

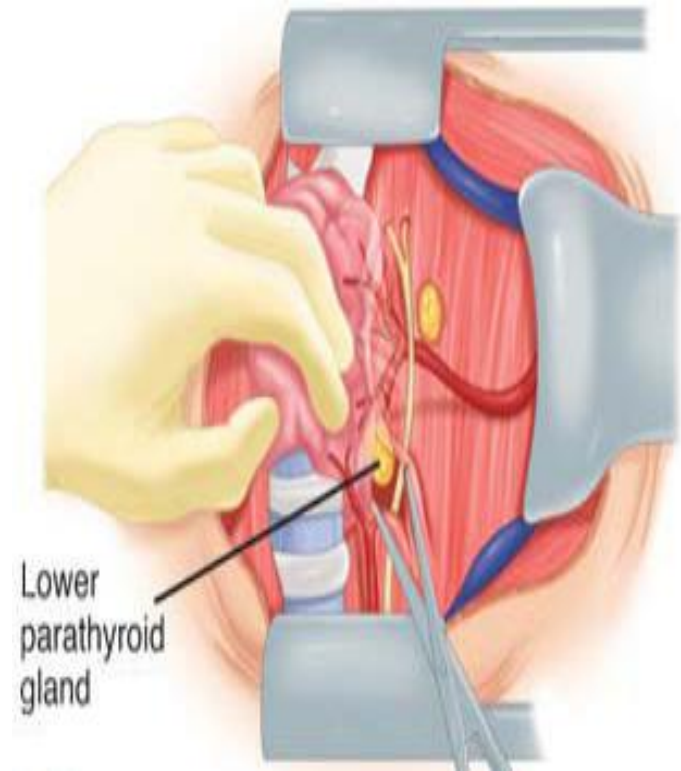
PARATHYROID ADENOMA

SRAVAN KUMAR

Moderator: Dr.(Brig)P. KRISHNA MURTHY

SURGICAL ANATOMY

- The number of parathyroid glands vary from 2-6. In 80% people, there are 4 (2 on each side).
- Superior parathyroid glands are derived from the 4th branchial pouch, which also gives rise to the thyroid gland.
- The position of superior parathyroid glands is more consistent, usually located on the posterior surface of the upper portion of the thyroid lobe within a 2-cm circumscribed area cranial to the point where the recurrent laryngeal nerve (RLN) intersects the course of the inferior thyroid artery
- Inferior parathyroid glands are derived from 3rd branchial pouch along with thymus and descend along with it. Due to this descent of the thymus, location of inferior parathyroids can be anywhere between upper pole of thyroid and mediastinum.



Ectopic Locations of parathyroid glands:

- Thyrothymic ligament
- Tracheoesophageal groove
- Retroesophageal space
- Retropharyngeal/high cervical
- Carotid sheath
- Intrathyroid
- Ant/post superior mediastinum
- Intrathymic
- Aorto-pulmonary window

- Histology: chief and oxyphil cells and a stroma composed primarily of adipocytes. Acidophilic, mitochondria-rich oxyphil cells appear during puberty and increase in number with age.
- The parathyroid cells rely on the calcium-sensing receptor (CASR) to regulate PTH secretion by sensing extracellular calcium levels
- PTH regulates the calcium levels via its actions on three target organs, the bone, kidney, and gut
 - Bone- PTH stimulates resorption of calcium and phosphate
 - Kidney- PTH Stimulates reabsorption of calcium and conversion of $25(\text{OH})\text{D}_3$ to $1,25(\text{OH})_2\text{D}_3$; inhibits reabsorption of phosphate and bicarbonate
 - Gut-PTH acts indirectly through vit D to increase calcium absorption

- Etiology of Primary hyperparathyroidism – 90:9:1 rule is applicable: 90% adenoma (including multiple adenomas), 9% hyperplasia, and less than 1% carcinoma. Adenoma is usually single gland pathology. Hyperplasia involves all the 4 glands.
- Single-gland disease is consistent with a mechanism involving spontaneous growth and hyperfunction, whereas multiglandular disease suggests the presence of some exogenous stimulus or underlying genetic defect.

CLINICAL MANIFESTATIONS

Classic pentad (kidney stones, painful bones, abdominal groans, psychic moans, and fatigue overtones).

weakness, fatigue, bone and joint pains, polydipsia, polyuria, nocturia, constipation, decreased appetite, nausea, pruritus, anxiety, depression, and memory loss.

COMPLICATIONS

Osteoporosis, osteitis fibrosa cystica, bone fractures

Nephrocalcinosis and renal dysfunction

Pancreatitis

Peptic ulcer disease

Hypercalcemic crisis

MANAGEMENT

The diagnosis hinges on the demonstration of hypercalcemia with overproduction of parathyroid hormone and the exclusion of other possible causes of hypercalcemia.

Diagnostic Workup

- careful history taking, including records or medications, symptoms, prior head and neck radiotherapy, and other endocrinopathies in the patient and the patient's family.
- Estimation of serum calcium levels through two or three determinations.
- Check for elevation of PTH .
- chest radiograph : To rule out bony metastases, sarcoidosis, pulmonary tumors.
- serum protein electrophoresis : to rule out multiple myeloma.
- 24 hour urinary calcium determination (i.e., benign familial hypocalciuric hypercalcemia).
- Rule out multiple endocrine neoplasia (usually multiple endocrine neoplasia type I).

Preoperative localisation of adenoma:

Non-invasive :

Technetium-99m sestamibi scan

CT Scan

MRI

4D-CT, PET-CT

Invasive studies:

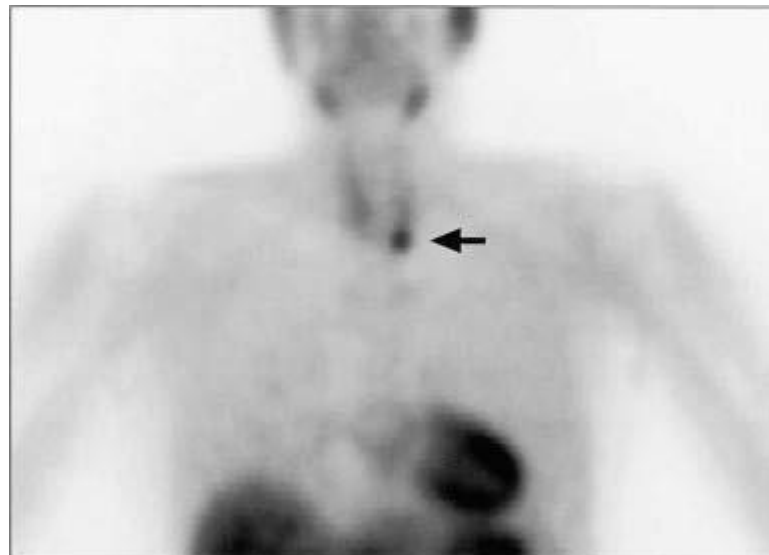
Angiography, venous localisation, USG guided biopsy

SESTAMIBI SCAN:

Principle: metabolically active tissue with high mitochondrial count will take up the ^{99m}Tc

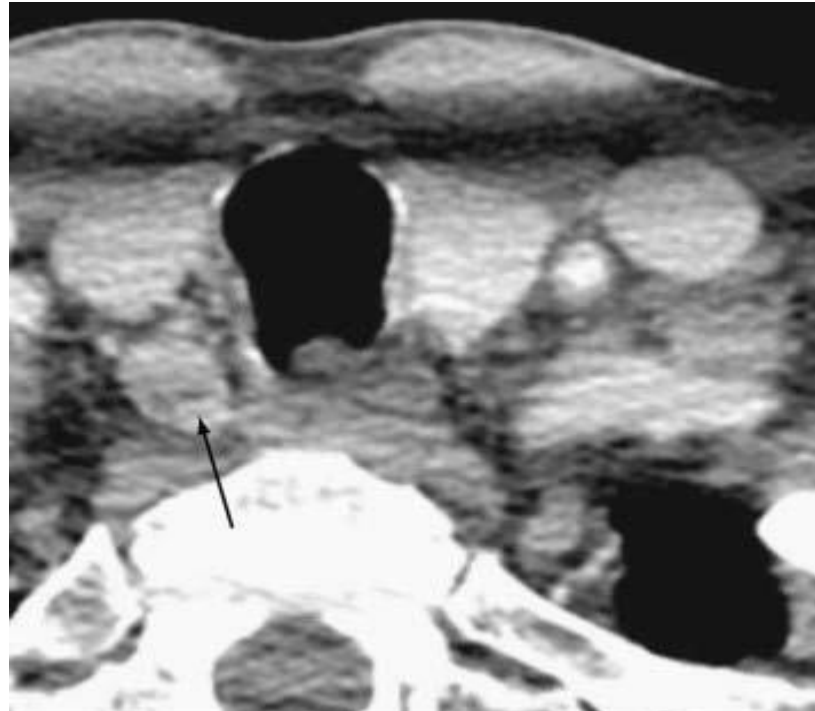
Procedure: Intravenous injection of ^{99m}Tc

AP and oblique views of thorax and neck with gamma camera immediately after injection and at 1h and 4h or SPECT (single photon emission computed tomography)



CT :

- Higher sensitivity than ultrasound, but involves radiation
- 4D-CT is derived from 3D CT scanning, with added dimension from changes in perfusion of contrast over time, which allows to characterize hyperfunctioning parathyroid glands



INVASIVE LOCALISATION STUDIES:

- Selective arteriography in conjunction with venous sampling for PTH
- Requires catheterization of multiple veins in the neck and mediastinum, from which blood samples are obtained with rapid PTH measurement
- Parathyroid adenomas have increased vascularity, demonstrating a characteristic blush on arteriography
- Indicated for patients requiring re-exploration with negative or discordant imaging studies



INDICATIONS FOR SURGERY IN ASYMPTOMATIC PATIENTS

1. Significant hypercalcemia (serum calcium = 1 mg/dL above the upper limit of normal reference range)
2. Significant hypercalciuria (24-hour urinary calcium excretion \geq 400 mg)
3. Creatinine clearance reduced by 30% compared to age-matched subjects
4. Decreased bone density at the lumbar spine, hip, or distal radius (as determined by dual-energy x-ray absorptiometry) that is more than 2.5 SDs below peak bone mass (t-score <-2.5)
5. Age younger than 50 years
6. Patients for whom medical surveillance is either not desirable or not possible

Benefits of surgical management :

- Renal function and bone density improvement
- Resolution of neuropsychiatric symptoms
- Quality of life better
- Prolongs survival
- Reduction in cardiovascular incidents

Operative Goals

- Achieve a normocalcemic state.
- Avoid injury to the laryngeal nerves (recurrent and superior).
- Produce an incision that is cosmetically acceptable to the patient.
- Engender minimal postoperative morbidity and negligible mortality

Surgical options:

- 1) Bilateral neck exploration
- 2) Minimally invasive parathyroidectomy
- 3) Video assisted and Endoscopic parathyroidectomy

Bilateral Neck exploration

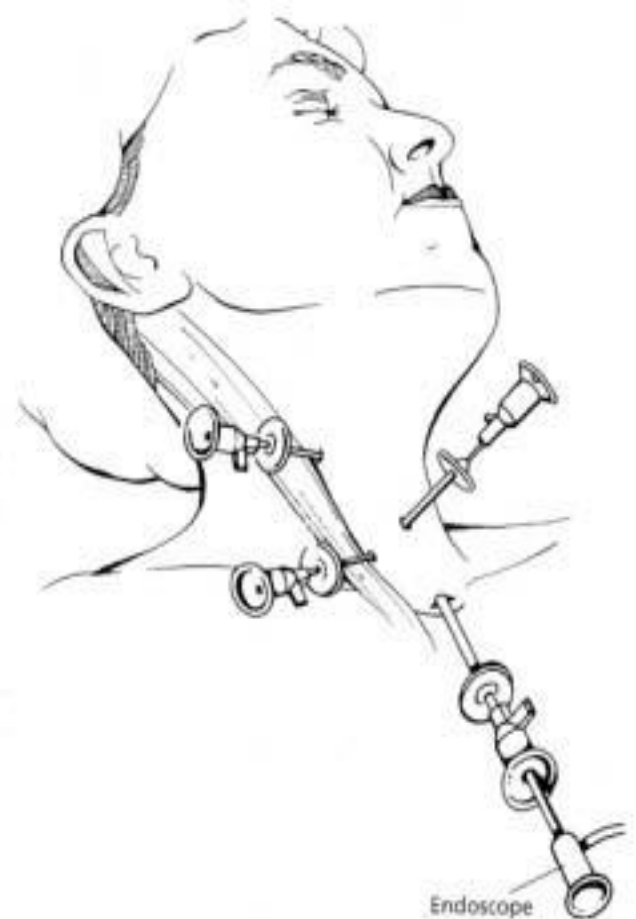
- Classic approach, now used when:
 - 4 gland hyperplasia is suspected
 - Family history of MEN1, MEN2A, PHPT
 - Concomitant thyroid disorder
 - Parathyroid localization studies are negative
 - ioPTH does not fall after unilateral exploration
- 4 gland exploration, removal of enlarged parathyroid
- Intraoperative, histopathologic frozen section examination of excised parathyroid tissue
- Complication rate 1-3%
- Cure rate 95-99%

Focused Parathyroidectomy (Minimally-Invasive Parathyroidectomy)

- Unilateral exploration
- Preoperative localization
- Intraoperative PTH monitoring
- Local/ regional anesthesia
- Ambulatory surgery
- Complication rate 1.2%
- Cure rate 93-99%

Video-Assisted Parathyroidectomy and Endoscopic Parathyroidectomy

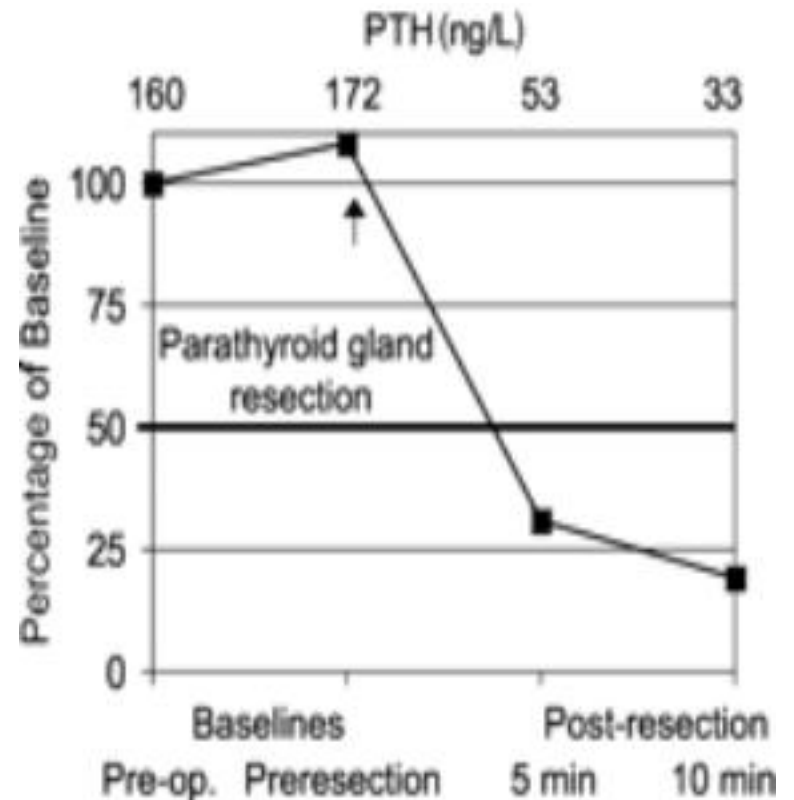
- Creation of working space in the neck with CO₂ insufflation (5-8 mmHg)
- port placement
- Operative space created between platysma and strap muscles
- Increased operative time and expenses
- Small amount of blood often diminishes view
- Metabolic derangements due to absorption of CO₂
- Greatest use for thoracoscopic resection of mediastinal parathyroid adenomas



Intraoperative Monitoring of PTH

Rapid PTH assay:

- PTH level is sent before induction of anesthesia, at resection of adenoma and 5 and 10 minutes after resection of adenoma
- 50% reduction at 10 minutes compared to original level confirms removal of parathyroid adenoma



STEPS TO FIND THE MISSING PARATHYROID

- Perform bilateral internal jugular venous sampling for PTH
- Perform a cervical thymectomy
- Open the carotid sheath
- Search for an undescended gland, occasionally found in undescended thymic tissue
- Perform intraoperative ultrasound of the thyroid gland
- Sternotomy is not recommended during initial exploration
- If the gland cannot be found, terminate the operation, leaving normal parathyroid gland intact

Summary

- Patients with symptomatic and asymptomatic primary hyperparathyroidism benefit from parathyroidectomy
- After biochemical diagnosis of HPT, technique of choice for PHPT due to parathyroid adenoma is focused parathyroidectomy with preoperative localization (sestamibi scan most widely used) and intraoperative PTH monitoring
- Drop of ioPTH to under 50% of preop value 10 minutes after resection confirms resection of hyperfunctioning parathyroid adenoma
- If adenoma cannot be found and/or ioPTH does not drop appropriately, bilateral extended cervical exploration and if needed hemithyroidectomy on the side of localization should ensue (10-15% of parathyroid adenomas are ectopic, 5-10% double adenoma)
- If adenoma still cannot be found after extended cervical exploration and hemithyroidectomy, the procedure should be aborted and further localization studies

THANK YOU