

# Parathyroid Surgery

**David Goldenberg MD, FACS**

Steven and Sharon Baron Professor and Chair

Penn State Health ; Penn State University College of Medicine

AAO-HNS/AHNS SYMPOSIUM

Resident & Fellow Head & Neck Surgery Symposium

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- History
- Anatomy and embryology
- Calcium physiology
- Hyperparathyroidism
- Diagnosis and clinical features
- Localization techniques
- Surgery
- Complications and follow-up
- Questions you may see on tests

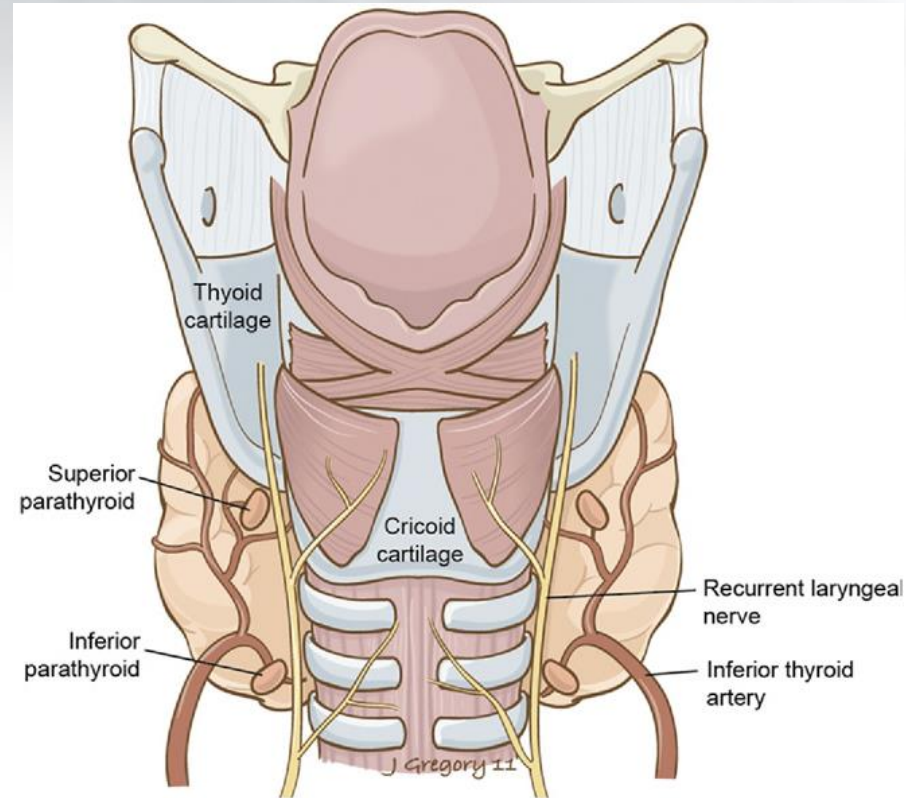
# History

- **In 1852, Sir Richard Owen first described the parathyroid glands while performing necropsy on an indian rhinoceros**
- In 1879, **Sandström** described human parathyroids (*glandulae parathyroidae*)
- In 1891, **von Recklinghausen** described osteitis fibrosa cystica, but its association with hyperparathyroidism (HPT) was not reported until 1904, when Ashkanazy described the bony lesions in a patient with a parathyroid tumor
- Calcium measurement possible in 1909 and association with parathyroids established
- **In 1925, Mandl performed the first parathyroidectomy in Vienna.** (38 yr old man with severe bone pain secondary to osteitis fibrosa cystica)The patient was initially symptom free but developed recurrent bone problems 6 years later
- **In 1926, the first parathyroidectomy** in was performed the US; patient who had 5 subsequent surgeries, including a thyroidectomy, until an ectopic gland was removed from the superior mediastinum
- In 1934, **Albright** reported on the association between parathyroid disease and chronic renal failure
- 1977 Nobel prize for sequencing of parathyroid hormone

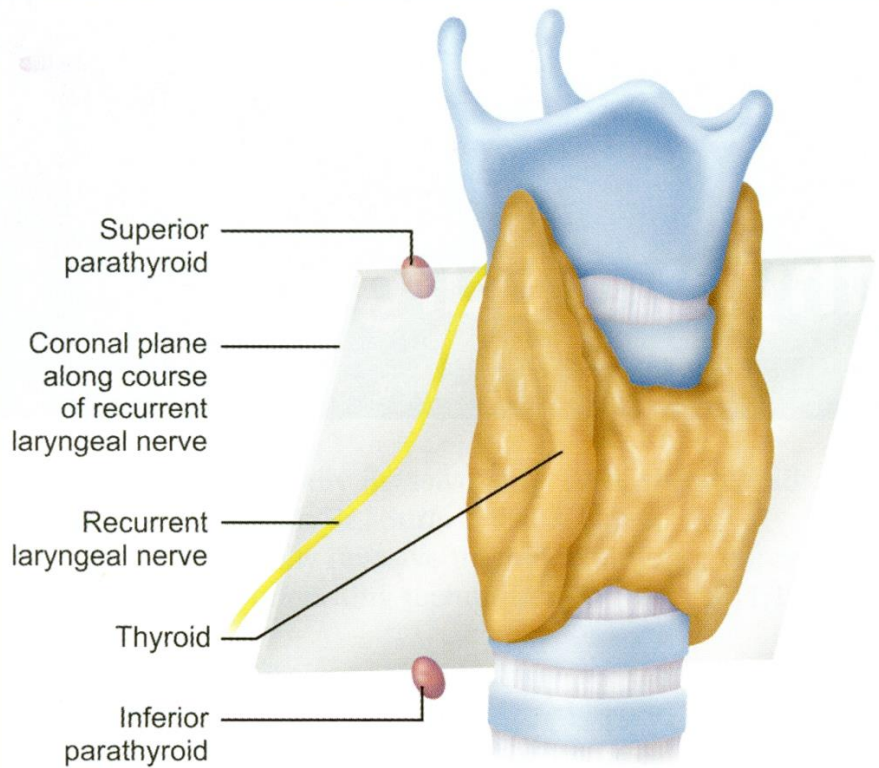


# Anatomy

- Usually derive most of blood supply from branches of inferior thyroid artery, although branches from superior thyroid supply at least 20% of upper glands
- Glands drain ipsilaterally by superior, middle, and inferior thyroid veins



**Figure 14** Posterior schematic of the neck demonstrates the common

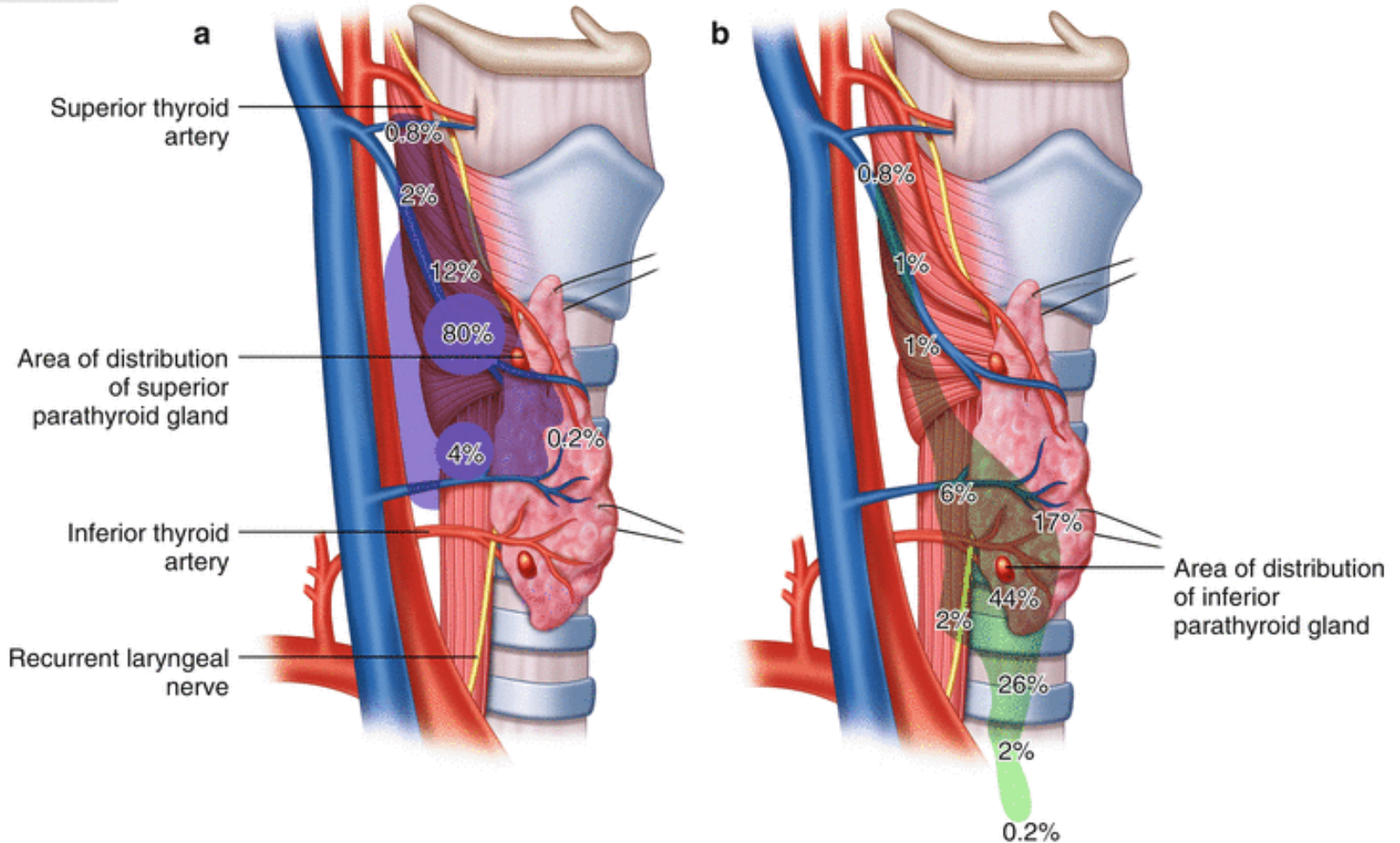


Superior glands usually dorsal to the RLN at level of cricoid cartilage  
 Inferior glands located ventral to nerve

- The superior parathyroid glands are most commonly located in the posterolateral aspect of the superior pole of the thyroid gland at the cricothyroid cartilage junction.
- 1 cm above the intersection of the inferior thyroid artery and the recurrent laryngeal nerve
- The inferior parathyroid glands are most commonly found near the lower thyroid pole of the thyroid.
- Superior glands have contralateral symmetry in about 80% of cases, and the inferior glands in about 70%

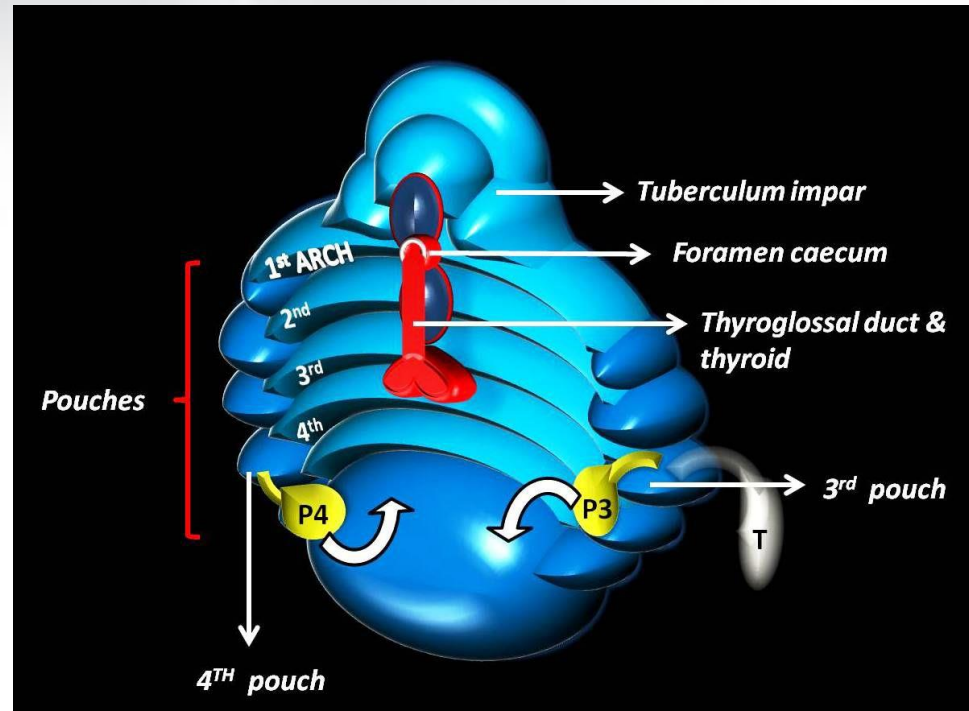
# Distribution

Figure 3.2



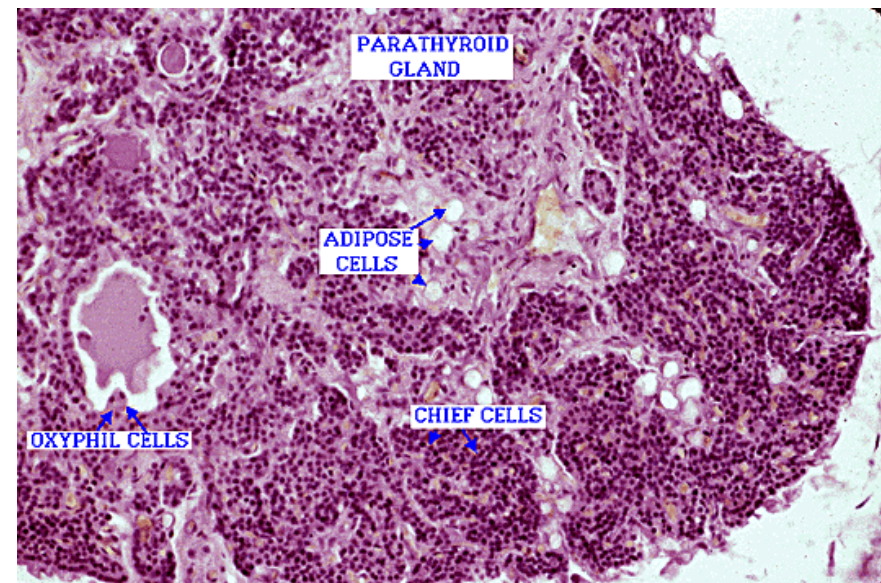
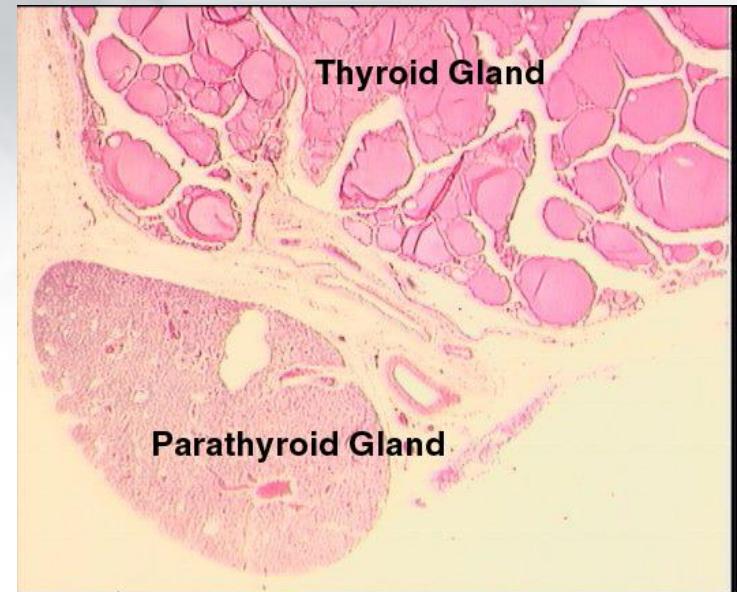
# Parathyroid Embryology

- The PTH glands develop at 6 weeks and migrate caudally at 8 weeks
- The **superior** PTH glands develop with the thyroid gland from the **4th** branchial pouch and are generally consistent in position
- The **inferior** PTH glands descend with the thymus from the **3rd** branchial pouch; The inferior parathyroid glands are more variable in location because of long descent



# Histology

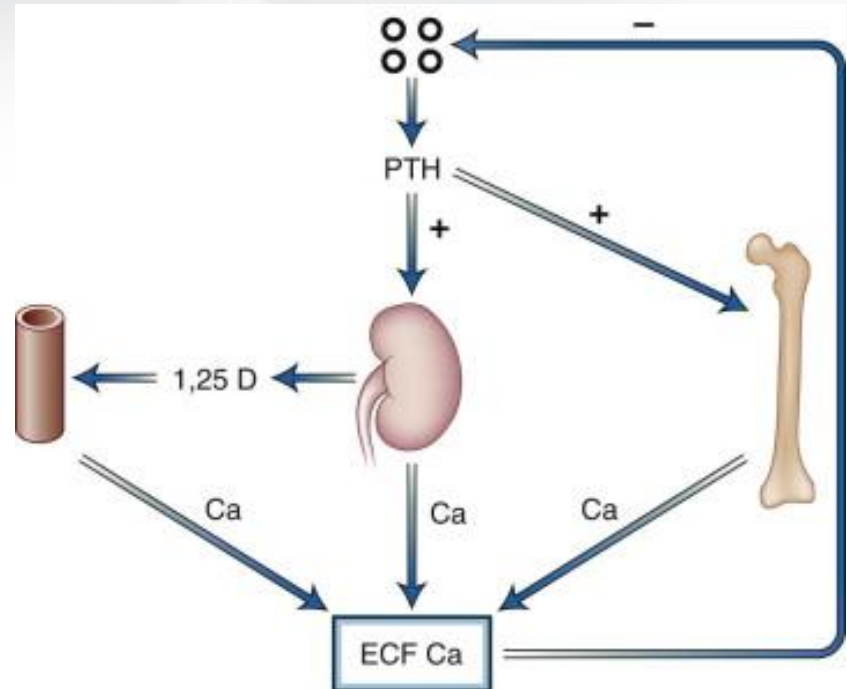
- The PTH glands are composed mostly of chief cells and oxyphil cells within an adipose stroma
- Chief cells secrete PTH, an 84–amino acid protein, whenever serum calcium levels fall
- The function of the oxyphil cells is uncertain (modified or depleted chief cells that no longer secrete PTH??)
- PTH binds to its peripheral receptors and stimulates osteoclasts to increase bone resorption, to the kidney to increase calcium resorption and renal production of 1,25-dihydroxyvitamin D<sub>3</sub> (1,25[OH]<sub>2</sub>D<sub>3</sub>), and to the intestine to increase absorption of calcium and phosphate.
- All together, these processes raise the serum calcium level





# Calcium physiology

- PTH-calcium feedback loop that controls calcium homeostasis
- Four organs—the parathyroid glands, intestine, kidney, and bone—together determine the parameters of calcium homeostasis
- PTH secretion also is stimulated by low levels of 1,25-dihydroxy vitamin D, catecholamines, and hypomagnesemia



# The spectrum of hyperparathyroidism

TYPE	CAUSE	TREATMENT
Primary HPT	Unregulated overproduction of parathyroid hormone resulting in abnormal calcium homeostasis, due to adenoma, hyperplasia or carcinoma, familial syndromes(MEN 1 or MEN 2a), familial isolated hyperparathyroidism (FIHPT) etc.	Surgery: open / minimal access Parathyroidectomy
Secondary HPT	Excessive production of parathyroid hormone secondary to a chronic abnormal stimulus such as chronic renal failure and vitamin D deficiency.	Primarily medical management
Tertiary HPT	Autonomous hypersecretion of parathyroid hormone causing hypercalcaemia often seen in chronic secondary hyperparathyroidism (prolonged compensatory stimulation) and often after renal transplantation.	Total parathyroidectomy with auto transplantation, subtotal parathyroidectomy

# Primary Hyperparathyroidism

- Affects approximately 100,000 patients a year
- Primary hyperparathyroidism occurs in 0.1 to 0.3% of the general population and is more common in women (1:500) than in men (1:2000)
- Primary hyperparathyroidism is characterized by increased parathyroid cell proliferation and PTH secretion which is independent of calcium levels
- The most common cause of primary hyperparathyroidism is a sporadic, single parathyroid adenoma resulting from a clonal mutation (~85-95%)
- Less common are parathyroid hyperplasia (~2.5%), parathyroid carcinoma (malignant tumor), and adenomas in more than one gland (together ~0.5%).
- Primary hyperparathyroidism is also a feature of several familial endocrine disorders: MEN type 1 and MEN type 2A, and familial hyperparathyroidism.

# Double parathyroid adenomas - “fact or fiction”?

- Double parathyroid adenomas have been reported to occur in 1.7% to 9% of patients with primary hyperparathyroidism
- Controversy still exists as to whether double adenomas are a distinct entity or part of four gland hyperplasia presenting metasynchronously.
- There is no reliable method to accurately distinguish adenoma from hyperplasia.
- Some feel that the most reliable clinical criteria to document double adenomas, is the absence of recurrent hyperparathyroidism on follow up of at least 5 years following selective gland excision
- Others have authoritatively documented the existence of double adenoma as a separate entity and are not simply missed cases of four-gland hyperplasia.



# Diagnosis and clinical features – primary hyper PTH

Differential Diagnosis of Hypercalcemia*
<b>Parathyroid</b>
Primary hyperparathyroidism: Sporadic, Familial
<b>Nonparathyroid Endocrine</b>
Thyrotoxicosis
Pheochromocytoma
Acute adrenal insufficiency
Vasointestinal polypeptide hormone-producing tumor (VIPoma)
<b>Malignancy</b>
Solid tumors
Lytic bone metastases
Lymphoma and leukemia
Parathyroid hormone-related peptide
Excess production of 1,25(OH) <sub>2</sub> D <sub>3</sub>
Other factors (cytokines, growth factors)
<b>Granulomatous Diseases</b>
Sarcoidosis
Tuberculosis
Histoplasmosis
Coccidiomycosis
Leprosy
<b>Medications</b>
Calcium supplementation
Thiazide diuretics
Lithium
Estrogens, antiestrogens, testosterone in breast cancer
Vitamin A or D intoxication
<b>Other</b>
Benign familial hypocalciuric hypercalcemia
Milk-alkali syndrome
Immobilization
Paget's disease
Acute and chronic renal insufficiency
Aluminum excess
Parenteral nutrition

- Middle-aged and older women are most commonly affected.
- It is characterized by hypersecretion of PTH, leading to hypercalcemia.
- The diagnosis is made by demonstrating elevated serum calcium and intact PTH (iPTH) levels and normal or increased urinary calcium levels in the setting of normal renal function.
- A 24-hour urine collection can help exclude the diagnosis of benign familial hypocalciuric hypercalcemia (BFHH)
- BFHH is a generally benign condition transmitted in an autosomal dominant fashion that cannot be corrected by parathyroidectomy.

# Diagnosis and clinical features

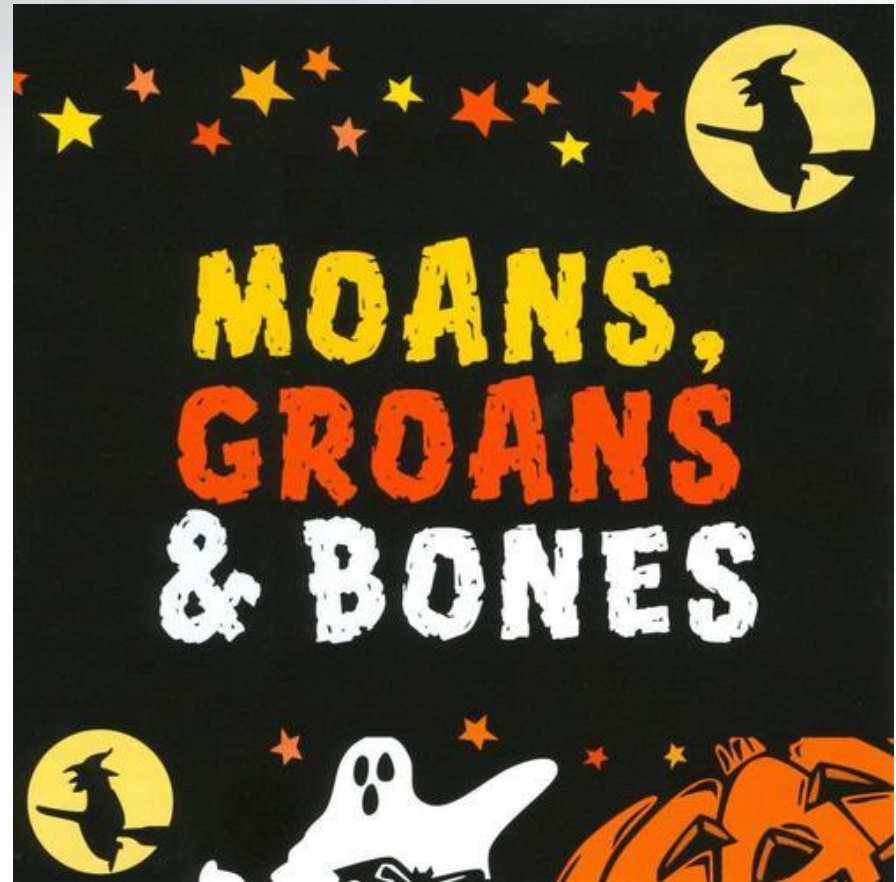
- Before advent of the serum channel autoanalyzer, patients with primary HPT were typically seen with the clinical manifestations of hypercalcemia

## THEN

- Painful bones, kidney stones, abdominal groans, “psychic moans,” and fatigue overtones
- Until the 1970s, 75% of patients presented with nephrolithiasis

## NOW

- Less than 20% of primary HPT patients have renal symptoms
- Less than 5% have evidence of osteitis fibrosis cystica
- **Nonspecific complaints such as “brain fogginess” fatigue, lethargy, and depression are most commonly cited**
- Hypertension -one third of patients with HPT



# Indications for surgery with asymptomatic PHPT

Serum calcium concentration of 1.0 mg/dL (0.25 mmol/L) or more above the upper limit of normal

## Skeletal indications-

Bone density at the hip, lumbar spine, or distal radius that is more than 2.5 standard deviations below peak bone mass (T-score <-2.5).

Previous asymptomatic vertebral fracture (by radiograph, computed tomography [CT], magnetic resonance imaging [MRI], or vertebral fracture assessment).

## Renal indications

Estimated glomerular filtration rate (eGFR) <60 mL/min.

Twenty-four-hour urinary calcium >400 mg/day (>10 mmol/day).

Nephrolithiasis or nephrocalcinosis by radiograph, ultrasound, or CT.

## Age less than 50 years

\*Patients with asymptomatic PHPT who do not meet surgical intervention criteria may still choose parathyroidectomy because it is the only definitive therapy.

# Labs

- Confirm Hypercalcemia is present
- Eliminate potential causative medications
- Obtain intact Parathyroid Hormone (PTH) Level
- PTH normal or high: Obtain 24 hour Urine Calcium
  - 24 hour Urine Calcium normal or high
    - Primary Hyperparathyroidism
    - Recovery from Acute Tubular Necrosis
    - Lithium therapy
  - 24 hour Urine Calcium low
    - Familial benign hypocalciuric hypercalcemia



# Imaging, localization and surgery

- Preoperative localization studies are increasingly becoming the standard of care, as they enable focused surgical techniques.
- Many surgeons advocate for 2 concurrent examinations to definitively identify the site of disease.
- Almost all authors advocate for intraoperative parathyroid hormone level monitoring.

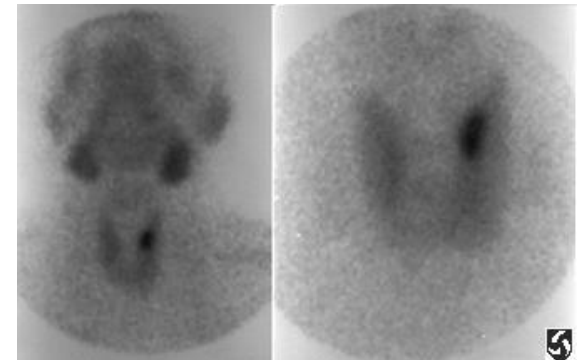
# Preoperative localization

- Noninvasive studies include ultrasonography (US), nuclear medicine scintigraphy, computed tomography (CT) scanning, and magnetic resonance imaging (MRI).
- Invasive procedures (Less common today, ) such as parathyroid selective arteriography and/or selective parathyroid venous sampling.

- Level III evidence suggests a role for preoperative imaging prior to minimally invasive parathyroidectomy.
- Ultrasonography and nuclear scintigraphy both have level II evidence as a first-line examination.
- Some authors advocate parathyroid ultrasonography as a first-line test given the lack of ionizing radiation, low cost, and ease of use.
- Confirmatory testing with nuclear scintigraphy or, increasingly, multiphase CT, is often obtained if surgery is considered.

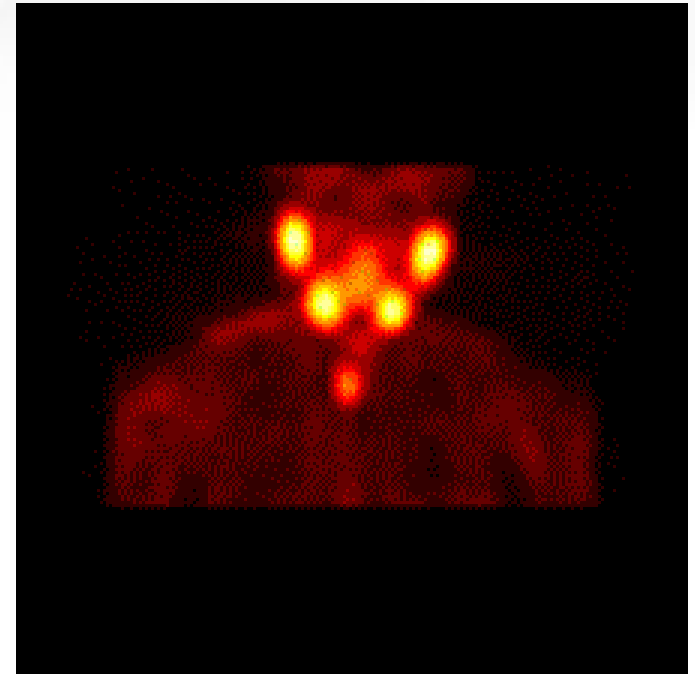
# Sestamibi washout scan (Planar MIBI)

- Technetium-99m-methoxyisobutylisonitrile (99mTc-sestamibi or MIBI)
- First used for cardiac scintigraphy and was noted to concentrate in parathyroid adenomas
- Radioisotope uptake increases with gland weight MIBI concentrated in tissues rich in mitochondria  
i.e. Heart, Salivary glands, Thyroid glands, Parathyroid glands
- Sestamibi scintigraphy alone provides limited anatomic detail.
- A negative 99mTc sestamibi scan is seen in 12 - 25 % of patients with 1<sup>o</sup> HyPTH
- Sestamibi scanning is often unrevealing in patients with parathyroid hyperplasia, multiple parathyroid adenomas, and in those with coexisting thyroid disease



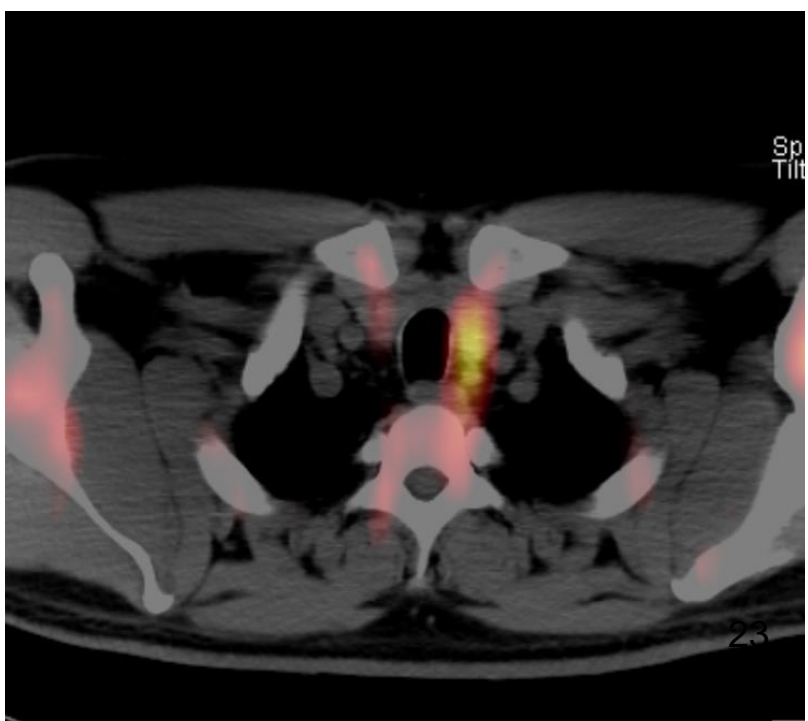
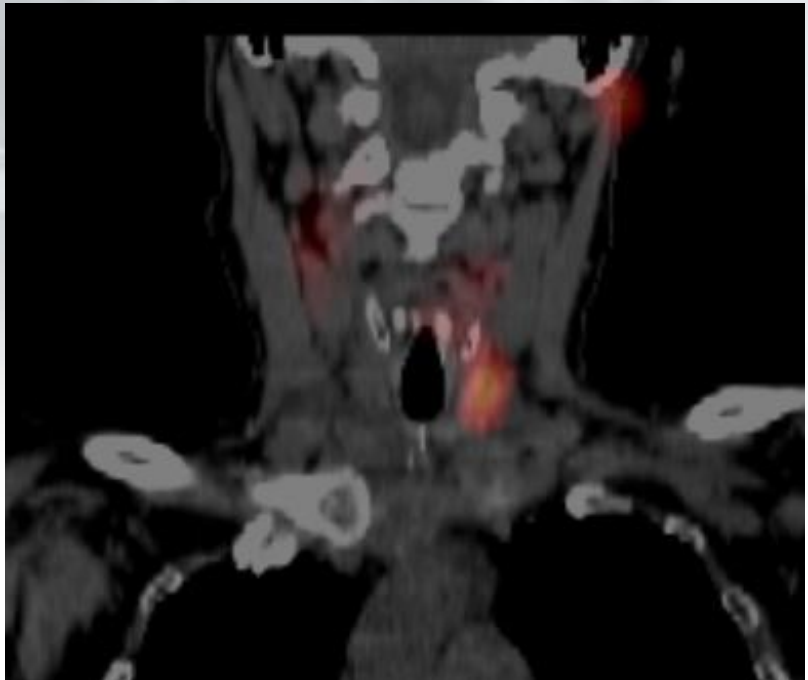
# Sestamibi-single photon emission computed tomography (SPECT)

- Sestamibi-single photon emission computed tomography is a three-dimensional sestamibi scan
- During the scan, 30 (typical) or more images are taken surrounding the patient's head and neck
- The addition of SPECT improves the sensitivity for identifying abnormal parathyroid glands to 92 to 98 % as compared with 71 to 79 % for planar sestamibi scintigraphy
- SPECT scanning can be performed at any time within the first several hours after a patient is injected with the radioactive Sestamibi radiopharmaceutical
- The multidimensional images illustrate the depth of the parathyroid gland or glands in relation to the thyroid and improve detection of ectopic glands



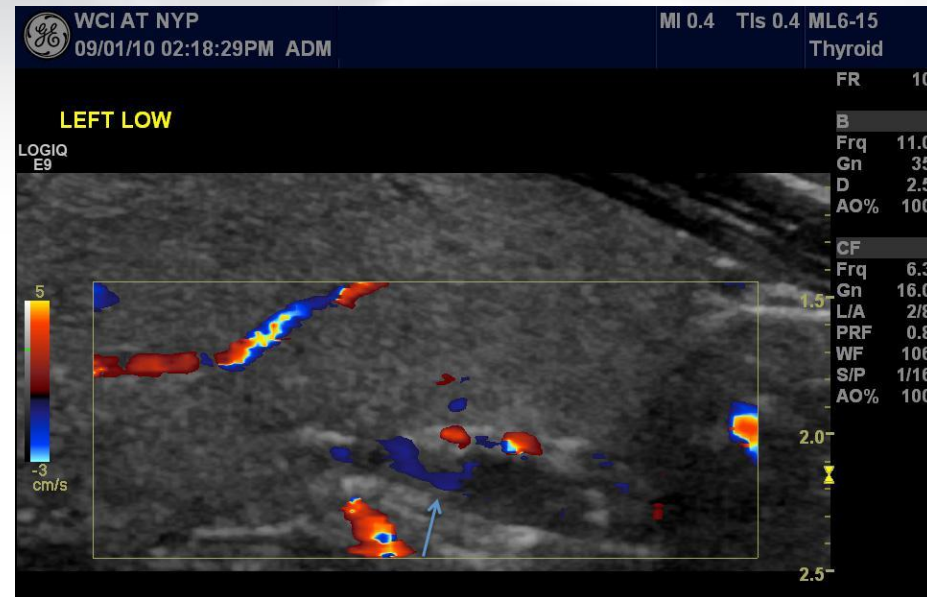
# SPECT-CT

- SPECT and CT fusion — SPECT-CT adds the ability to discriminate parathyroid adenomas from other anatomic landmarks, which may facilitate the surgical procedure.
- Wimmer G et al -Study evaluating 30 patients with multiglandular disease, SPECT-CT predicted the location of all abnormal glands in 46 percent of cases compared with 37 and 13 percent for CT alone and SPECT alone, respectively.
- Lavelly et al (JHMI group) -Scintigraphy was performed on 110 patients with primary hyperparathyroidism and no prior neck surgery.
- Early SPECT/CT in combination with any delayed imaging method was statistically significantly superior to any single- or dual-phase planar or SPECT study for parathyroid adenoma localization



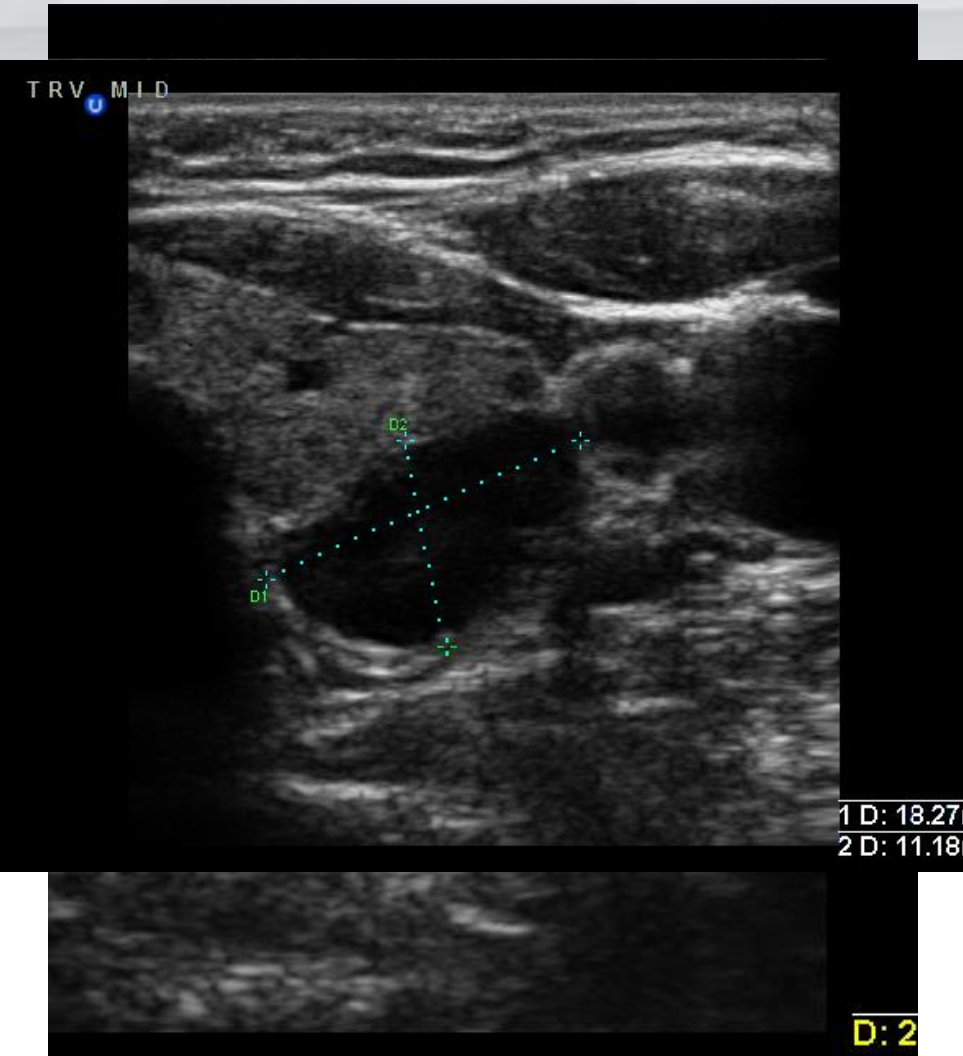
# Ultrasound

- Neck ultrasonography (US) is also often utilized for parathyroid localization
- Ultrasound is effective, noninvasive, and inexpensive
- Limitations include operator dependency and restriction to neck because it cannot image mediastinal parathyroid lesions.
- As with sestamibi based techniques, the sensitivity of ultrasound for parathyroid adenoma localization is reduced in patients with thyroid nodules.
- However, US is helpful for the characterization and evaluation of any thyroid pathology, facilitating operative planning.
- The sensitivity of ultrasound for detecting enlarged parathyroid glands ranges from 72 to 82 %
- Ultrasound often is used in combination with sestamibi, in which case the combined true-positive rate rises to 90%; Sensitivity of 75-92%





# Parathyroid ultrasound



- Normal parathyroid is not seen on US
- Typical Parathyroid Adenoma
  - Hypoechoic or anechoic
  - Oval
  - Homogeneous
  - Extrathyroid
- A typical parathyroid adenoma is about 10–30 mm in length,

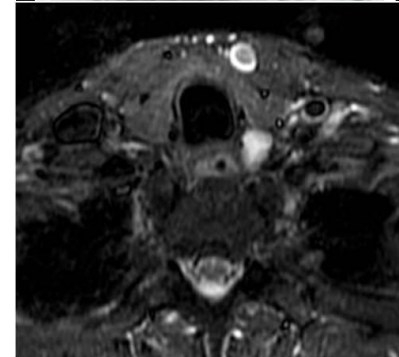
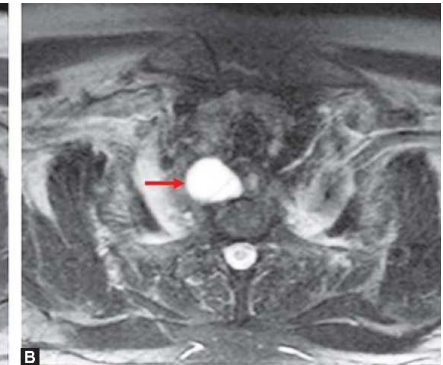
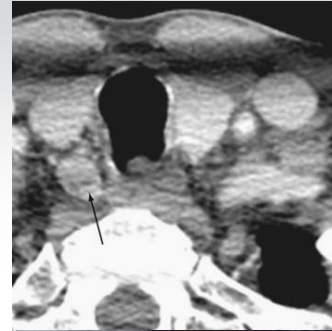
(A normal gland usually measures about 5 × 3 × 1 mm)

- Disadvantages to the use of US alone include decreased accuracy in patients with smaller parathyroid gland size, obesity, or mediastinal glands located behind the clavicles



# Cross sectional imaging-MRI, 4D-CT scan

- Cross-sectional imaging useful for visualizing mediastinal tumors and glands within the tracheoesophageal groove.
- MRI - parathyroid adenomas often appear intense on T2-weighted images.
- Four-dimensional CT (4D-CT), a imaging modality similar to CT angiography, is derived from three-dimensional (3D)-CT scanning with an added dimension from the changes in perfusion of contrast over time.

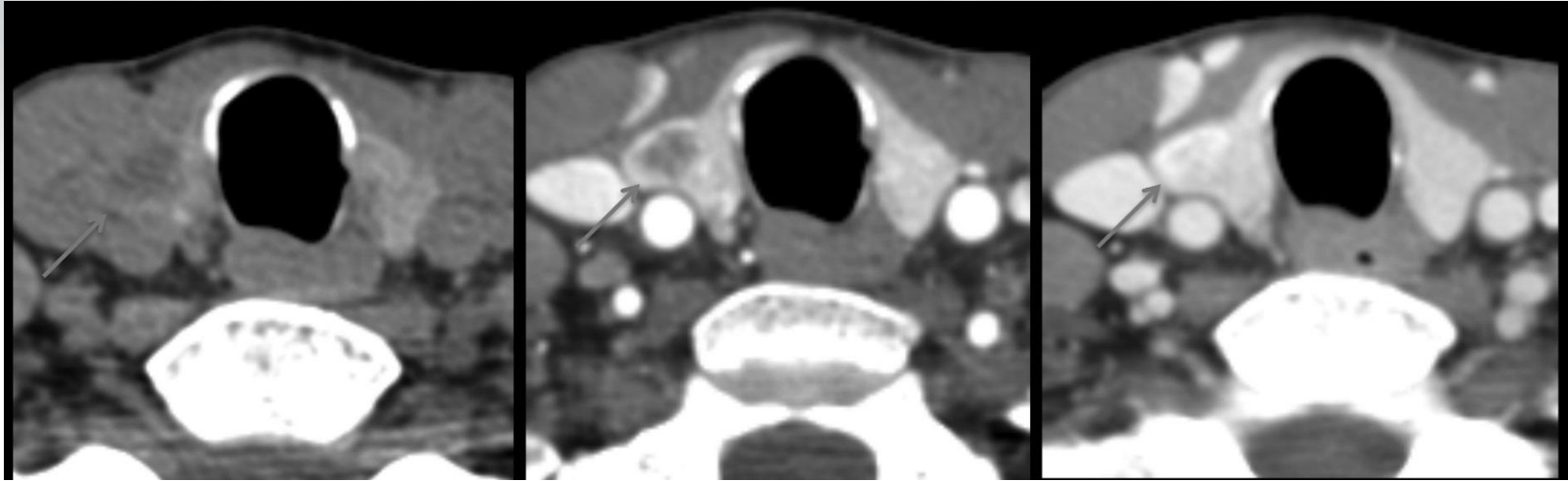


Axial STIR image showing a T2 hyperintense lesion in the left tracheoesophageal groove

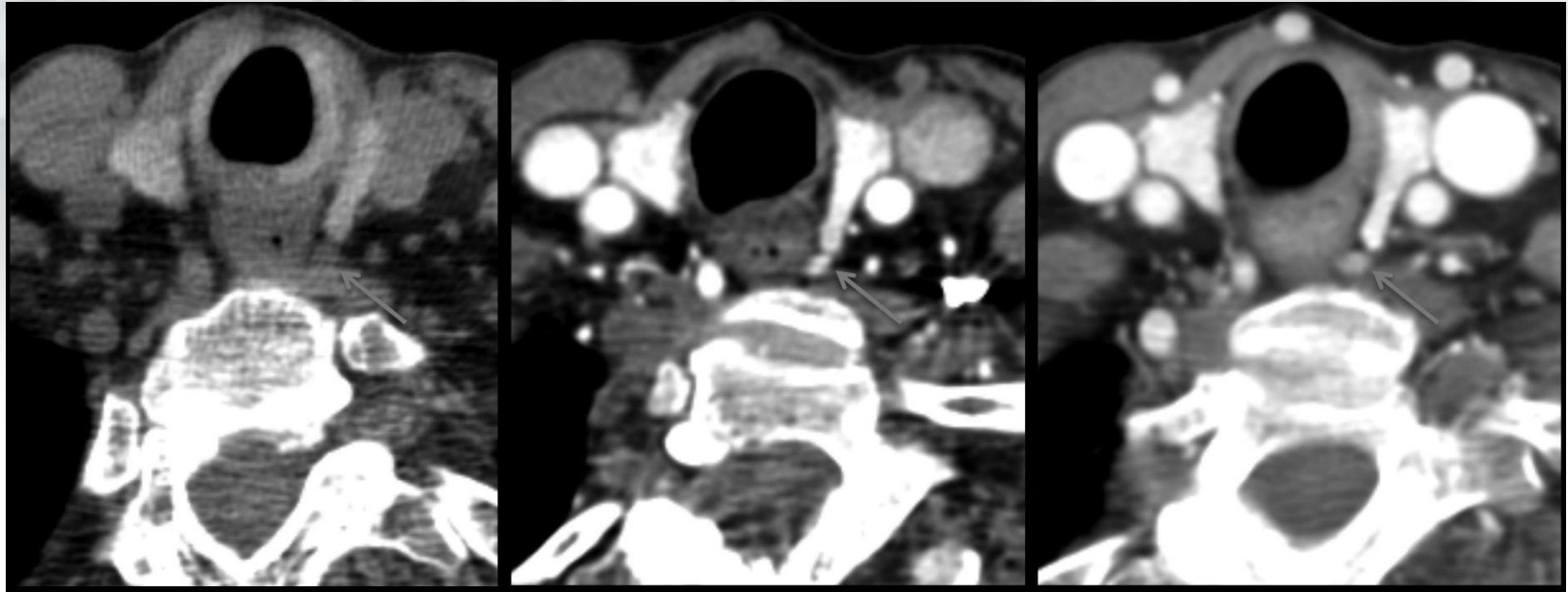
# 4D-CT

- Multiphase CT has become a standard for diagnostically confounding cases or, for first-line preoperative localization given the high accuracy.
- The “4D-CT” scan was originally described using 4 separate images phases, 1 noncontrast and 3 post contrast.
- Most recommend using a 3-phase technique to reduce the radiation dose.
- The first noncontrast images can be helpful to distinguish adenomas from the intrinsically dense iodine-rich thyroid gland, while the early and delayed postcontrast imaging highlight the hypervascular nature of adenomas and their characteristic early washout. CT is limited by the ionizing radiation required for the multiphase technique.
- The primary disadvantage of 4D-CT is the radiation exposure, which, compared with sestamibi imaging, results in a >50-fold higher dose of radiation absorbed by the thyroid.
- Thus- The use of 4D-CT should be highly selective in younger patients
- However, newer dose reduction techniques including automatic tube current modulation appear effective in reducing radiation dose.

# 4D-CT



Axial CT images in noncontrast (A) early post-contrast (B) and delayed post-contrast (C) phases demonstrate an intrathyroidal lesion with subtle hypodensity on precontrast imaging and delayed enhancement. This enhancement pattern is seen less commonly than early enhancement and washout.



Axial CT images in noncontrast (A) early post-contrast (B) and delayed post-contrast (C) phases demonstrate a subtle left tracheoesophageal groove lesion with characteristic early enhancement and washout.

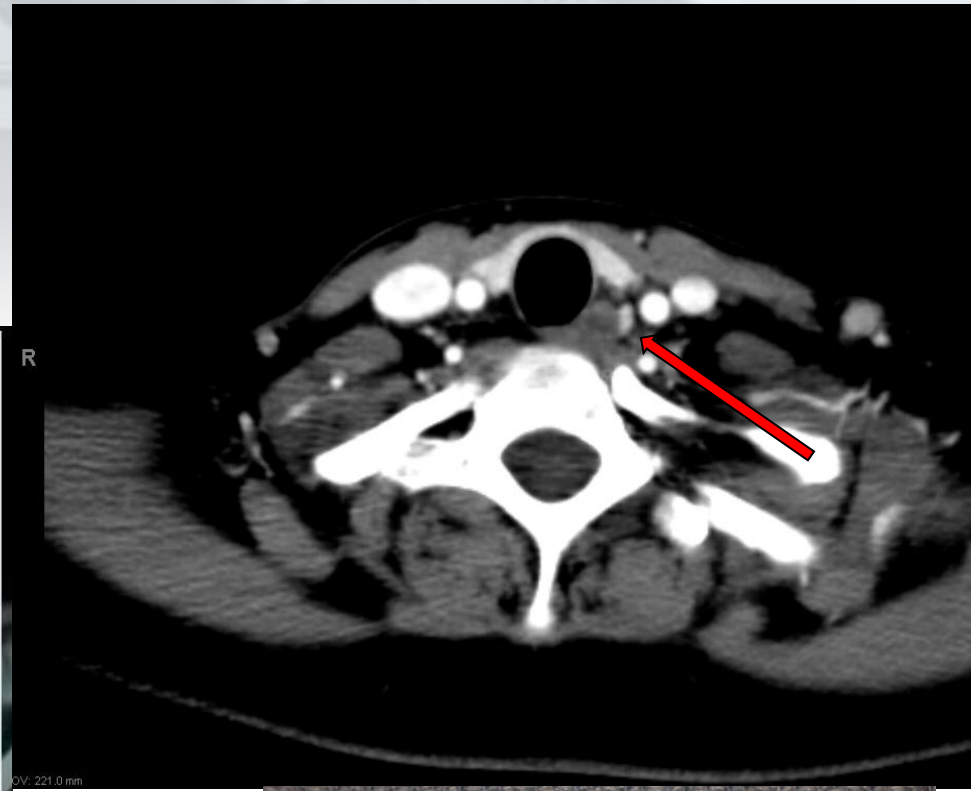
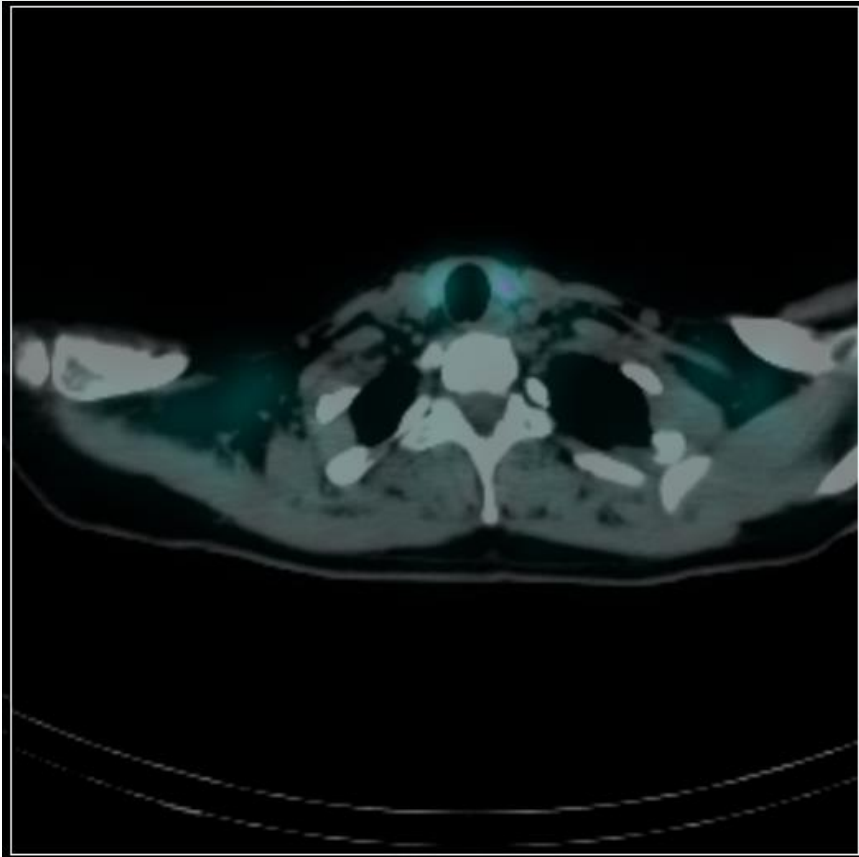
This case illustrates the sensitivity of 4D-CT for small adenomas.

# 4D-CT

- Ectopic glands may be seen, most commonly within the mediastinum.
- Intrathyroidal lesions may be subtle; detection is greatly improved by a multiphase technique, as in the image below.
- 4D-CT is sensitive for small adenomas that may elude other imaging techniques.
- A prominent feeding artery at the margin of a parathyroid adenoma (polar vessel)
- Diagnostic confidence that a suspicious lesion is a parathyroid adenoma not a lymph node



# Case



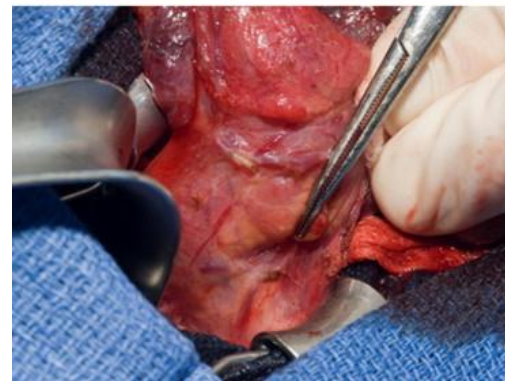
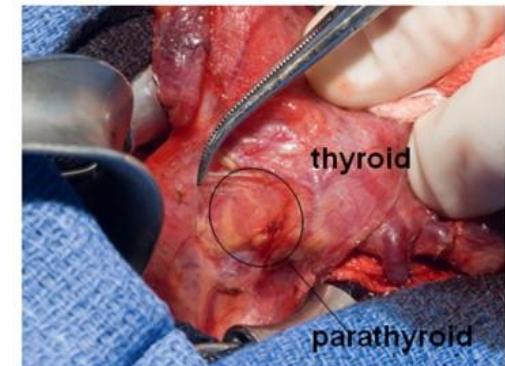
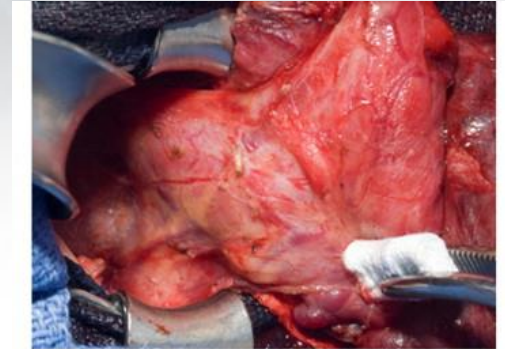


# Surgical Evolution

- Bilateral four gland exploration
- Unilateral exploration  
(identify adenoma + normal)\*
- Targeted single gland excision  
Intraoperative PTH\*\*  
Midline vs. Lateral approach
- Endoscopic

Video Assisted

Trans axillary robotic



# Bilateral exploration

Hyperplasia/multiple adenomas

Secondary hyper-PTH

Tertiary hyper-PTH

Primary hyper-PTH

Familial

MEN syndrome

# Bilateral Neck Exploration

- Systematically look for all 4 glands
- Do not completely excise any glands until all 4 are identified
- Multiple adenomas – leave normal gland(s)
- 4 Gland hyperplasia
- Subtotal excision
- Leave  $\frac{1}{2}$  of most viable gland

# ***UNILATERAL exploration***

*Is appropriate if:*

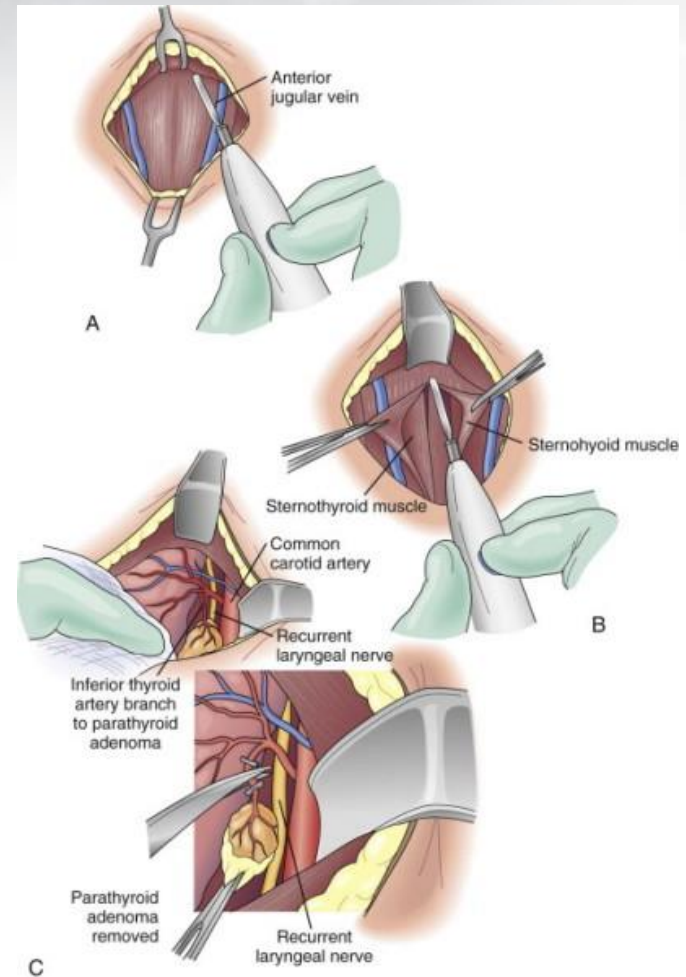
- **Diagnosis is consistent with primary hyper-PTH**
- **Positive preop localization study**

# ***“Minimally Invasive” Parathyroidectomy***

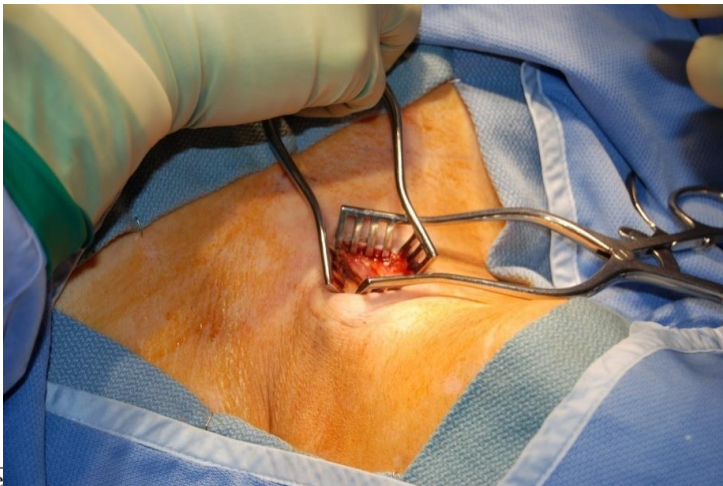
- Focal exploration, small incision
- Excision of single adenoma
- Intraop PTH
- MIRP
- +/- Video assisted (*MIVP*)

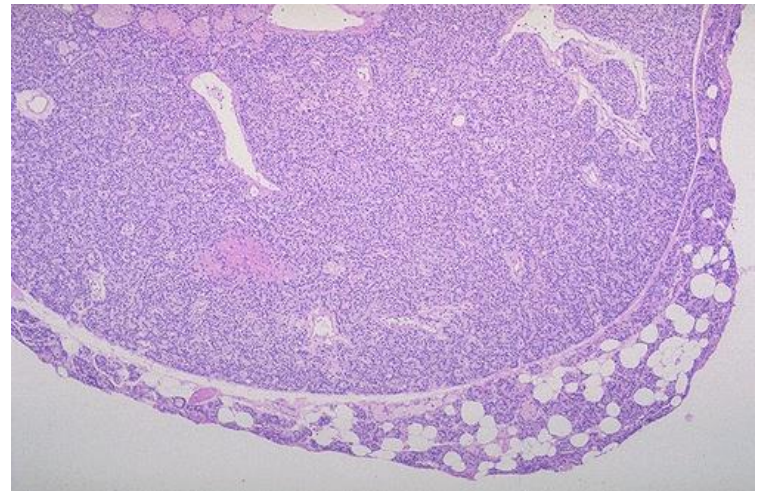
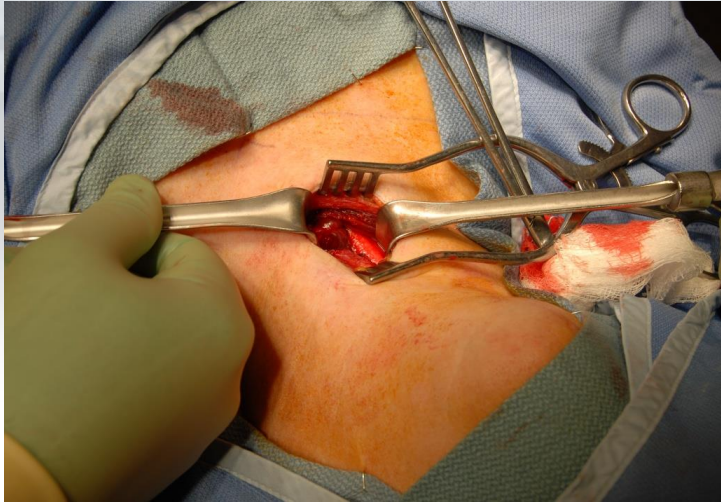
# Minimally Invasive Parathyroidectomy (a.k.a. MIP, guided, focused, directed)

- 85-95% of primary HPT results from a single adenoma
- Cured by excision of the offending gland- directed surgery after accurate preoperative localization has been used with increased frequency
- MIP involves the use of unilateral neck surgery



# Surgery Steps: After localization









# ***Ectopic Locations***

## ***Inferior parathyroid***

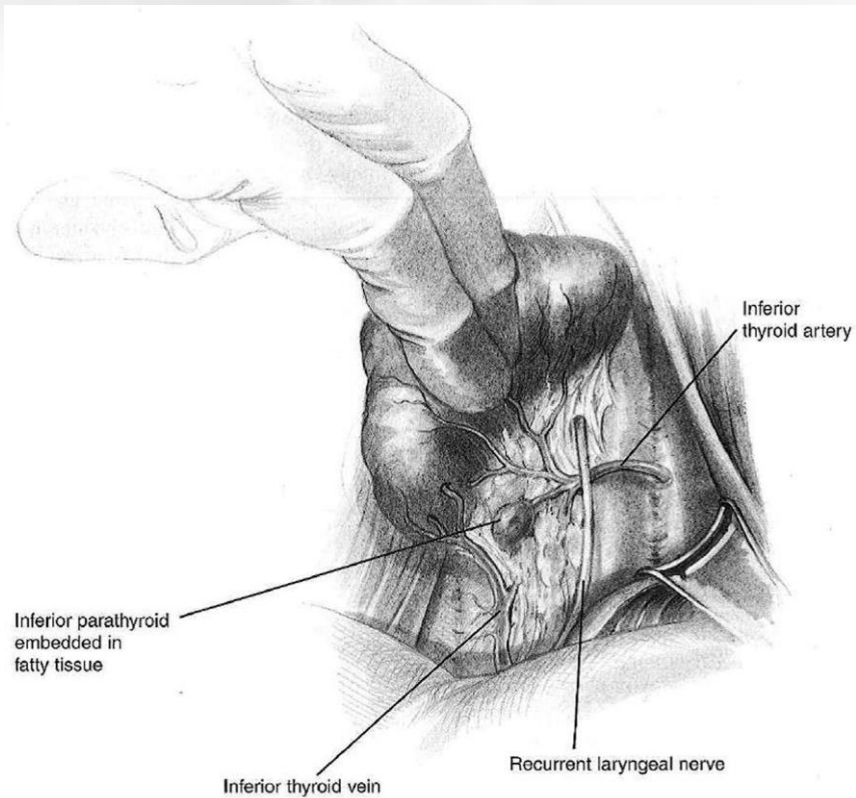
- Carotid sheath
- Superior mediastinum
- Thymus

## ***Superior parathyroid***

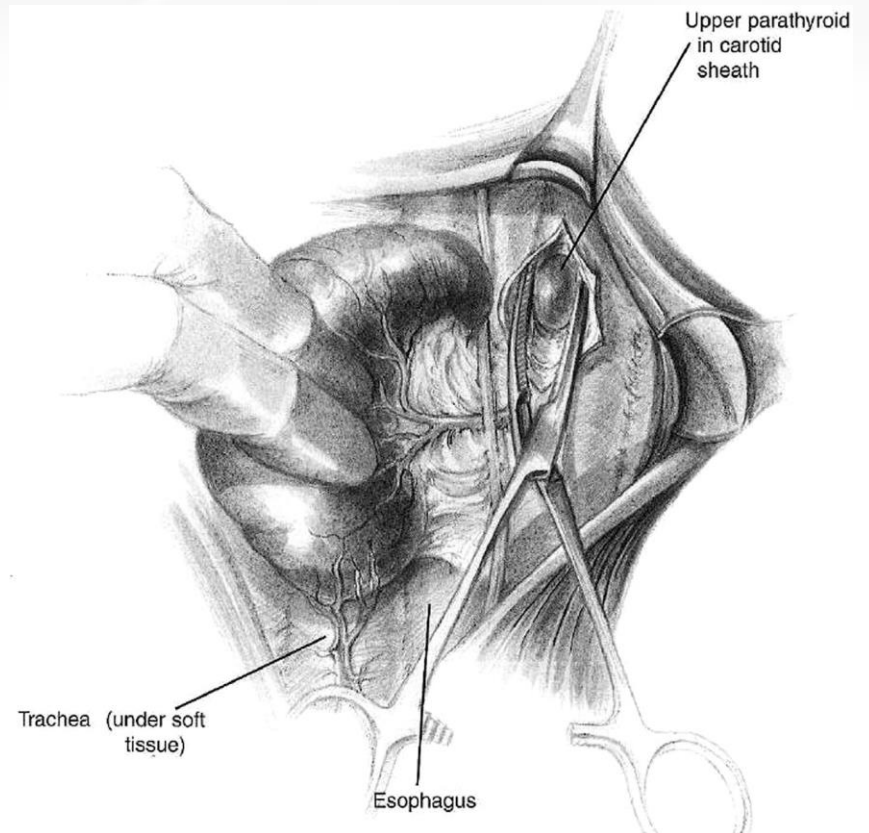
- Carotid sheath
- Retro/para-esophageal

# Ectopic Locations

Inferior parathyroid gland here is found in its eutopic position anterior to the recurrent laryngeal nerve near the inferior pole of the thyroid gland.



The carotid sheath is opened to identify an ectopic superior parathyroid gland



# *Final consideration for the “missing gland”*

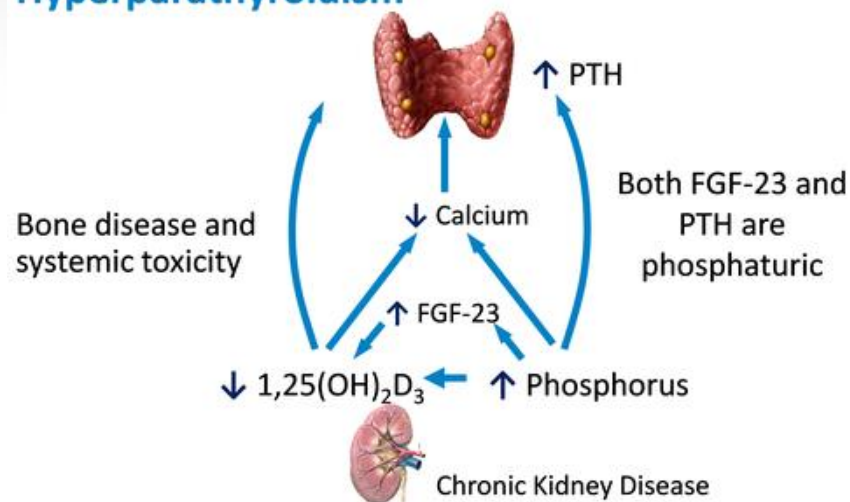
- Intra-thyroid parathyroid
- Hemithyroidectomy on side of “missing gland”



# Secondary Hyperparathyroidism

- When HPT is seen in the setting of chronic renal failure, it is termed *secondary HPT*
- 90% of patients with chronic renal failure have some evidence of secondary HPT
- Failing kidneys do not convert enough vitamin D to its active form, and do not adequately excrete phosphate.
- Insoluble calcium phosphate forms in the body and removes calcium from the circulation
- Secondary hyperparathyroidism can also result from malabsorption (chronic pancreatitis, small bowel disease, malabsorption-dependent bariatric surgery) - fat soluble vitamin D can not get reabsorbed.

## Pathophysiology of Secondary Hyperparathyroidism



# 2<sup>o</sup> hyperparathyroidism

- Usually managed initially medically, (vitamin D analogues & calcimimetic agents (e.g., cinacalcet)

Indications for Surgery- severe refractory or complications

- *Renal osteodystrophy* (osteitis fibrosa cystica, osteomalacia, and adynamic bone disease)
- Uremic pruritus, or severe itching with end-stage renal failure,
- General weakness
- Sever anemia
- Calciphylaxis is a rare, severe, and life-threatening complication characterized by calcification of the media of small to medium-sized arteries
- Results in ischemic damage in dermal and epidermal structures. Calcification can lead to nonhealing ulcers, gangrene, sepsis, and death



# Tertiary hyperparathyroidism



- **Tertiary hyperparathyroidism** is a state of excessive secretion of PTH after a long period of secondary hyperparathyroidism
- It reflects development of autonomous parathyroid function following a period of persistent parathyroid stimulation.
- The parathyroids no longer - respond to calcium feedback inhibition, which results in hypercalcemia
- Most often after renal transplant

# Indications for Parathyroidectomy in patients with 2<sup>o</sup> and 3<sup>o</sup> HPT

Table 1

Indications for Parathyroidectomy in Patients with Secondary HPT

Calciphylaxis  
Patient preference  
Medical observation not possible  
Failure of maximal medical management with:  
  Hypercalcemia  
  Hypercalcuria  
  PTH >800 pg/mL  
  Hyperphosphatemia (with calcium×phosphorus > 70)  
  Osteoporosis  
Symptoms: pruritis, pathologic bone fracture, ectopic soft tissue calcifications, severe vascular calcifications, or bone pain

Table 2

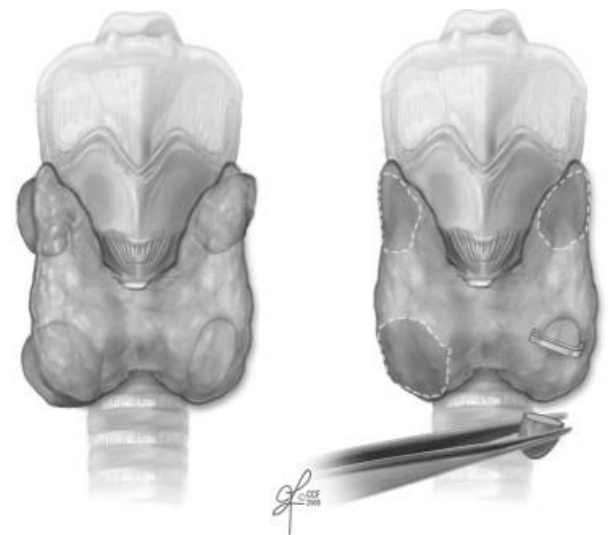
Indications for Parathyroidectomy in Patients with Tertiary HPT

Severe hypercalcemia (serum calcium > 11.5 or 12 mg/dL)  
Persistent hypercalcemia (serum calcium > 10.2 mg/dL more than three months to one year after surgery)  
Severe Osteopenia (low bone mineral density)  
Symptomatic hyperparathyroidism  
  Fatigue  
  Pruritis  
  Bone pain or pathologic bone fracture  
  Peptic ulcer disease  
  Mental status changes  
  History of renal calculi



# Surgical Strategies

- Generally, preoperative imaging before initial parathyroidectomy for secondary HPT is not indicated because bilateral neck exploration is required for identification of all glands, given that the underlying pathology is parathyroid hyperplasia
- Subtotal parathyroidectomy
- Total parathyroidectomy with heterotopic autotransplantation



## Subtotal parathyroidectomy:

### Advantages

- A well-vascularized eutopic gland will maintain function, in contrast to an autotransplanted gland, which would need to undergo neovascularization.
- Good for noncompliant patient (less likely to take calcium and vitamin D )
- Choosing an accessible gland and marking it with a clip for potential identification make reexploration easier.
- Avoiding an arm incision allows easier hemodialysis access.

### Disadvantages

- Second neck surgery is necessary if HPT recurs,
- Significant hypocalcemia if the remnant is not well vascularized.

## Total parathyroidectomy with autotransplantation

### Advantages

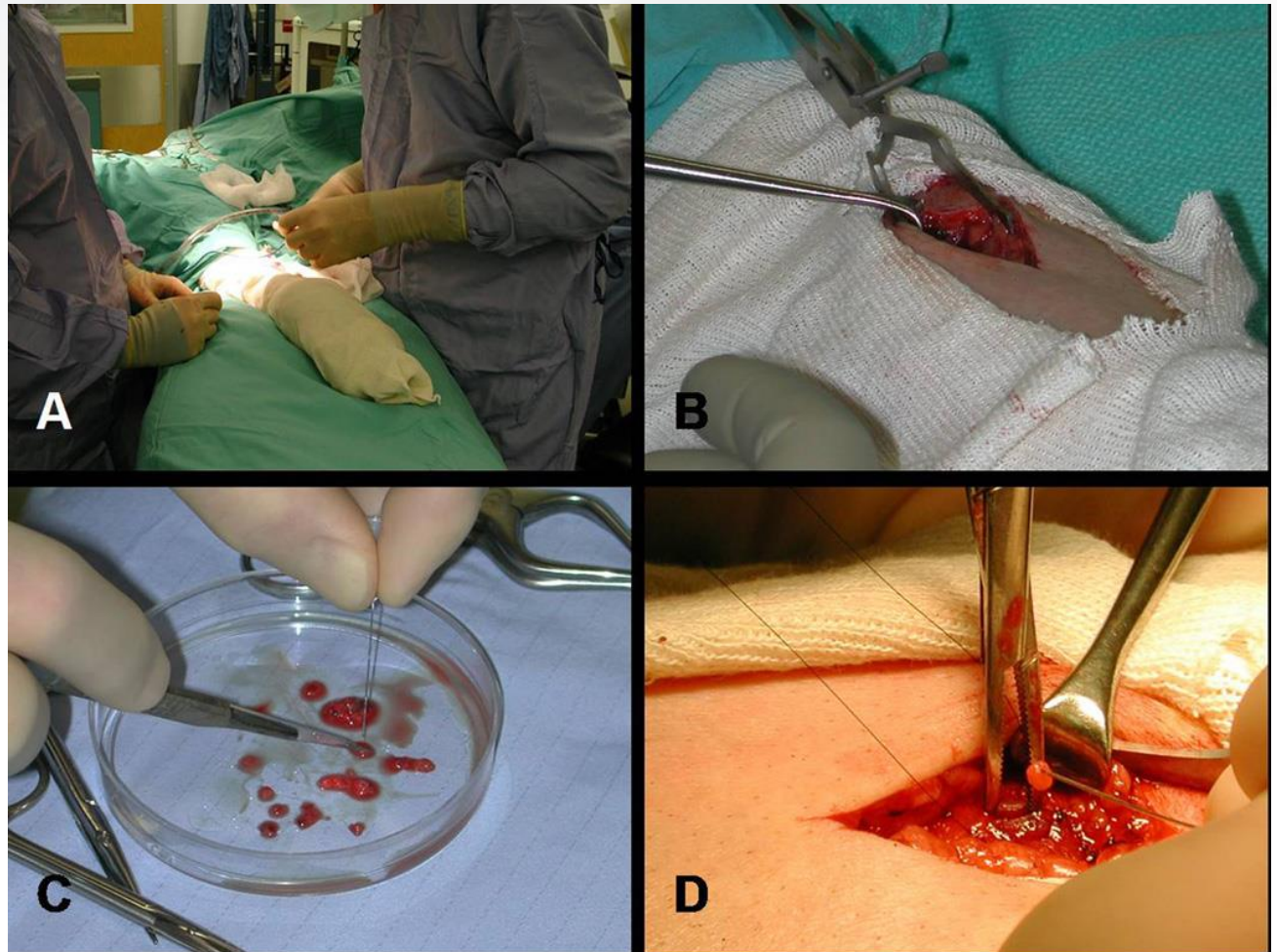
- Uses an easily accessible area
- The gland to be transplanted is minced into 1-mm pieces and 12 to 18 pieces are embedded in well-vascularized muscle and marked with a stitch or clip
- Some groups use a technique of injection into subcutaneous tissue.
- Neovascularization occurs over a period of several weeks.
- Residual parathyroid function is easily monitored and recurrences can be treated by partial resection under local anesthesia

### Disadvantages

- More aggressive medical treatment is necessary postoperatively to maintain adequate serum calcium levels and avoid serious hypocalcemic complications.
- Autograft failure can lead to hypoparathyroidism, which can be profound.
- Retrieval of all small grafts may be difficult at reoperation.
- Implantation into muscle may interfere with hemodialysis access in the future;
- Invasive growth of autografts into muscle and adjacent tissue requiring radical resection has been described.
- Supernumerary glands may still be present in the neck, thereby resulting in two potential sites of recurrence.

Total parathyroidectomy and implantation of parathyroid tissue into the non-dominant forearm.

Prior to surgery the non-dominant forearm should be prepped (A). After a small incision is made (B) and 50 to 100 mg of parathyroid tissue is dissected from a gland (C), the parathyroid tissue is transplanted into the brachioradialis muscle (D)



# Multiple Endocrine Neoplasia

- **MEN1 syndrome**: Primary HPT resulting from parathyroid hyperplasia associated with lesions of the pancreas and pituitary
- **The parathyroid glands are asymmetrically enlarged and there is a high incidence of supernumerary glands (up to 20%)**
- Parathyroid surgery in patients with MEN1 is thought of as a debulking or palliative procedure because recurrence is inevitable if survival is unlimited; it is indicated to treat and prevent the complications of HPT
- The initial surgical procedure of choice in a patient with MEN1 and HPT is subtotal parathyroidectomy or total parathyroidectomy with heterotopic autotransplantation of resected parathyroid tissue; transcervical thymectomy is also performed at the initial operation.
- (cryopreservation may be performed at the time of total parathyroidectomy whenever possible)

# Multiple Endocrine Neoplasia

- **MEN2A syndrome**: is marked by the findings of medullary thyroid cancer, pheochromocytoma, and **primary HPT**
- **HPT in MEN2A is the least common manifestation** and occurs in 20% to 30% of patients
- HPT in MEN2A differs from MEN1 in several important features, and the indications for parathyroidectomy and diagnostic criteria are more similar to those of sporadic primary HPT
- When compared with HPT in MEN1, HPT in MEN2A tends to be milder and more often asymptomatic because of a single adenoma, although multiglandular hyperplasia does occur. Therefore, curative resection can be less aggressive.
- Enlarged parathyroids encountered during thyroidectomy for medullary thyroid cancer in a normocalcemic patient are resected.
- Most but not all endocrine surgeons leave normal-appearing parathyroids in situ, although total parathyroidectomy with autotransplantation to the forearm has been advocated by some.

# Parathyroid Carcinoma

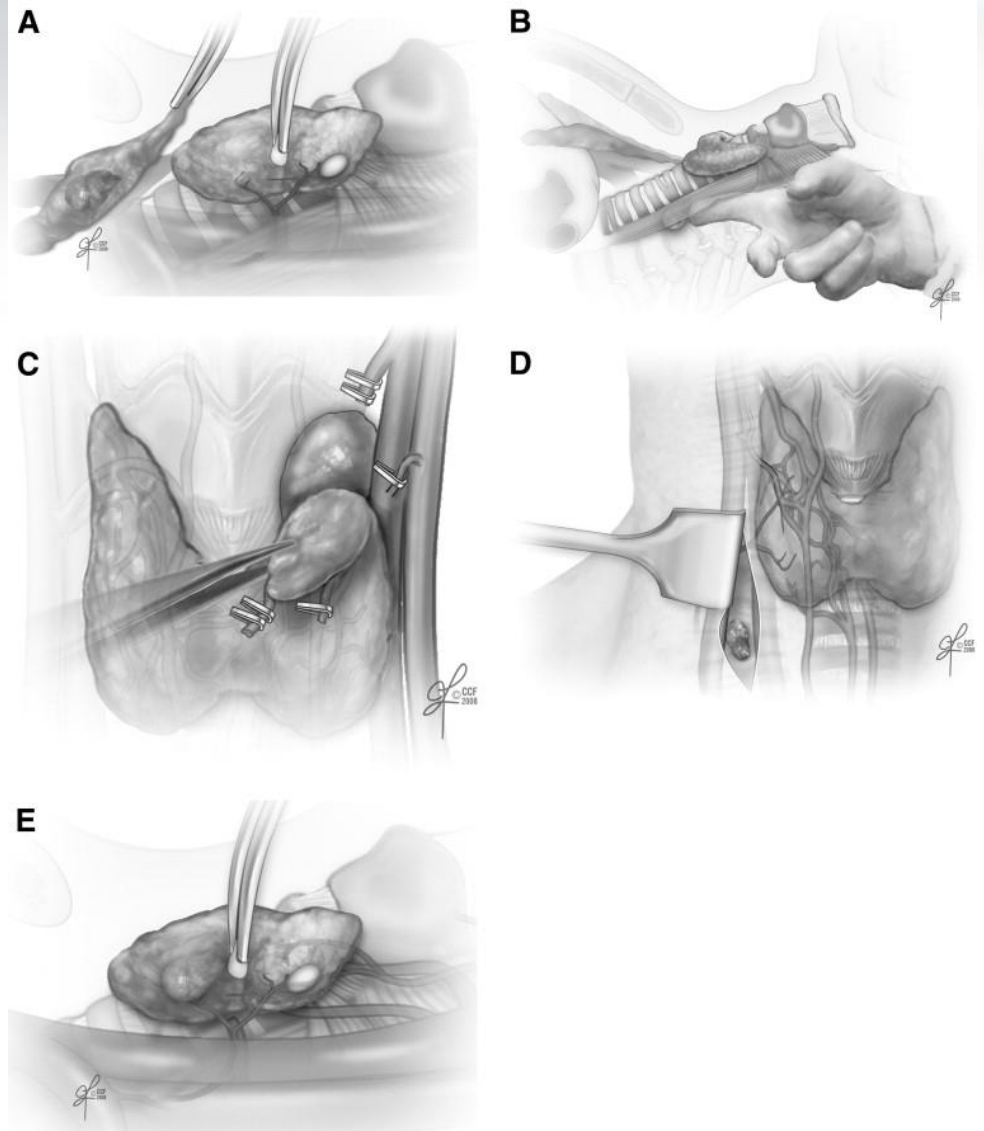
- Parathyroid carcinoma is the least-common endocrine malignancy, accounting for 0.005% of all cancer cases in the US
- Most patients with carcinomas have marked hypercalcemia (>14 mg/dL)
- Associated bone and renal disease than those with adenomas
- Extremely high PTH level,
- Palpable neck mass on physical examination,
- significant uptake on sestamibi scan,
- US evidence of invasion with loss of planes
- Lymphadenopathy
- En bloc resection is associated with a 40% local recurrence rate and an overall survival rate of 89% (mean follow-up, 119 months)
- Distant metastases generally develop in the lungs, liver, and bone; they can occasionally be treated by resection of individual tumor deposits.
- Most patients with metastatic or locally unresectable disease die of the metabolic effects of uncontrolled hypercalcemia



# Revision parathyroid survey:

- Examination for abnormal parathyroids in locations beyond the primary survey when it fails to reveal all pathologic glands

- (A) Examination of thymus
- (B) Palpation of retroesophageal space and anterior cervical spine
- (C) Mobilization of superior thyroid pole
- (D) Exploration of carotid sheath.
- (E) Abnormal parathyroid glands located intrathyroidally



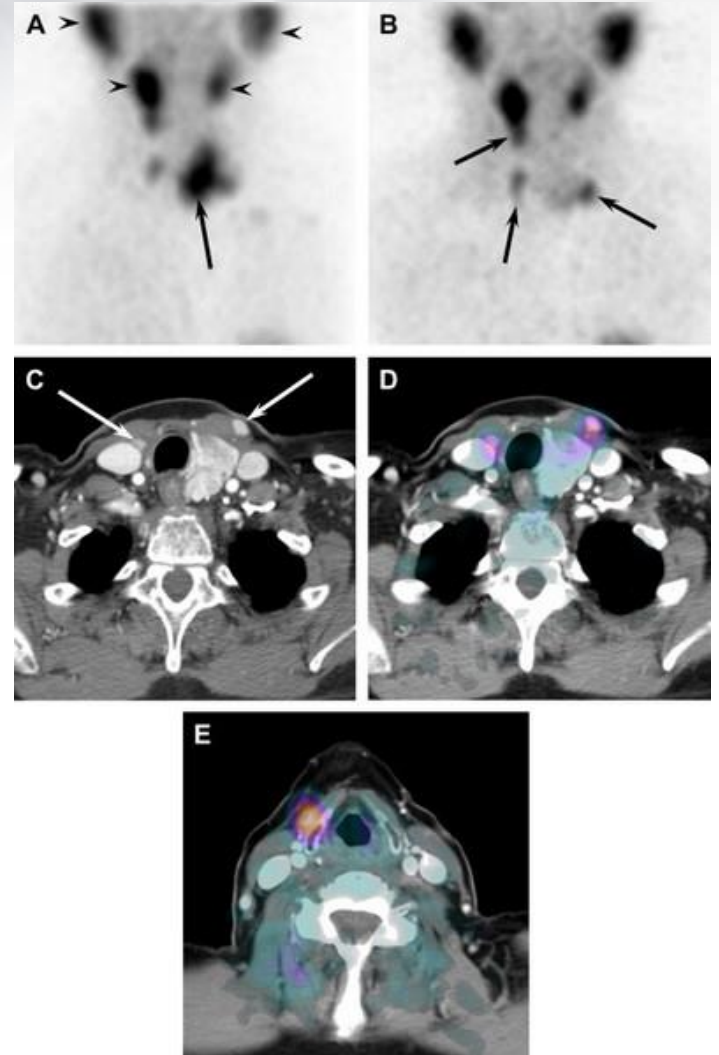
# Complications of Parathyroid Surgery

- Persistent HPT - 1-20% (experience dependent)
- Temporary hypocalcemia -20%
- Hungry Bone Syndrome (PTH normal; Ca low)
- Permanent hypocalcemia – 1%
  - (Permanent hypoparathyroidism is defined as persistent hypocalcemia requiring calcium and vitamin D supplementation 6 months after surgery)
- Nerve injury - recurrent or superior laryngeal - 1-10%
- Bleeding - <5%



# Parathyromatosis

- Parathyromatosis, a condition in which hyperfunctioning parathyroid tissue is distributed throughout the neck
- Multiple nodules of hyperfunctioning parathyroid tissue scattered through the neck and mediastinum) due to spillage of otherwise benign parathyroid tissue during surgery



# Questions you may be asked ....

- Embryology of PTH glands
- Differentiating between 1<sup>o</sup>, 2<sup>o</sup>, and 3<sup>o</sup> hyperPTH
- Localization techniques for primary hyperPTH
- Survey order and location for parathyroid exploration- Where to look when you can't find a PTH gland (first time and redo)



Questions?