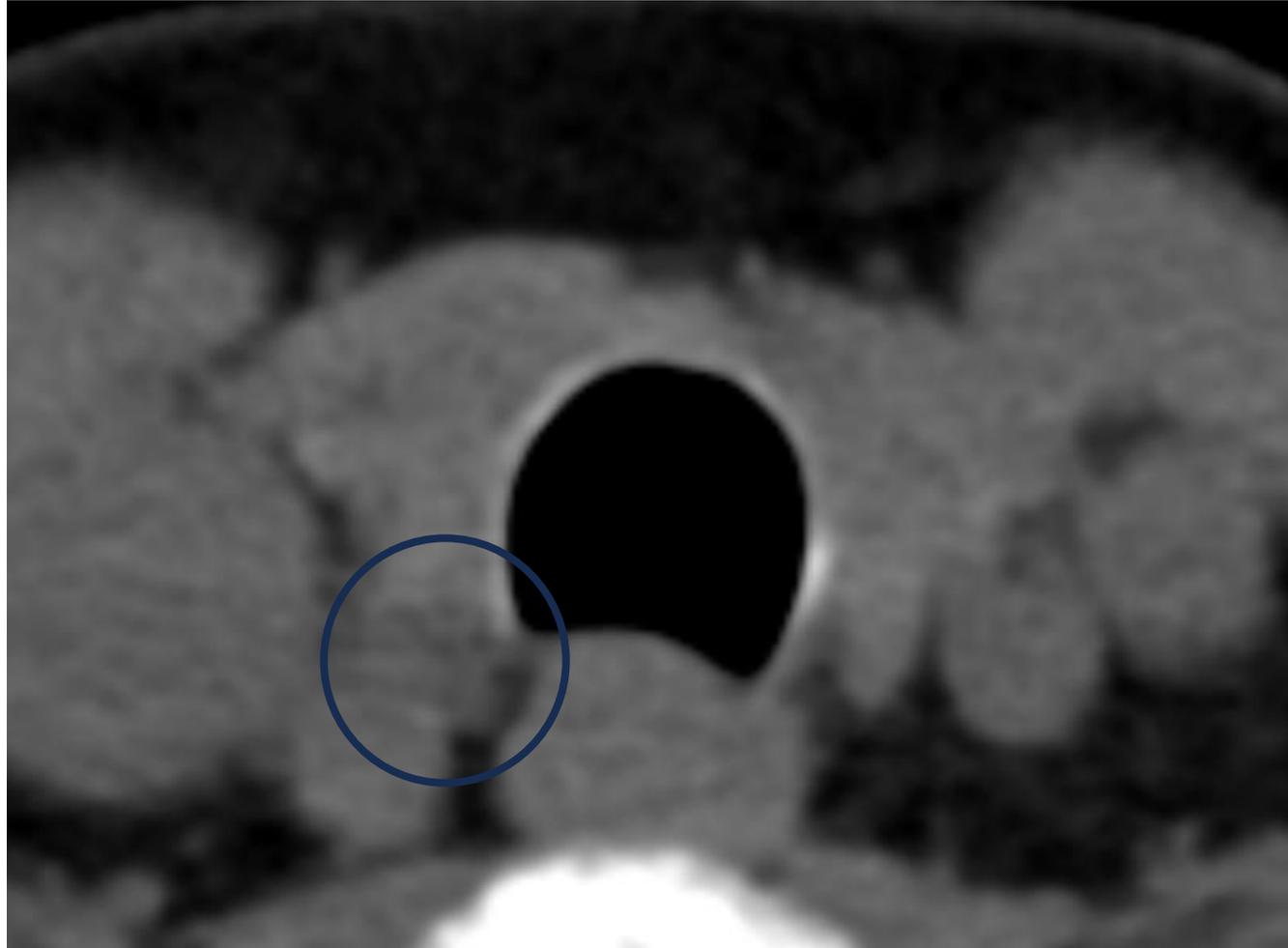
Parathyroid Cancer

- One case report of treatment of metastatic parathyroid cancer with pembrolizumab (60% reduction of tumor burden) (BMJ Case Rep 2020; 13(9): e235293)
- One case report of treatment of metastatic parathyroid cancer with anti-hPTH antibodies (12 yr remission) (Endocrine 2020;67:204-8)
- We found that LOH of a selected panel of tumor suppression genes was common, with most frequent LOH of the HPRT2, Rb, and MEN1 genes

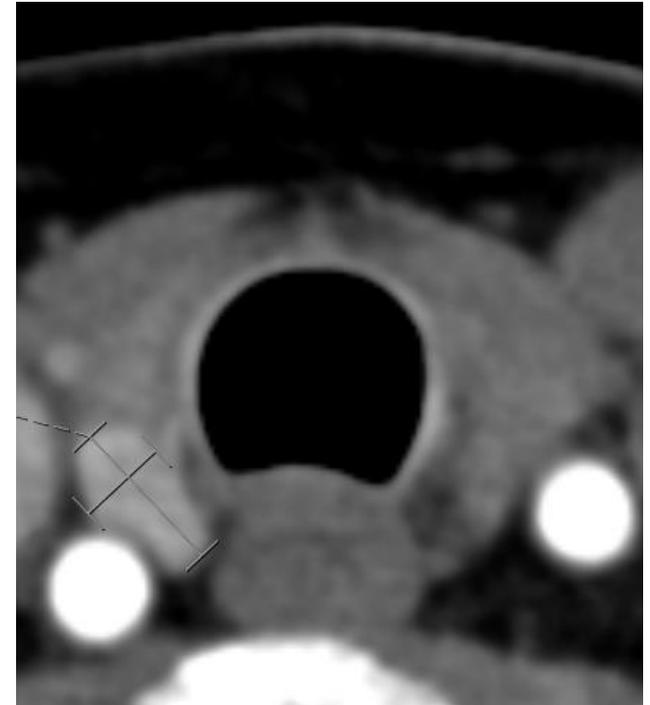
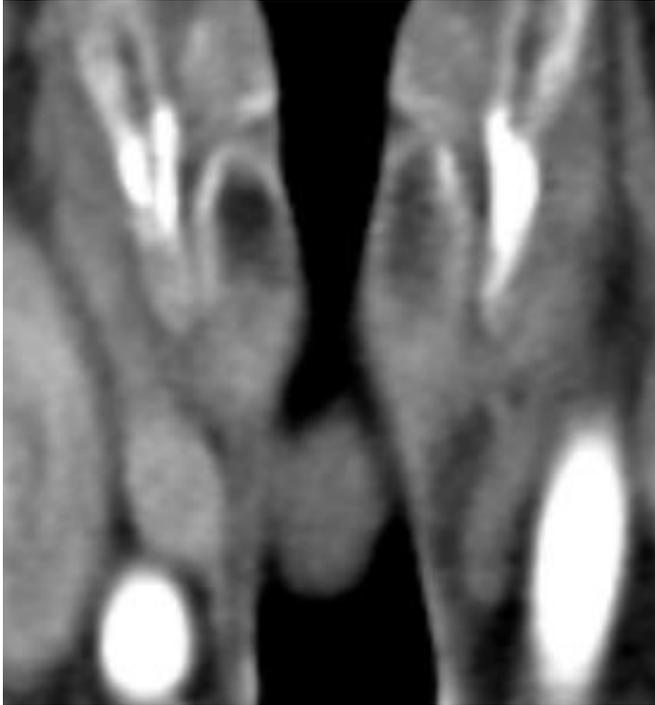
You Too Can Be a Parathyroid Radiologist!

- 4D Parathyroid CT and Parathyroid Ultrasound
- Parathyroids are almost always extrathyroidal. They may be adherent to the thyroid but almost always on the surface or completely separate from the thyroid.
- Pre-contrast: **the parathyroid adenoma is less dense than the thyroid.** Patient must be positioned to decrease scatter from the bones such as the clavicles. CT scan must be high resolution. Parathyroids are usually extrathyroidal, but so are lymph nodes.
- Arterial Phase: contrast is injected, and the parathyroid will perfuse. A lymph node will not perfuse. However, thyroid tissue will perfuse.
- Venous Phase: the thyroid may washout differently than the parathyroid.
- Parathyroid US distinguishes hypercellular parathyroids from ectopic thyroid tissue by being markedly hypoechoic compared to thyroid tissue of any type.

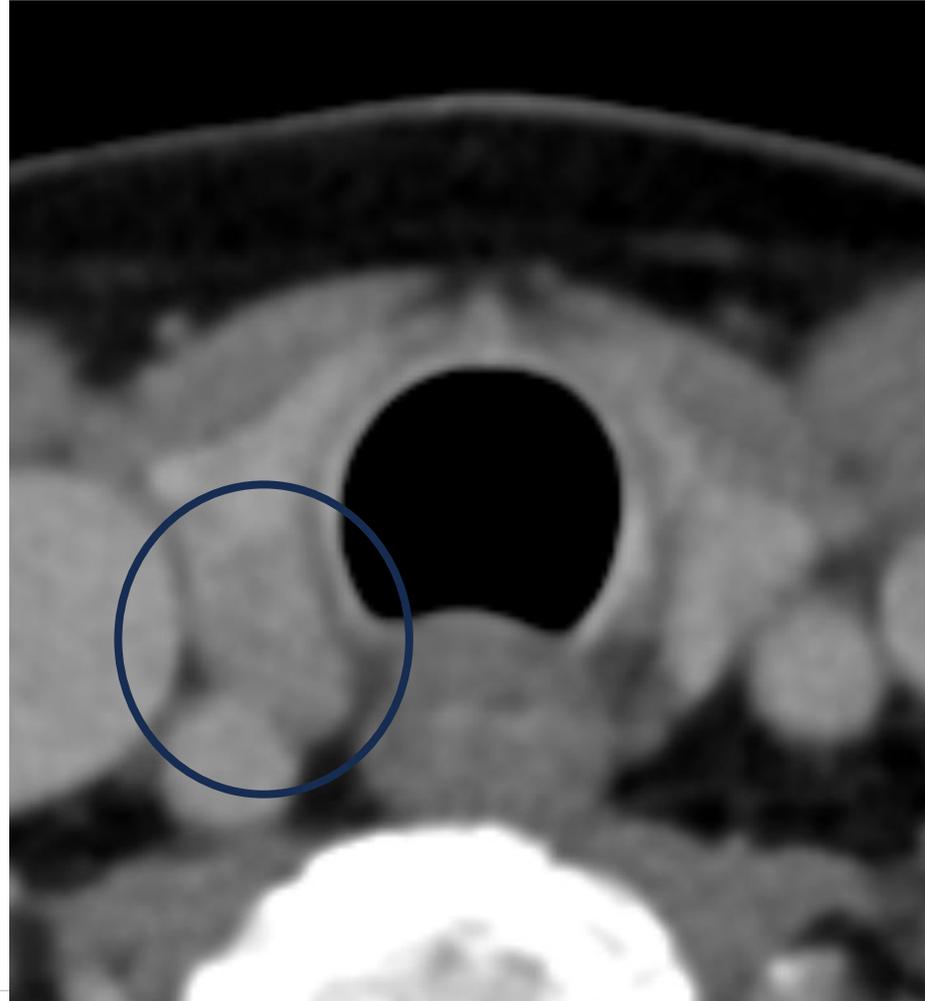
4D Parathyroid CT – Pre-Contrast



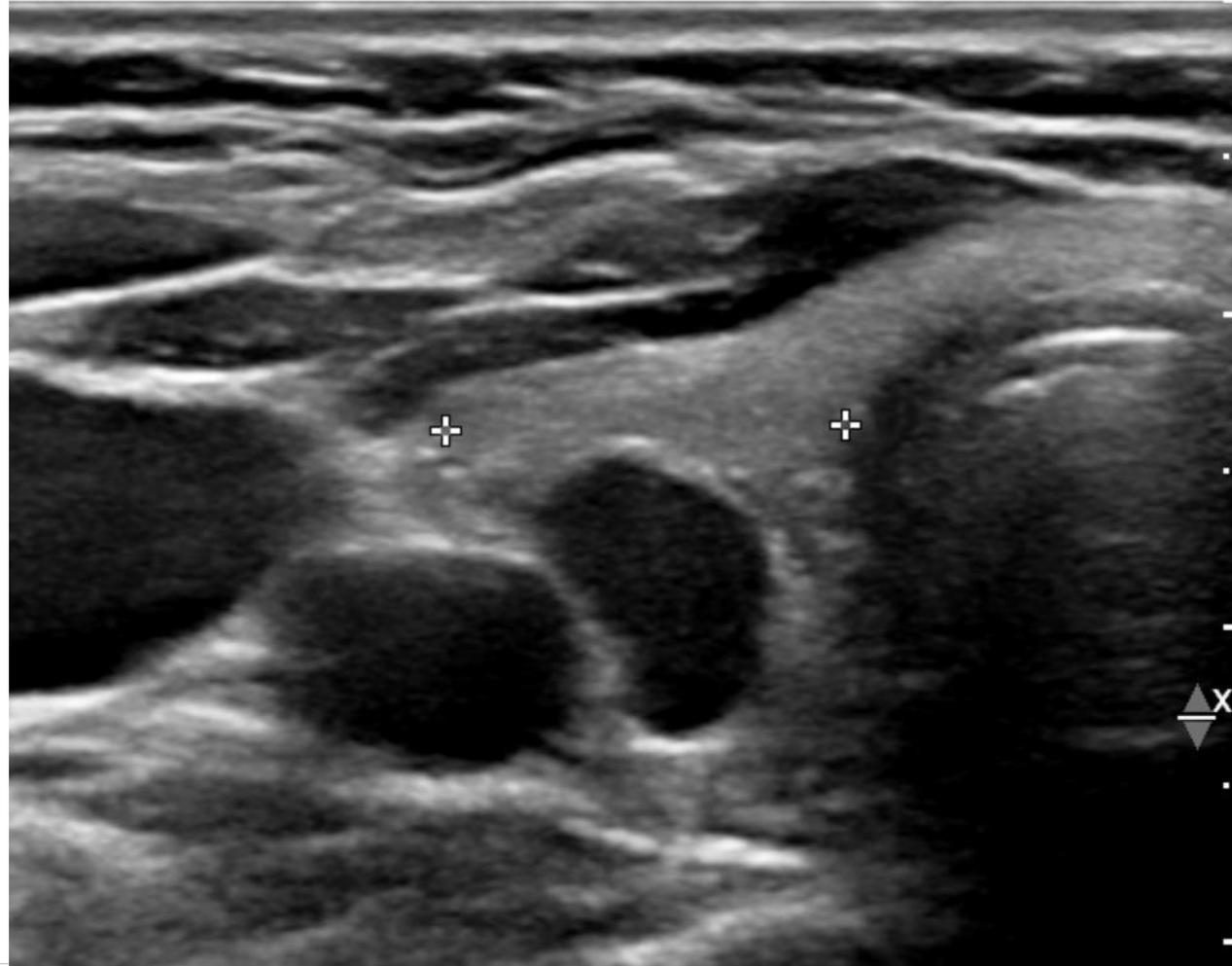
4D Parathyroid CT – Arterial Phase



Venous Phase



Parathyroid Ultrasound



In the OR...

- A normal right inferior parathyroid was identified
- No right superior parathyroid was identified in the expected location, just what appeared to be lobulated thyroid tissue, however, the recurrent laryngeal nerve seemed to run right through the lobulated tissue
- We resected the lobulation by dissecting anterior to the nerve creating a plane of dissection
- Frozen section confirmed hypercellular parathyroid
- Rapid intraoperative PTH dropped from 98 pg/ml to 12 pg/ml indicative of cure
- Patient is thyroid hormone dependent with probable longstanding Hashimoto thyroiditis causing inflammation and fibrosis seemingly encasing the parathyroid adenoma



 City of Hope