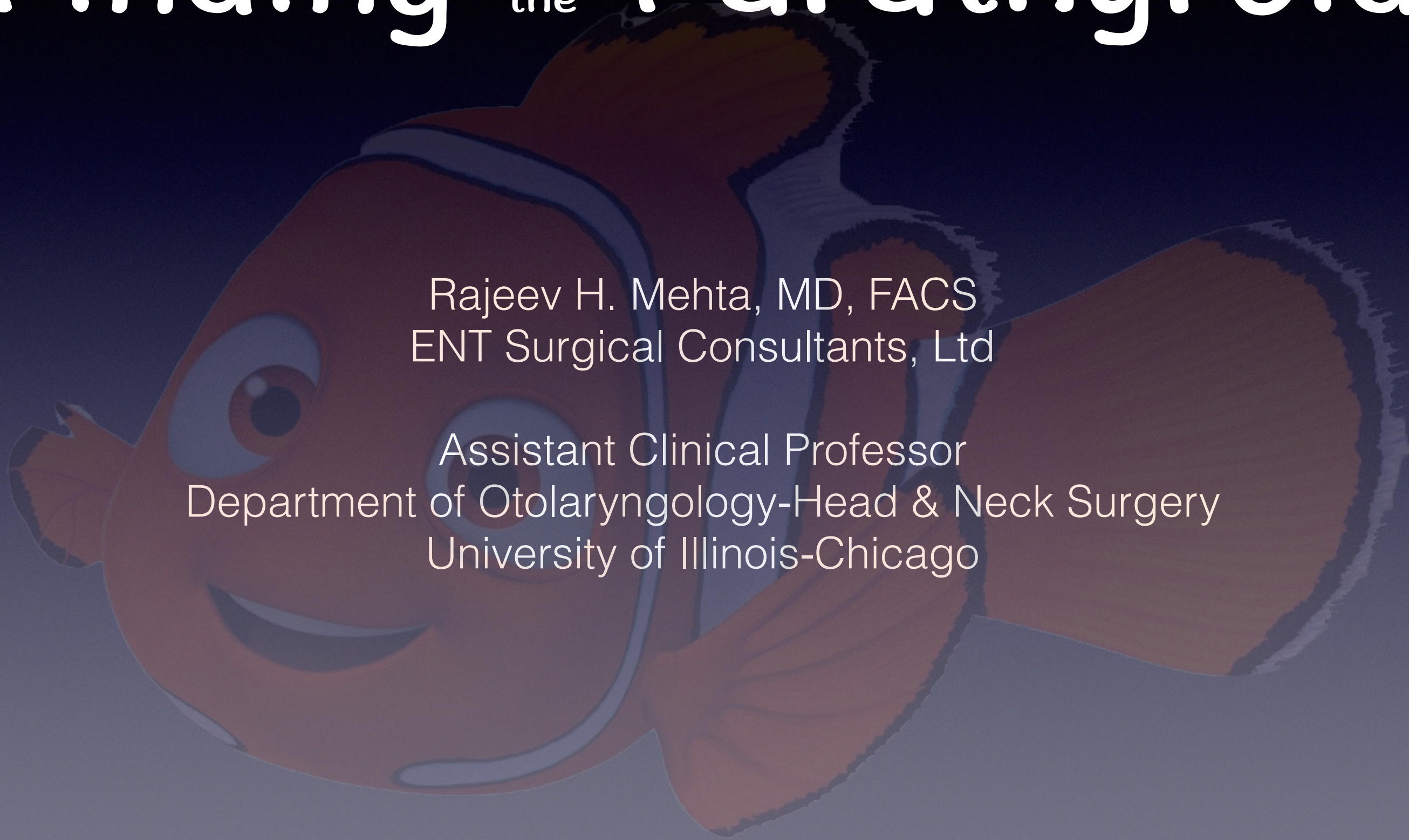


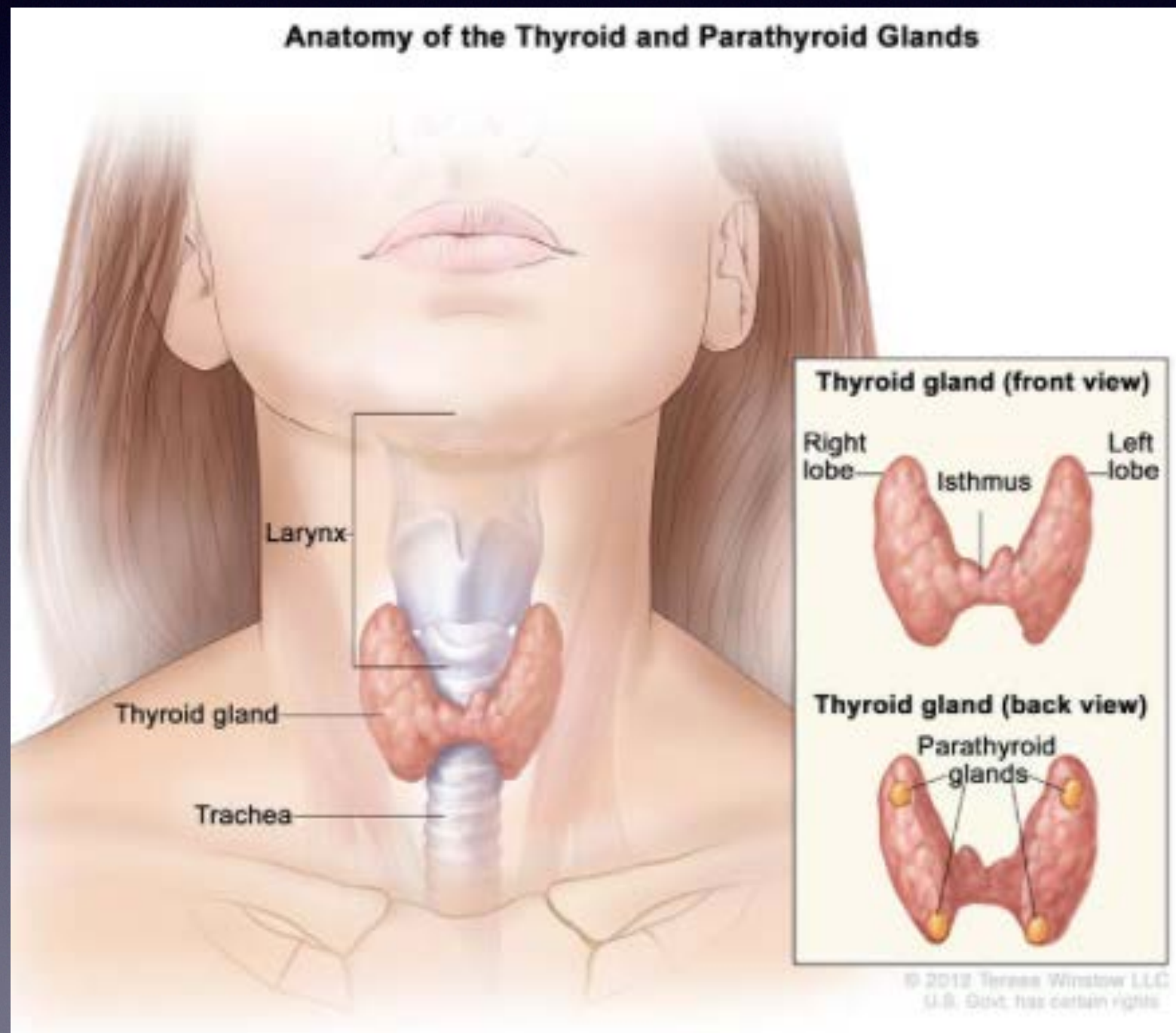
Finding _{the} Parathyroid

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- Hyperparathyroidism = Overactive parathyroid gland(s)
 - Parathyroid gland is the thermostat for blood calcium level
 - 4 glands-usually 2 on each side, inferior and superior
 - Calcium is important for bones and muscles (heart)
 - Overactive parathyroid causes high calcium level



Causes of Hypercalcemia

- Primary hyperparathyroidism (most common cause)
 - Parathyroid adenoma, double adenoma, & 4 gland hyperplasia
- Malignancy - bone mets (second most common cause)
- Drugs - Thiazide diuretics, lithium, vitamin D toxicity
- Renal disease (secondary & tertiary hyperparathyroid - 4 gland hyperplasia)
- Granulomatous disease - sarcoid, TB
- Benign familial hypocalciuric hypercalcemia (FHH) (trick surgeons)
 - a benign autosomal dominant condition that causes chronically elevated serum calcium and reduced calcium excretion. It is typically caused by an abnormal set-point for parathyroid hormone (PTH) secretion in the calcium sensing receptor (CASR)

Types of Hyperparathyroidism (HPT)

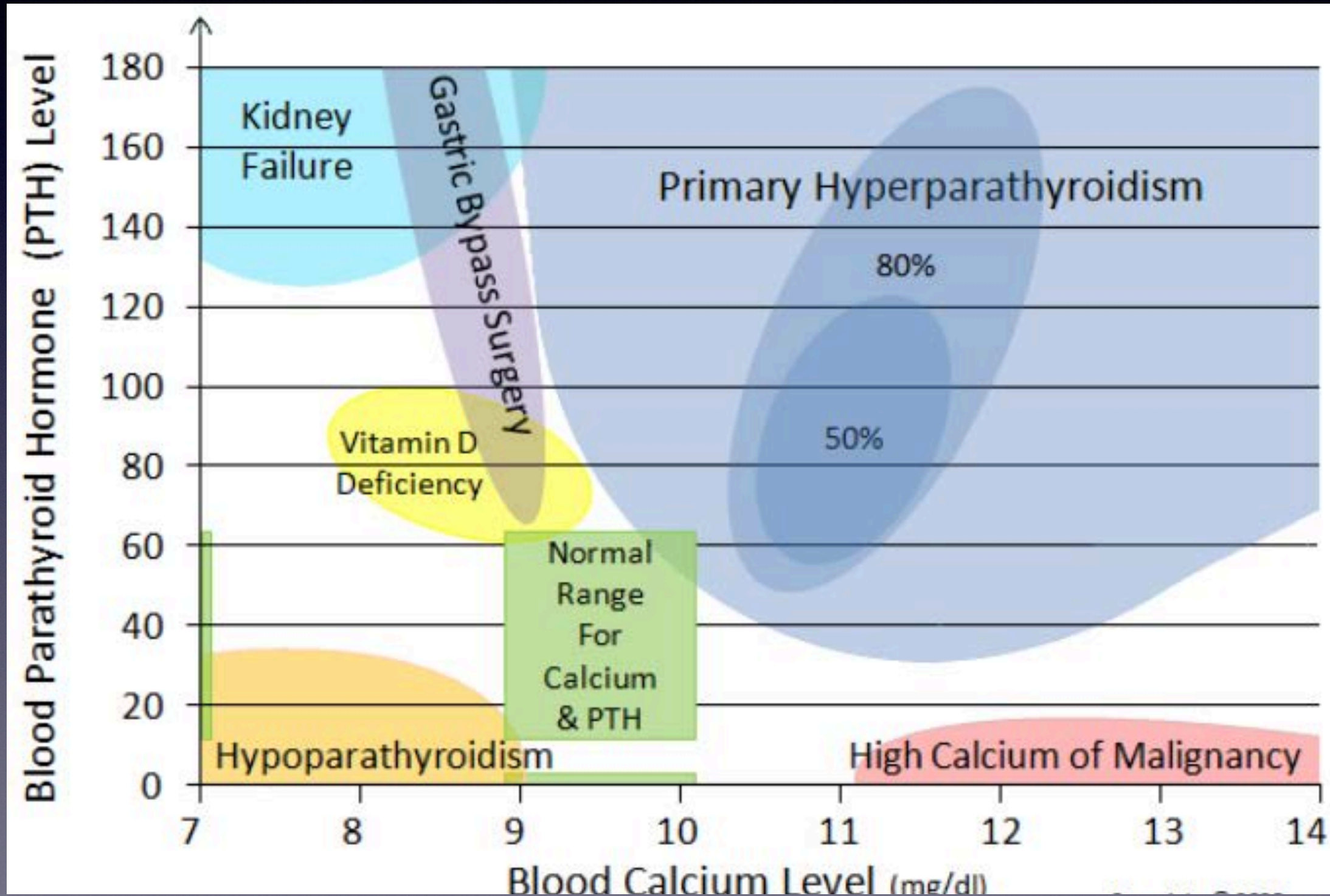
- Primary HPT - No known cause (PTH=70-300)
 - 85% Single adenoma (one overactive gland)
 - 12% Double adenoma (two overactive glands)
 - 3% Parathyroid hyperplasia (4 overactive glands)
- Secondary/Tertiary HPT - Cause is kidney failure (PTH=2-4000)
 - Parathyroid hyperplasia (4 overactive glands)

Vitamin D helps the body absorb calcium from the gut, with low Vitamin D more PTH is needed to maintain calcium

Symptoms of Hyperparathyroidism

- Kidney stones
- Osteoporosis/osteopenia
- Fatigue, bone/joint/muscle pain (take credit)
- Mental status changes (103 yrs old)
- Ulcers, nephrocalcinosis, pancreatitis, HTN, arrhythmias
- Mostly incidental finding on routine chemistry
(normal calcium = 8.5-10; normal PTH = 10-65)

Diagnosis of Primary Hyperparathyroidism



Parathyroidectomy

Incidence of hyperparathyroidism is increasing - 2 main factors

- 1) Increased screening/recognition of hypercalcemia
- 2) Aging population in whom the disease is more prevalent, especially postmenopausal women.



Parathyroid Localization Studies

PreOp Localization

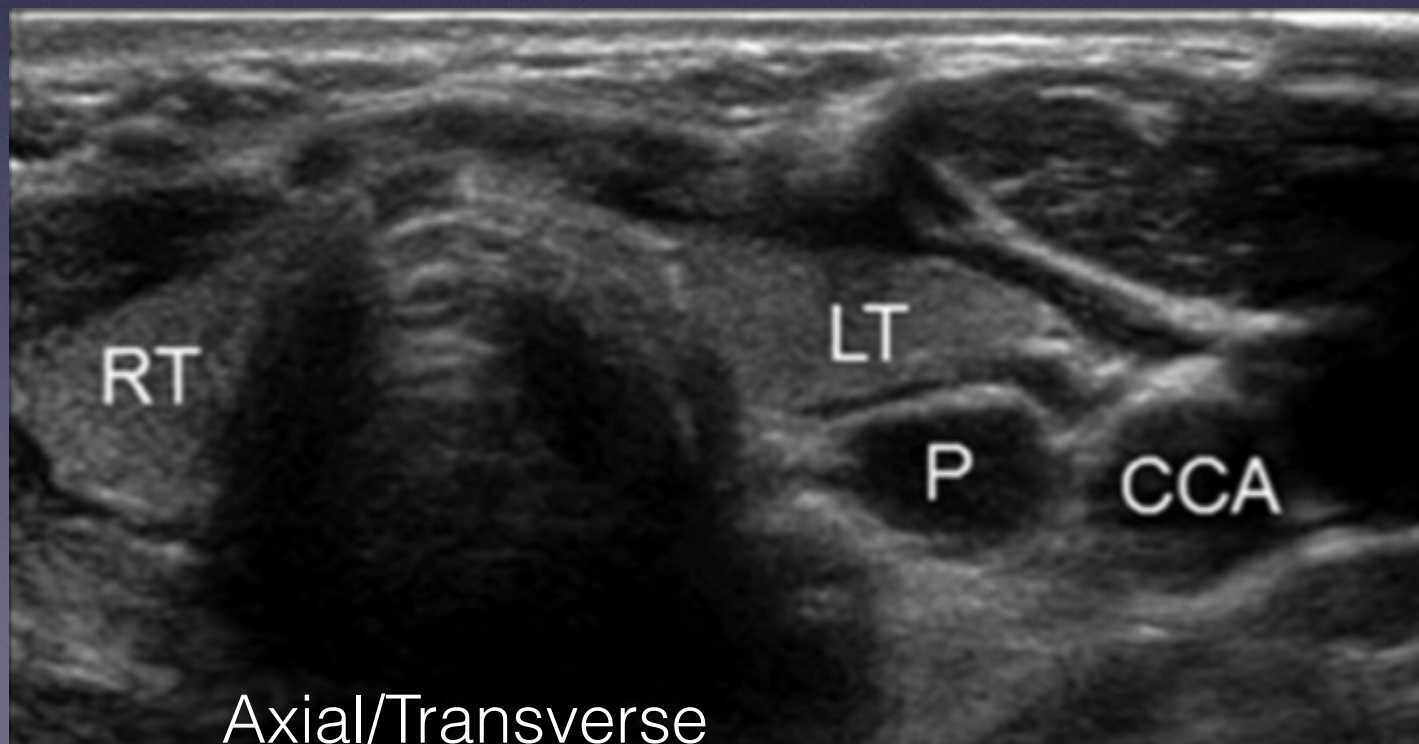
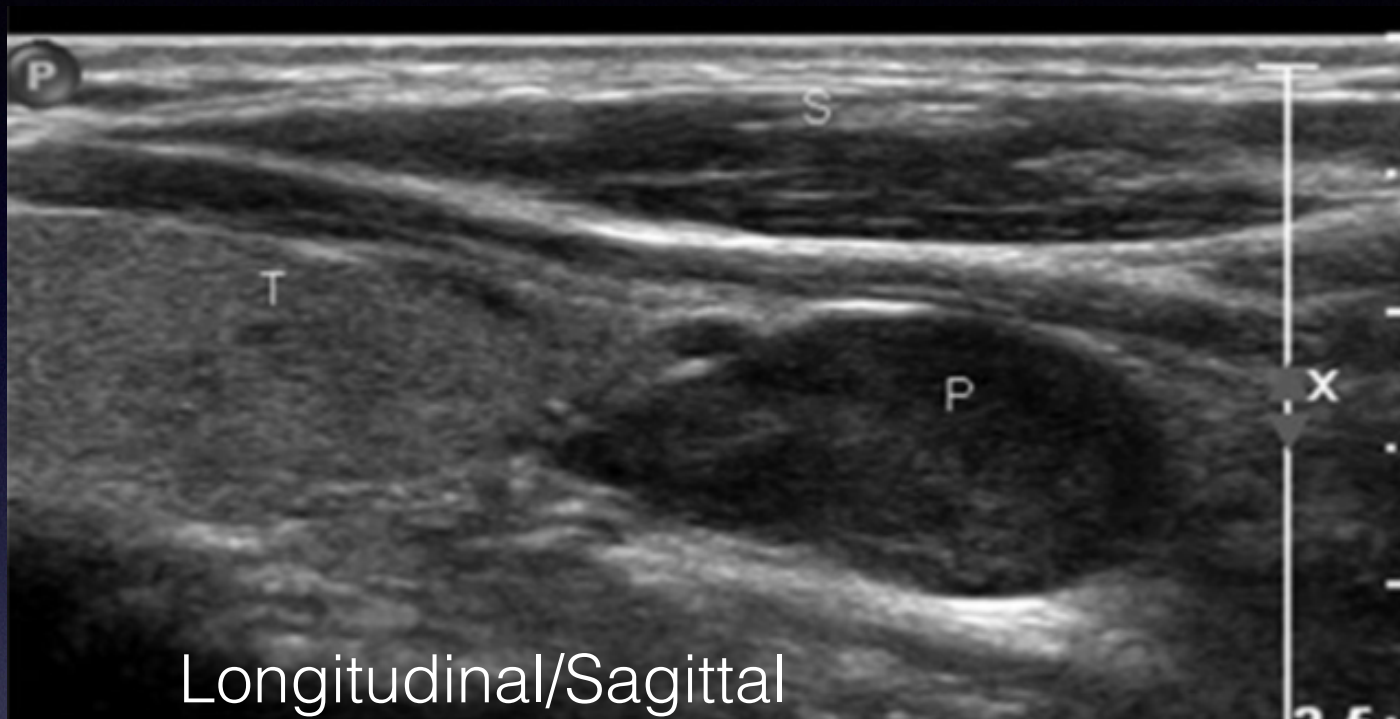
- Ultrasound
- Scintigraphy
- 4D CT, MRI
- US guided FNA
- Gamma Probe

IntraOp Localization

- Gamma Probe
- Methylene Blue
- PTH assay
- Selective Venous Sampling

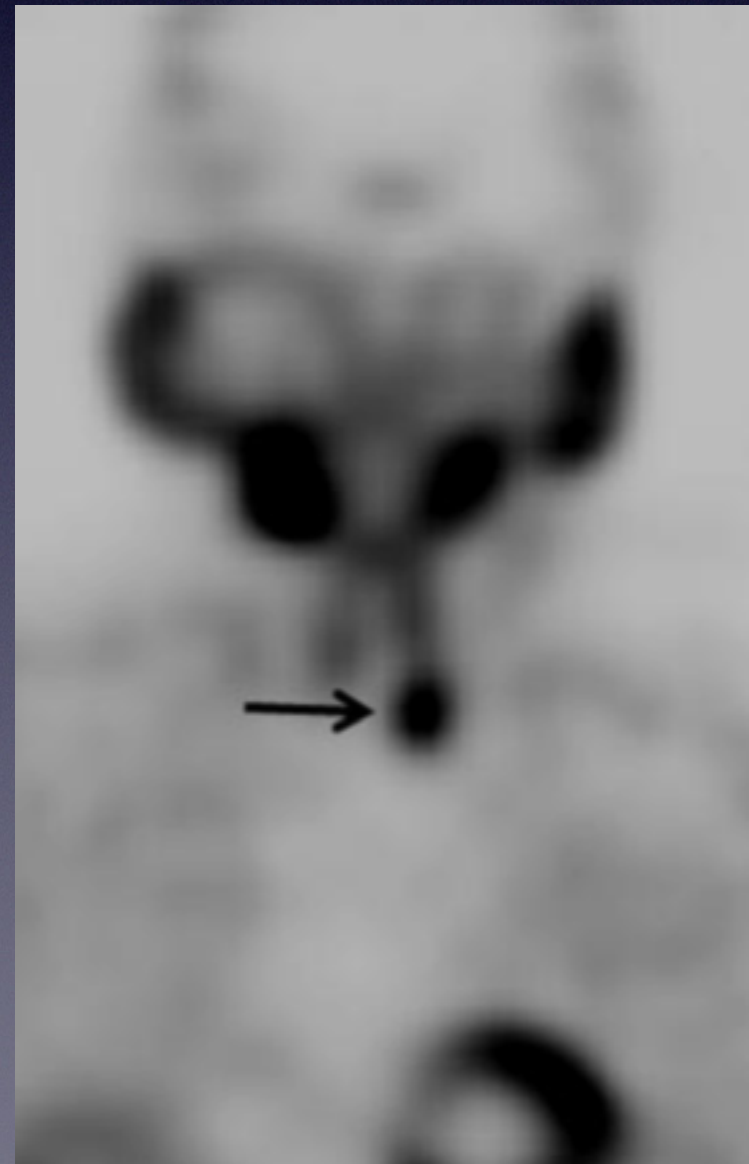
Ultrasound

- 5–15 MHz transducer
- Normal glands are not visible on ultrasound

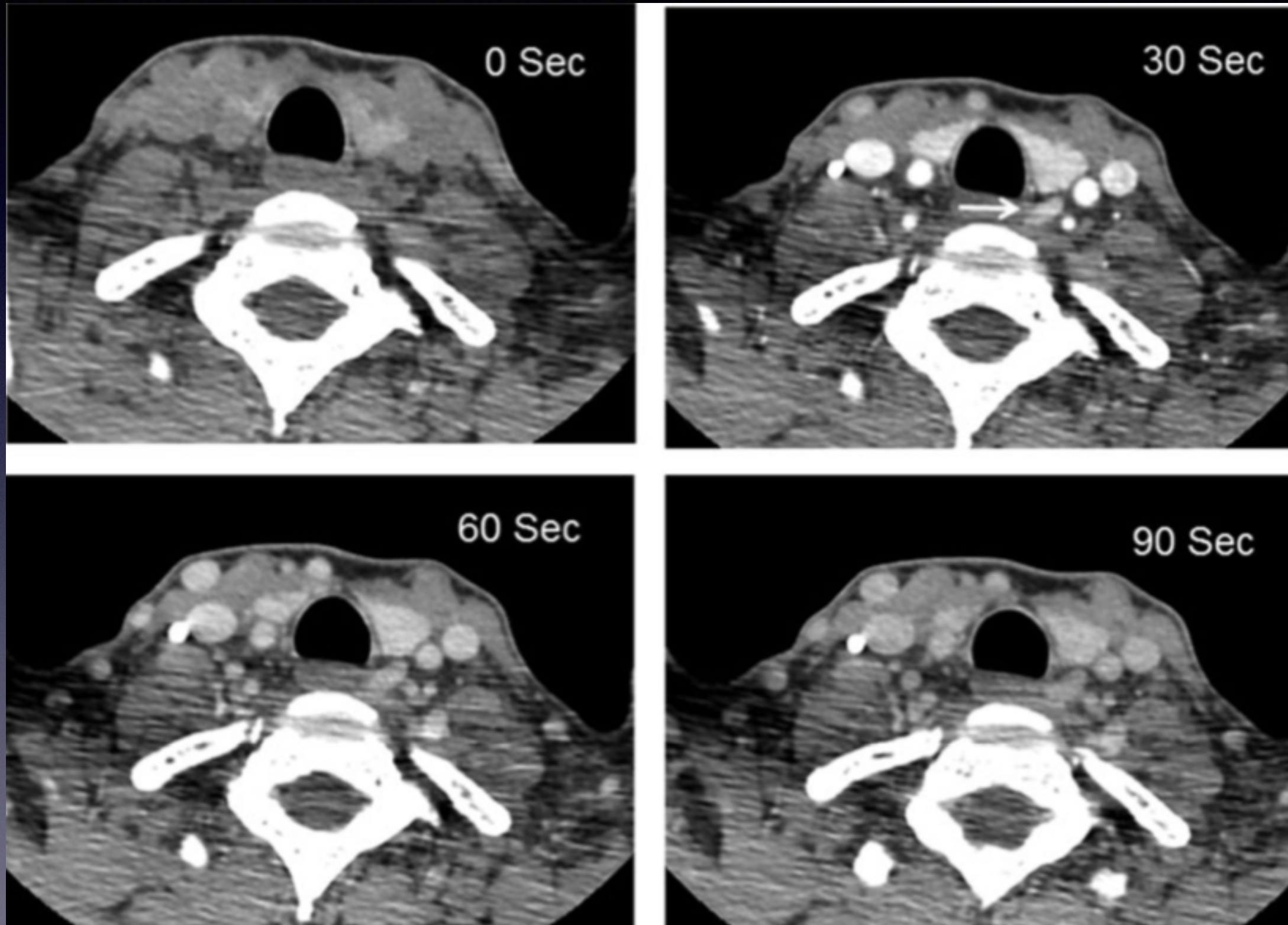


Scintigraphy

- technetium 99m (^{99m}Tc)-sestamibi scintigraphy
- 3-dimensional single-photon emission CT (SPECT)
- hybrid SPECT/CT protocol



Axial Imaging - 4D CT



Intraoperative Imaging

Methylene Blue

- Methylene Blue
 - 3.5mg/kg infused after induction of anesthesia
 - Neurotoxicity in patients taking Serotonin reuptake inhibitor medications



Gamma Probe

- Inject radio tracer 90 minutes prior to incision
- Localized abnormal gland preop & intraop
- Helps confirm cure intraop



IntraOp PTH

PTH protocol

1. Check preop PTH prior to incision
2. Check PTH 10, 20, & 30 minutes after adenoma removed

- Predictive accuracy of 97%
- IntraOp PTH changed the operative approach in 13%
- Need for second surgery without use of intraOp PTH is 10-15%
- Goal for PTH
 - Primary - should be less than 40 (probably less than 30) - remaining normal glands should be suppressed
 - Secondary/Tertiary - goal is around 75
 - Remaining parathyroid tissue is hyperplastic
 - Don't want to over-resect

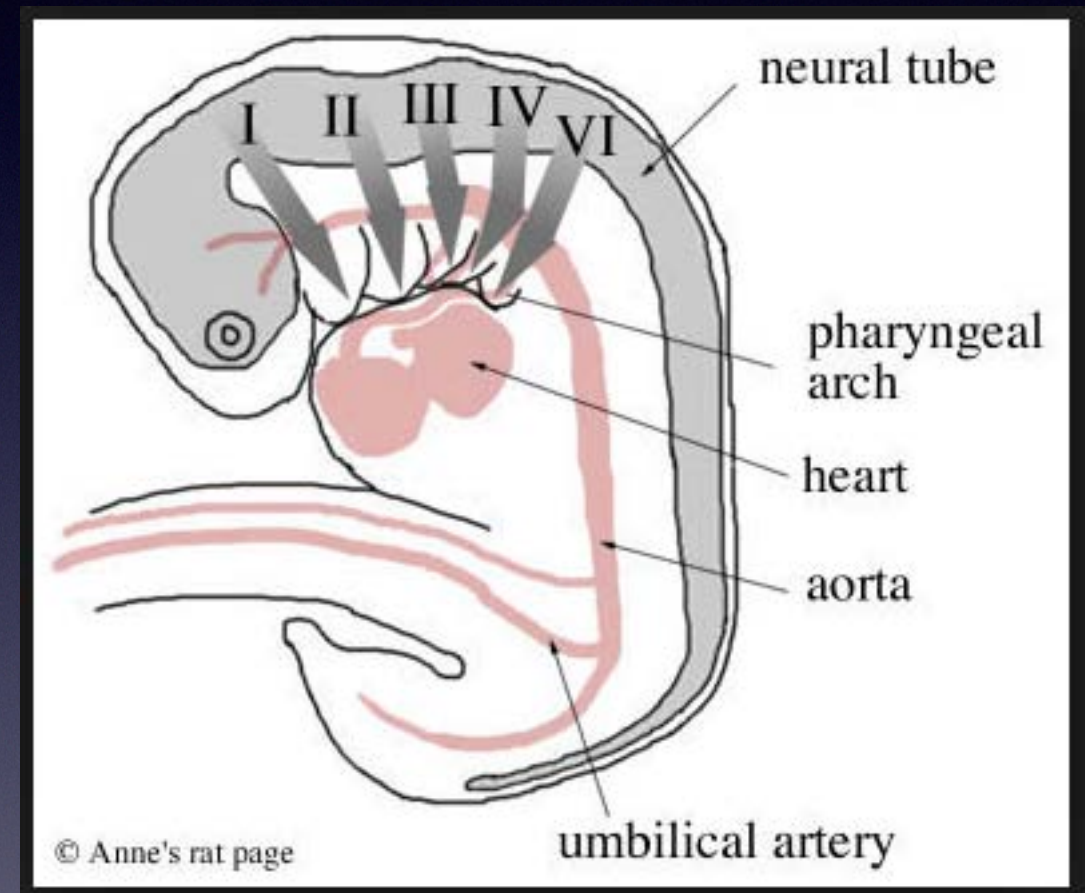


Intraoperative Internal Jugular Venous Sampling for PTH Assay

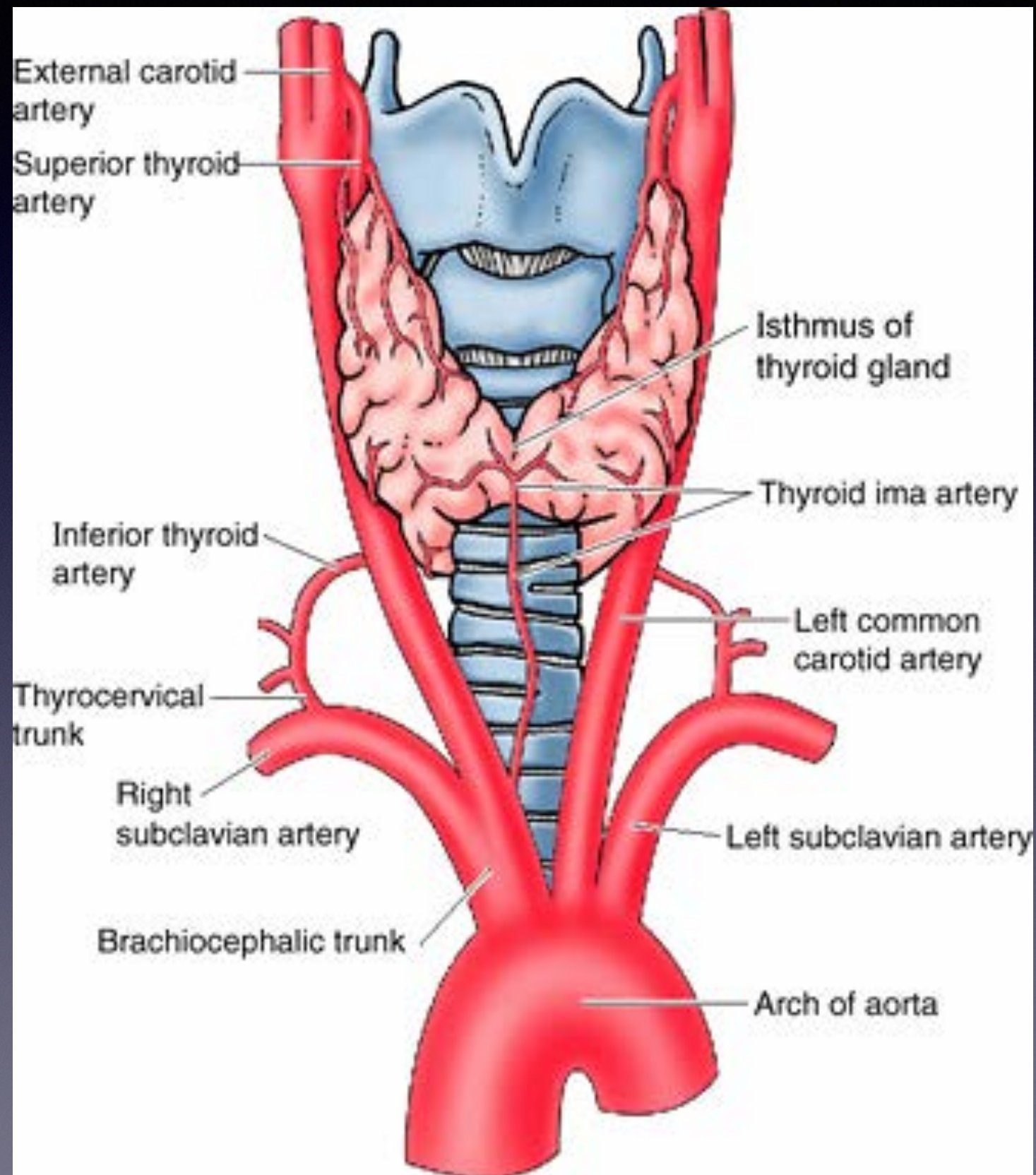
- Helps localize correct side (right or left)
- If both sides are equal, could be hyperplasia, double adenoma, or mediastinal location
- The best localization study is locating an experienced parathyroid surgeon!

Embryology of Parathyroid Glands

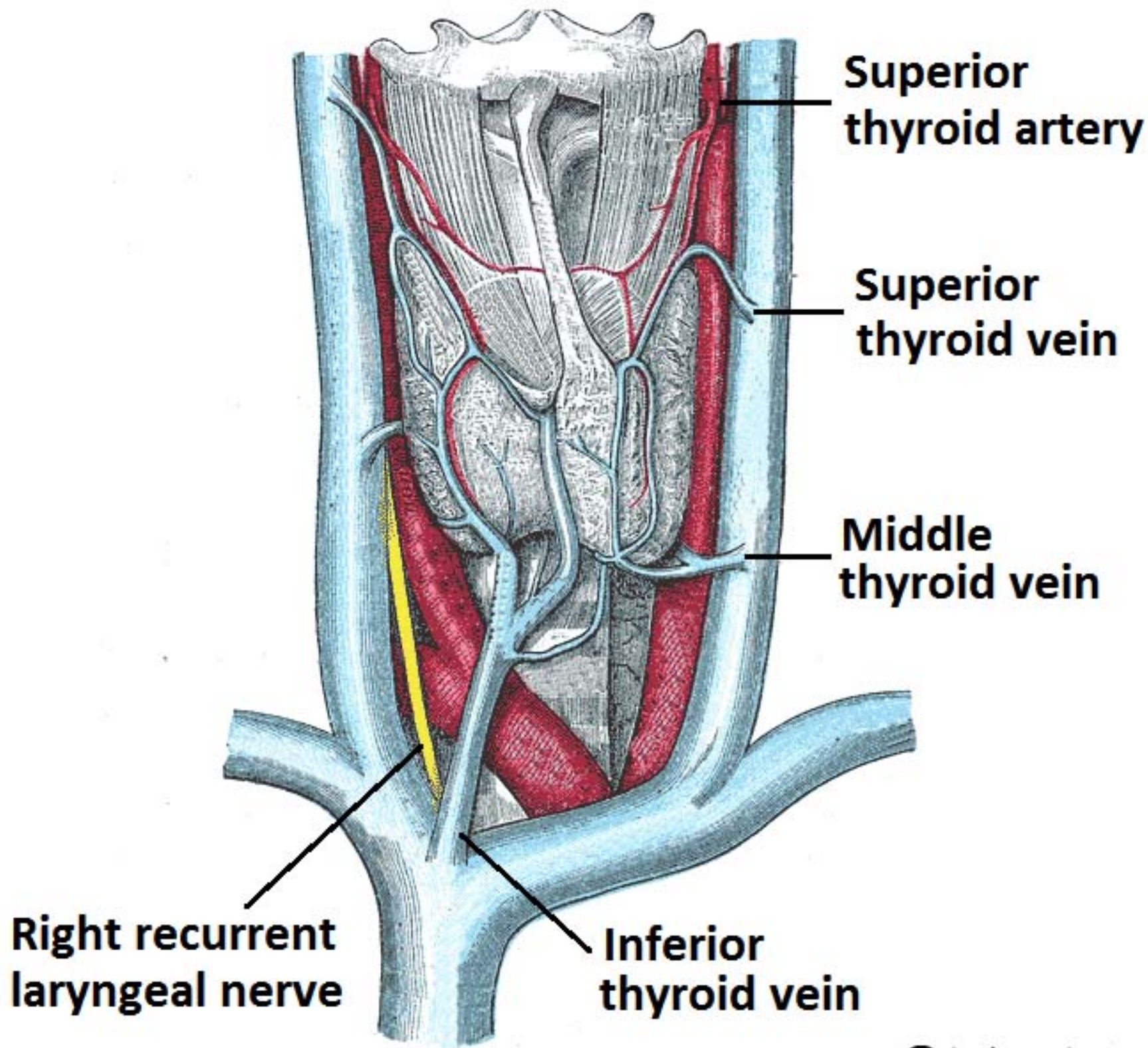
- 5th week gestation
- inferior parathyroid migrates from 3rd pouch along with thymus - anterior, more variable location
- superior parathyroid from 4th pouch - posterior, more constant location



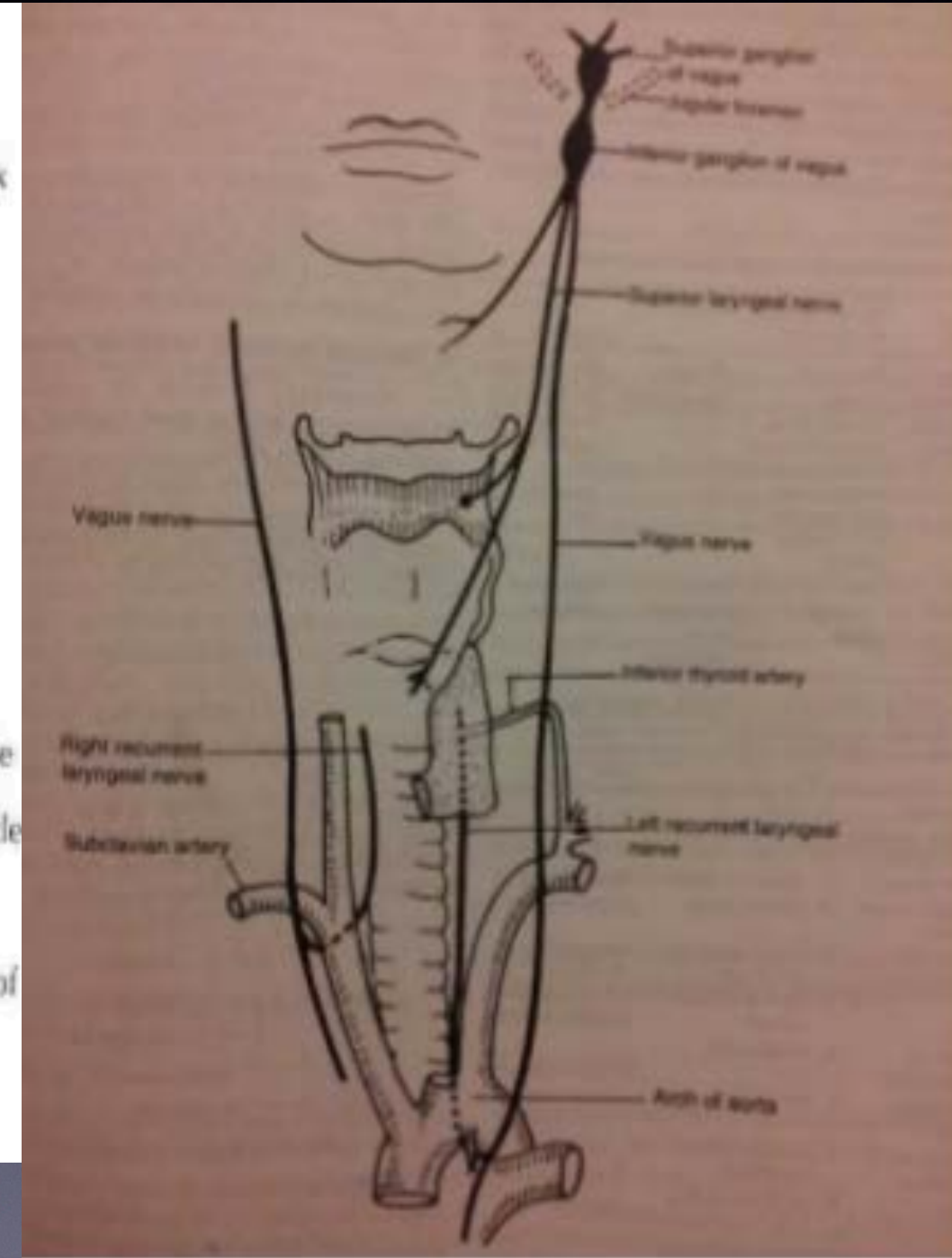
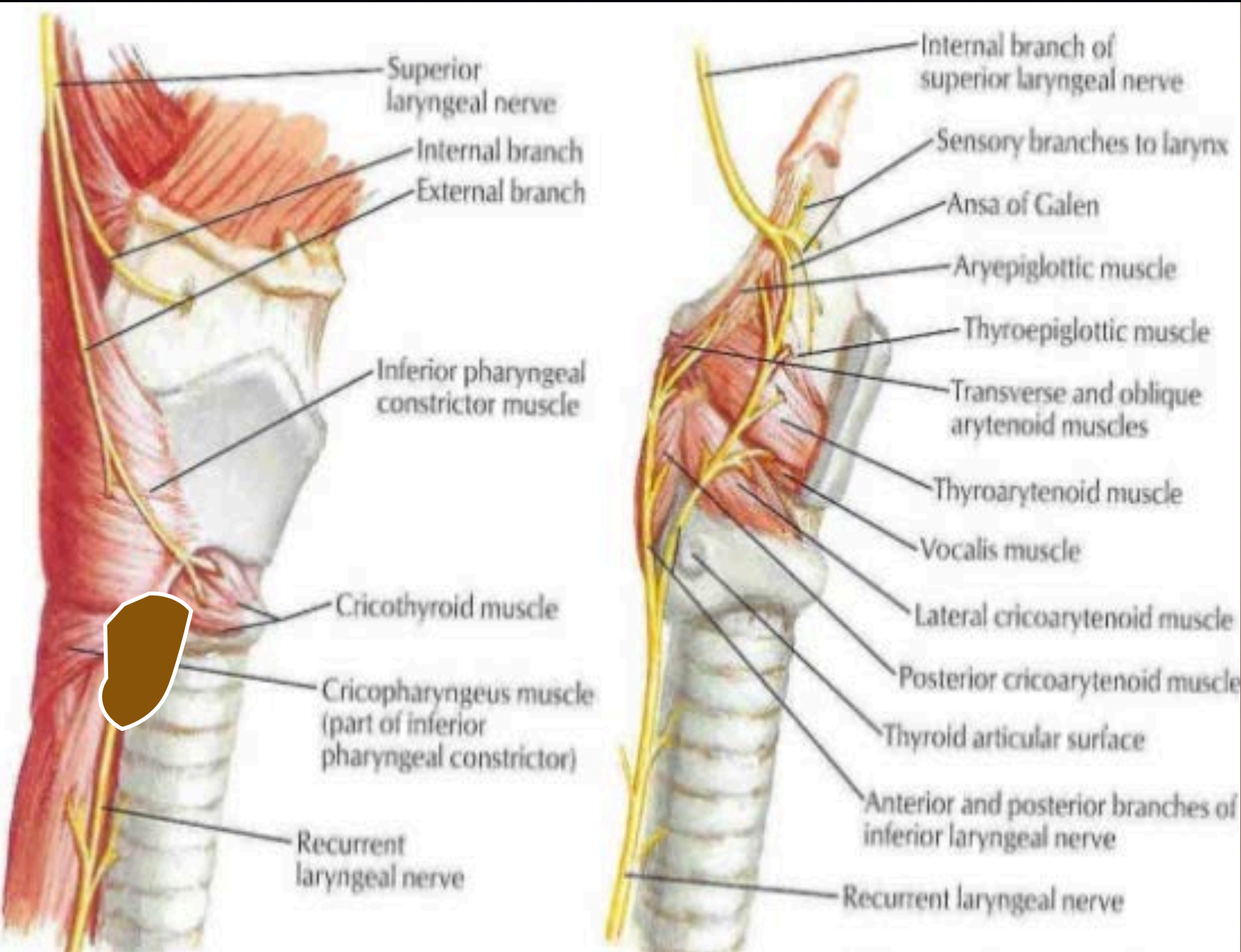
Arterial Supply



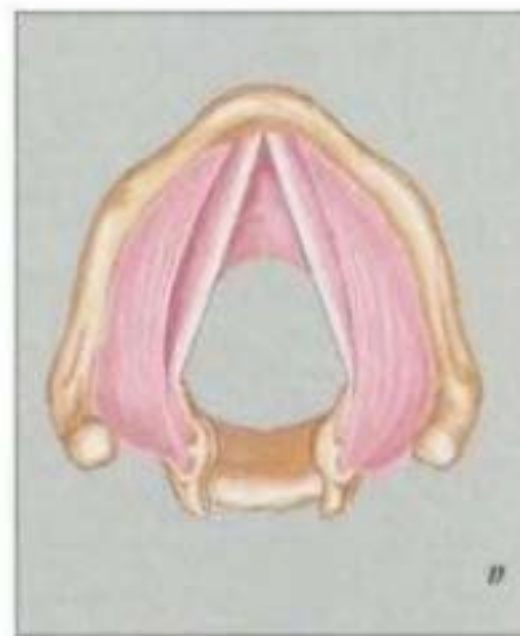
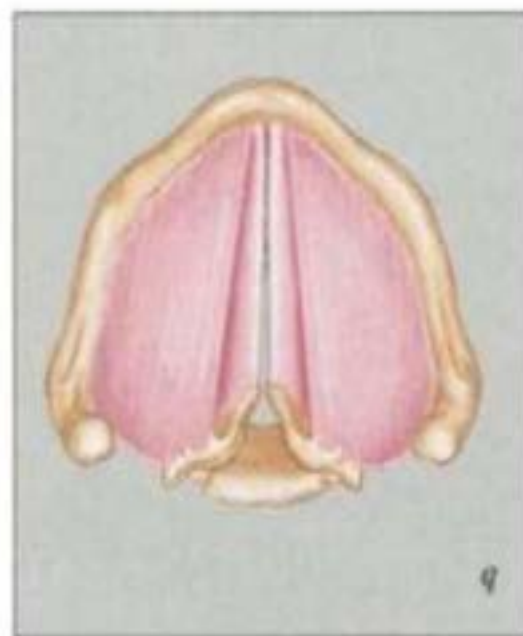
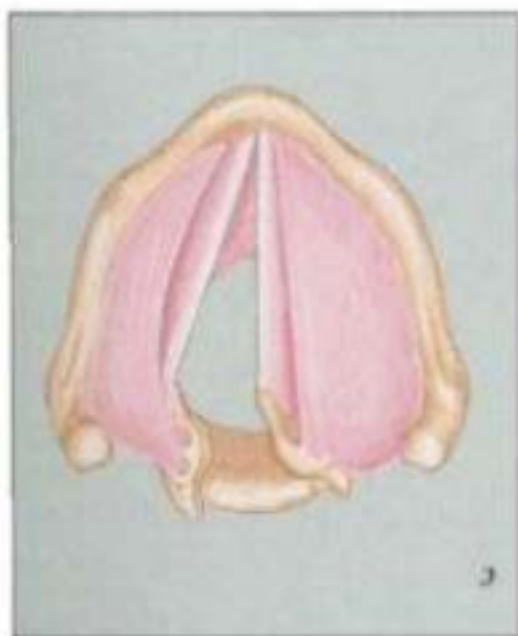
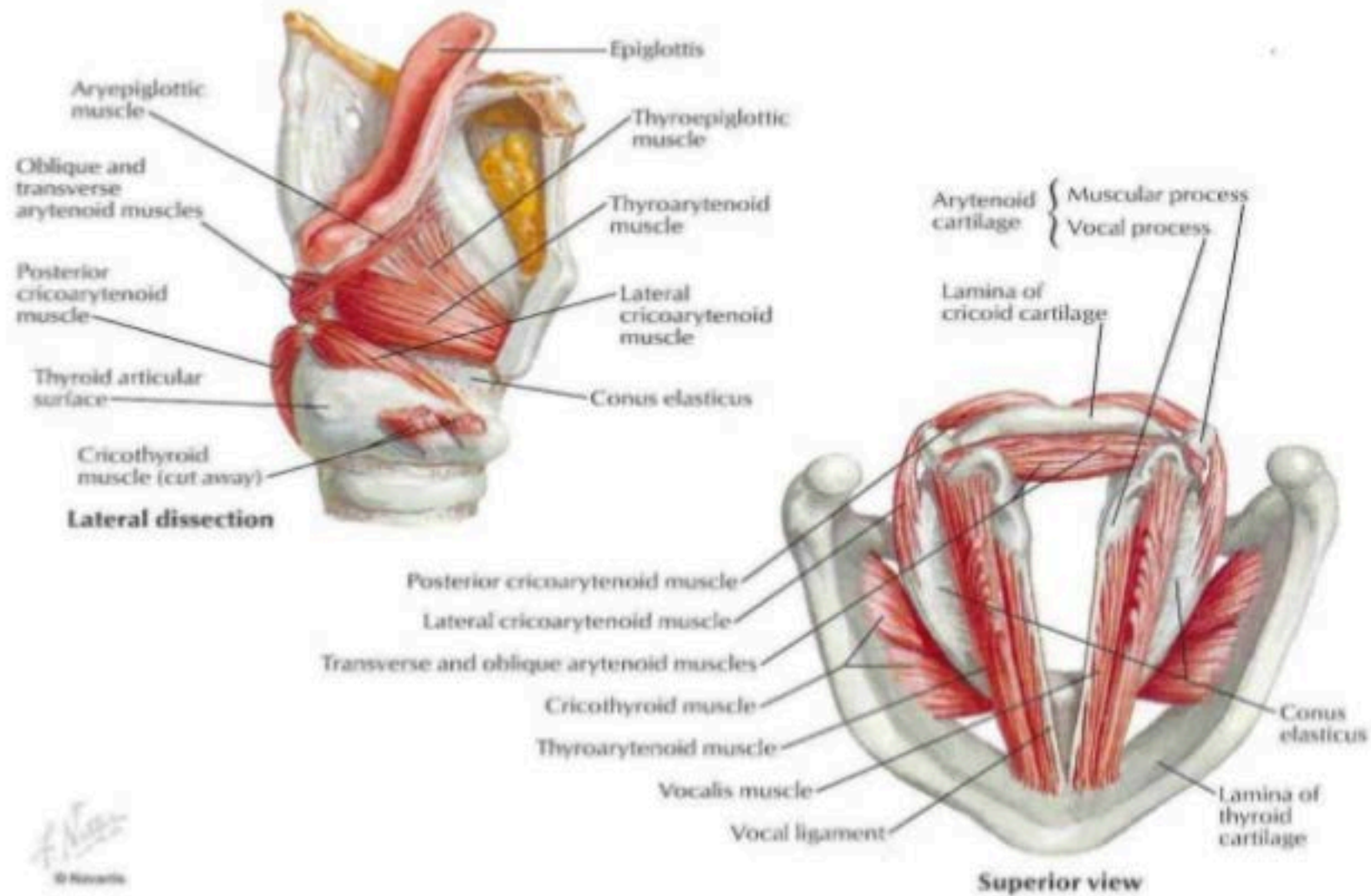
Venous Drainage



Nerve Supply to Larynx (Vocal Cords)

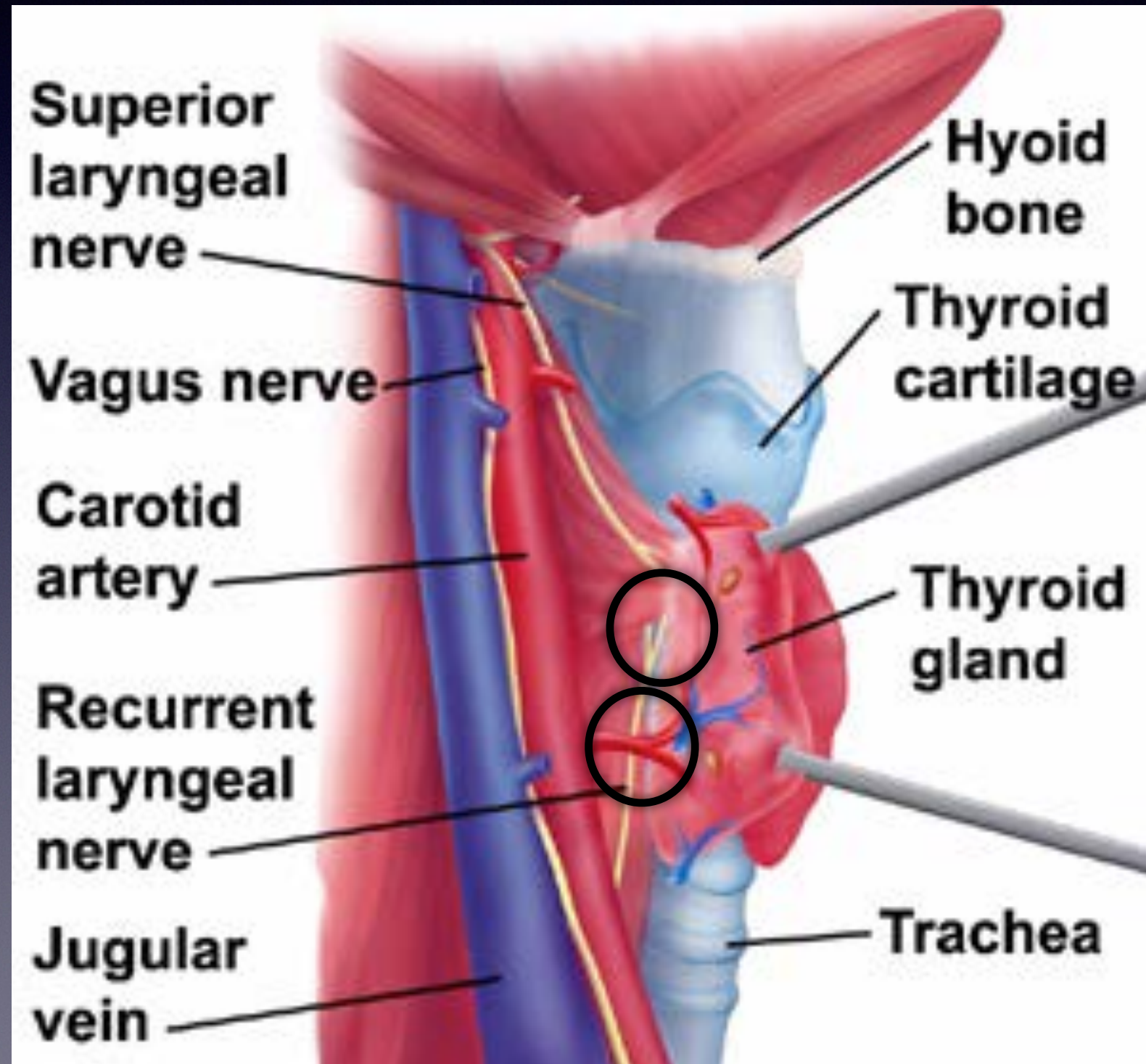


LARYNGEAL MUSCLES



Finding the Parathyroid

- Superior Glands
 - 85% are 1cm from the cricothyroid joint (where RLN enters larynx)
- Inferior Glands
 - 61% are 1cm from the inferior pole of the thyroid gland (RLN & ITA intersection)
 - 26% are in the thyrothymic ligament



Finding the Parathyroid

- Look more, dissect less
- Blunt Kittner dissection and look for bulging tissue
- Adenoma often has dark red/dark blue color
- Superior parathyroid will be deep to RLN
- Inferior parathyroid will be superficial to RLN
- Dissect all fascia off thyroid capsule
- When preop studies are negative, it is more likely superior parathyroid within the thyroid fascia or hyperplasia

Ectopic Parathyroids

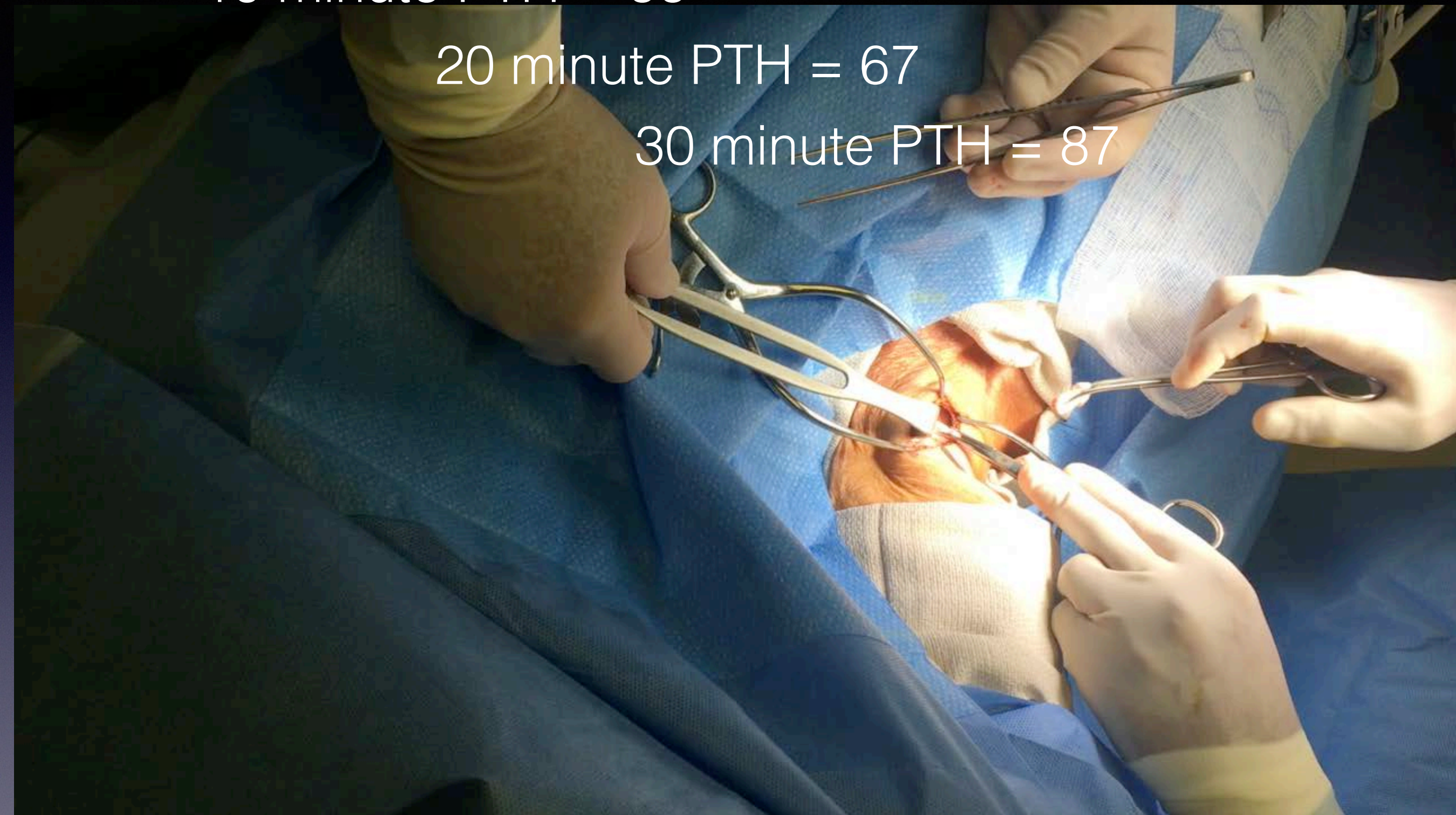
- 16 -22% incidence of ectopic parathyroids
- Single adenoma (89%); double adenoma (11%)
- Inferior parathyroid ectopic locations - thymus(30%), anterosuperior mediastinum(22%), intrathyroidal(22%), thyrothymic ligament(17%), submandibular(17%)
- Superior parathyroid ectopic locations - tracheoesophageal groove(43%), retroesophageal(22%), posterior mediastinal(14%), intrathyroidal(7%), carotid sheath(7%), paraesophageal(7%)

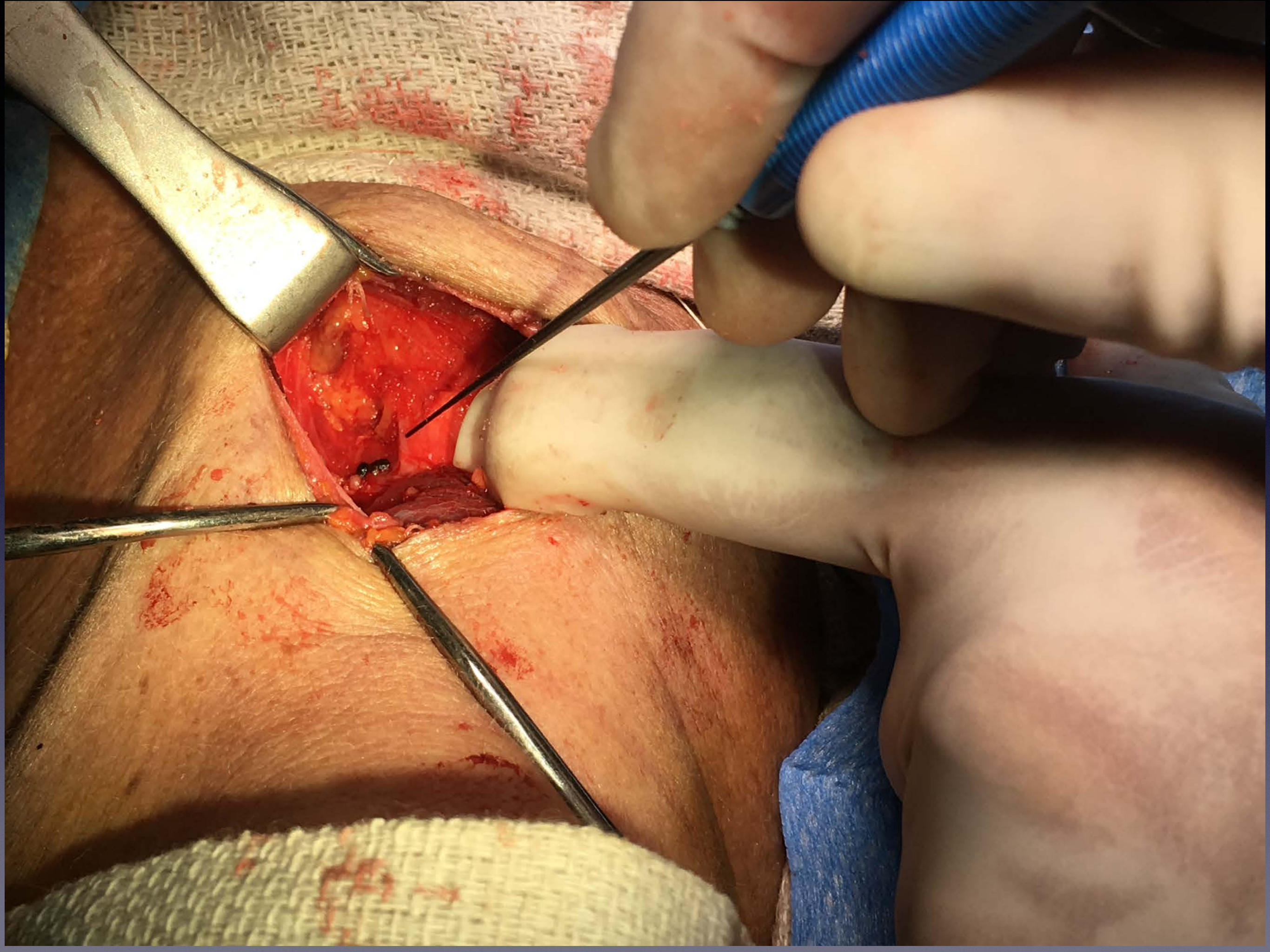
Preop PTH = 134

10 minute PTH = 66

20 minute PTH = 67

30 minute PTH = 87





An intraoperative photograph showing a surgical dissection. Several surgical instruments, including forceps and a scalpel, are visible, manipulating a reddish, fleshy tissue mass. The surgical field is exposed, with surrounding skin and soft tissue visible. The text "Final PTH = 9.8" is overlaid in yellow.

Final PTH = 9.8

3 1/2 gland parathyroidectomy for
parathyroid hyperplasia

Finding _{the} Parathyroid

Rajeev H. Mehta, MD, FACS

“The eye doesn’t see
what the mind doesn’t know”

Thank you!

- Any questions?

