MANAGEMENT OF THE COMPLICATIONS OF THYROID SURGERY

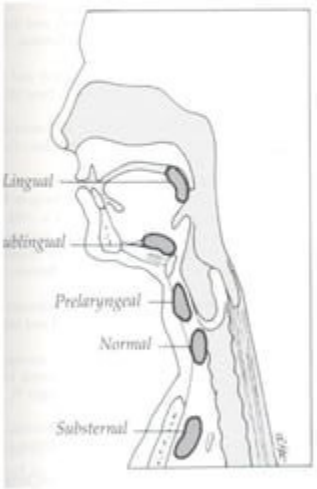
- Kayvan Aghazadeh M.D
Otolaryngologist
Amir aalam hospital

HISTORY



- Term 'thyroid' was coined by Thomas Warton in 17th century
- Emil Theoder Kocher is considered as the Father of Modern Thyroid surgery
- First thyroidectomy is considered to be done more than 1000 years ago by Abu-al-Qasim
- The earliest account of thyroidectomy was probably given by Roger Frugardi, 1170

Thyroid Embryology



THYROID GLAND (Anatomy)

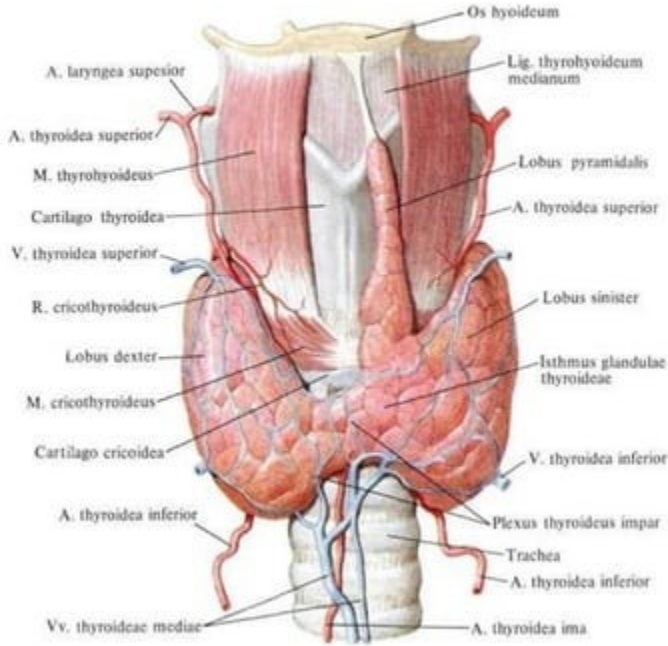
- Shield shape gland with an isthmus and two lateral lobes (near the third tracheal ring)
- Each lateral lobes have superior and inferior pole and firmly attached to laryngotracheal skeleton
- Blood supply: superior and inferior thyroid arteries
- Venous drainage: superior , middle , and inferior thyroid veins

Thyroid Anatomy

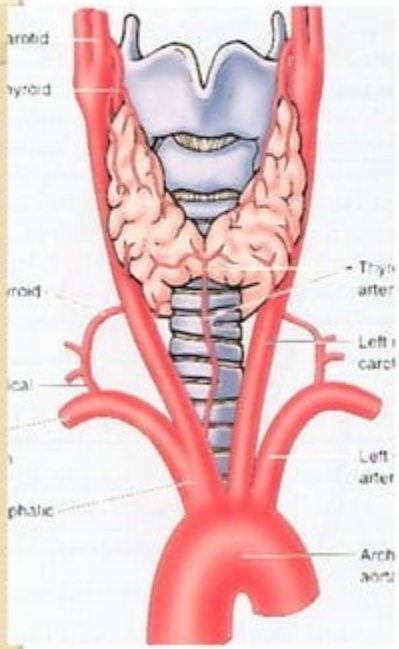
- Locate deep to the sternohyoid muscle, from level C5 to T1 vertebrae or anterior to the 2nd and 3rd tracheal rings.
- Thyroid gland is attached to the trachea by the lateral suspensory (Berry) ligaments.

RLN runs with inferior thyroid artery,
SLN with the superior thyroid artery

ANATOMY – Thyroid gland



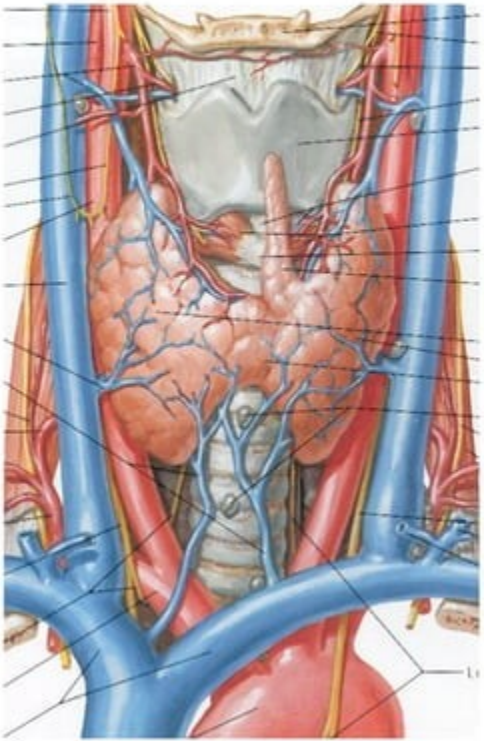
Anatomy



- Blood supply: sup. & inf. thyroid arteries
- Anatomy variant: thyroid ima artery, in 1.5% to 12%, in front of the trachea.
- Lymph vessels: drain to prelaryngeal, pretracheal and Para tracheal nodes.
- Innervation: superior, middle, and inferior sympathetic ganglia.

Anatomy

- Venous supply
  - Superior and middle thyroid v. drain into the IJ
  - Inferior thyroid v. drains into the brachiocephalic trunk



Attie incision

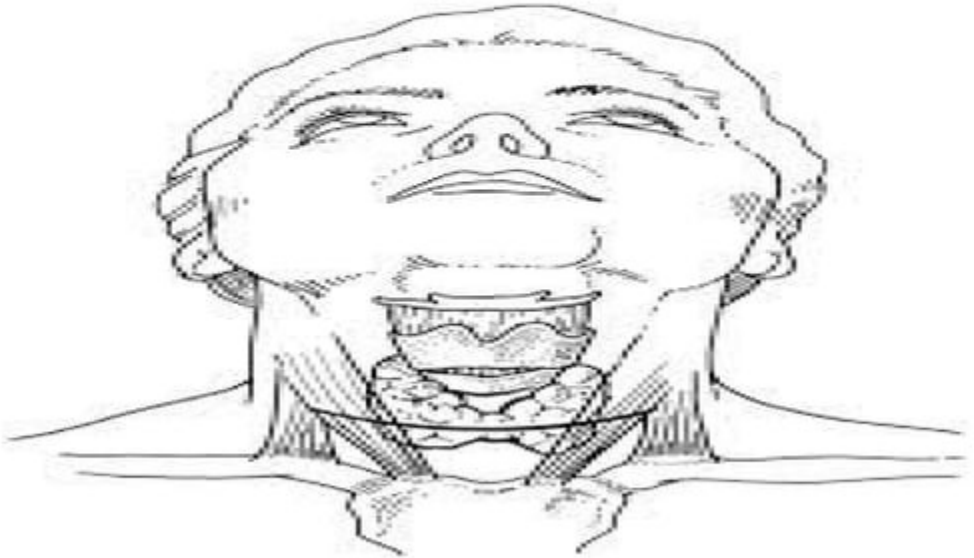




Figure 3 Raising subplatysmal flaps.

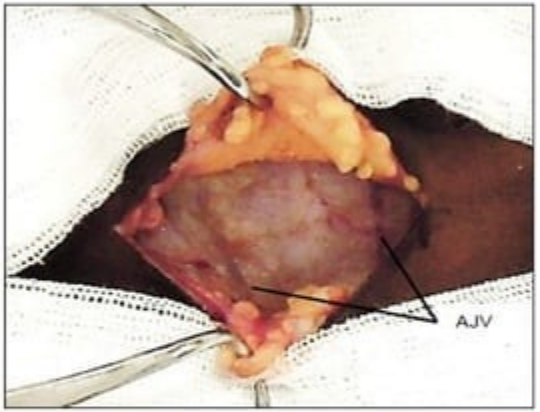


Figure 19: Subplatysmal skin flaps held with Jowell's retractor. Note anterior jugular veins (AJVs)

Exposure of thyroid gland

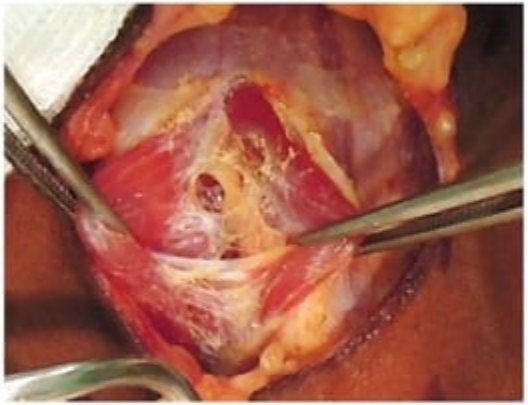


Figure 20: Fascia between sternohyoid and sternothyroid muscles divided to expose thyroid gland

Mobilization and dissection of upper pole

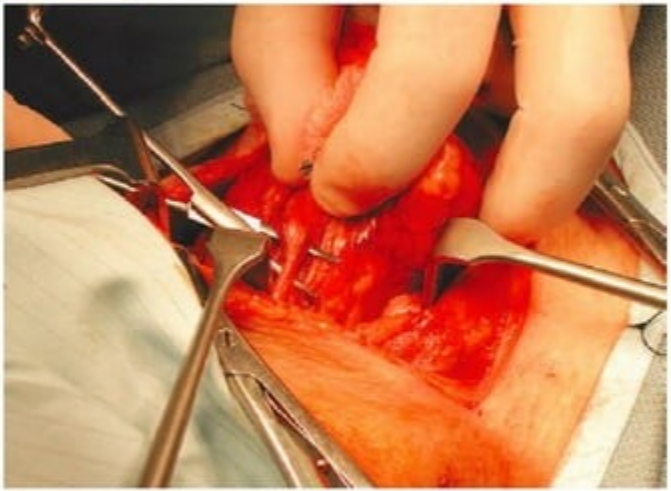


Figure 5 Exposure and ligation of the upper pole.

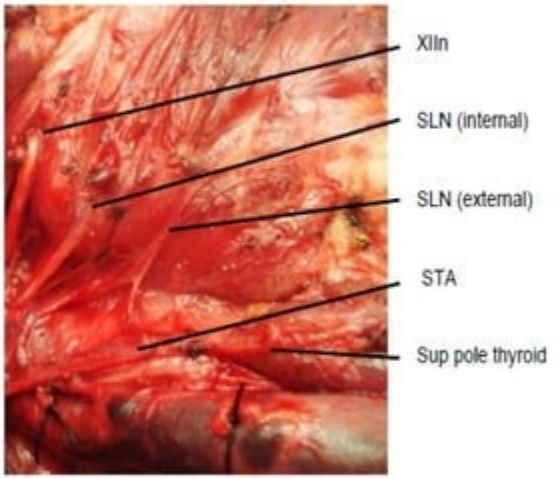


Figure 12: Anatomical relations of internal and external branches of right SLN to superior thyroid artery and to superior pole of thyroid

COMPLICATIONS

- Complications can typically be divided into nonmetabolic and metabolic complications.
- Of particular concern are injuries to the RLN and the parathyroid glands.
- postoperative infections are very unusual because of the abundant blood supply in the thyroid bed

IMMEDIATE COMPLICATIONS

- HEMORRHAGE
- INFECTION
- RECURRENT LARYNGEAL NERVE PALSY
- THYROID CRISES OR STORM
- RESPIRATORY OBSTRUCTION
- PARATHYROID INSUFFICIENCY OR TETANY

LATE COMPLICATIONS

- THYROID INSUFFIENCY
- RECURRENT THYROTOXICOSIS
- PROGRESSIVE EXOPHTHALMOS
- HYPERTROPHIC SCAR OR KELOID.

HEMATOMA

- Hematoma can usually be differentiated from seroma by the presence of skin ecchymosis, firmness to palpation, or clotted drain output
- Prevention consists of preoperative avoidance of anticoagulants and antiplatelet agents and meticulous intraoperative hemostasis

HEMORRHAGE

- Two types -
  - Deep to deep fascia
  - Subcutaneous
- May be primary or reactionary
- A deep bleeding produces tension hematoma. Usually due to slipping of the ligature of the superior thyroid artery, though it can also be from a thyroid remnant or a thyroid vein. This compresses on the airway & potentially life threatening unlike the subcutaneous bleeding.

HEMORRHAGE

- GOOD INTRAOPERATIVE HEMOSTASIS
- Don't traumatize the thyroid
- Avoid too much neck dressings
- Suction drain ??
- Do not waste time on imaging
- A tension hematoma requires opening of the wound, evacuation of hematoma & ligature of the bleeding vessels
- A subcutaneous hematoma can be aspirated.

INFECTION

- Aerodigestive tract entry is the single most important factor that contributes to the risk of wound infection.
- tyroidectomy without exposure to oral flora is considered a clean procedure.
- Administration of prophylactic antibiotics for clean neck dissections is reasonable

infection

- Factors associated with wound infection include
- the performance of bilateral neck dissections and total laryngectomy,
- advanced stage tumors, and in some studies,
- a history of prior tracheotomy and malnutrition.

- Diabetes was not found to be associated with a greater incidence of postoperative infection.

INFECTION

- Cellulitis – erythema, warmth & tenderness around the wound
- Abscess – superficial / deep
- Deep abscess associated with fever, leucocytosis, tachycardia

INFECTION

- Pus for Gram's stain & culture
- CT for deep neck abscess
- Can be prevented by proper hemostasis at the time of surgery & using suction drain.
- Peri-operative antibiotics not recommended.

- Once established
  - Antibiotics
  - Drainage of abscess.

SEROMA

- Division of lymphatic and adipose tissue during neck dissection

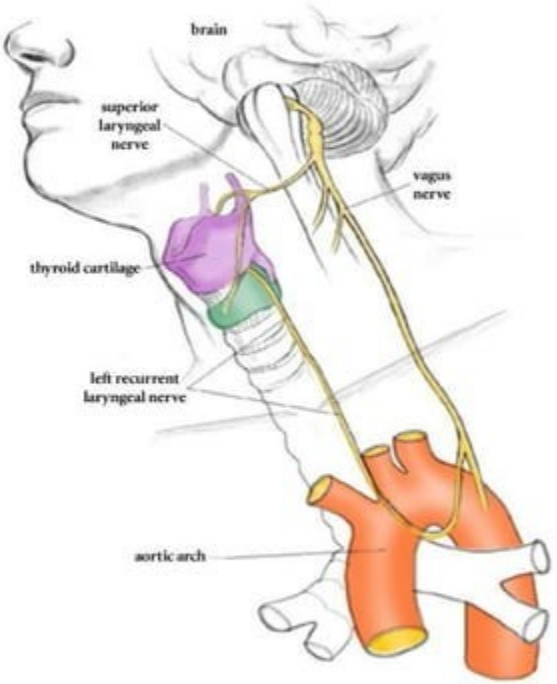
- especially after the removal of a large goiter.
- If a fluid collection is present, simple needle aspiration should manage the problem

Seroma



- Causes of seroma include incorrect drain placement, drain failure, or early drain removal.
- Prevention consists primarily of proper management of closed-suction drains that are left in place until the total output per drain falls below 25 mL in a 24-hour period
- Rx
- Fibrin glue
- management of seroma includes needle aspiration and, in select patients, drain replacement. Pressure dressings do not appear to prevent fluid reaccumulation.

- **Nerve supply:**
  - **Superior laryngeal nerve**
    - Internal branch (sensory) +superior laryngeal artery .
    - External branch ▸**cricothyroid muscle**
  - **Recurrent laryngeal nerve**
    - **RT side**: crosses the subclavian artery
    - **LT side**: arises on the arch of the aorta deep to ligamentum arteriosum
  - it is divided behind the **cricothyroid joint**
    - Motor ▸all the intrinsic muscles except ?
    - Sensory



Identification of RLN



Figure 21: Medial rotation of (R) thyroid lobe exposes the middle thyroid vein

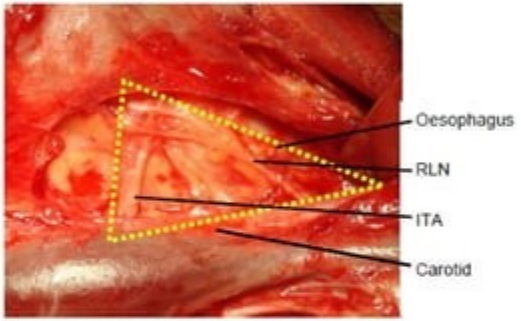


Figure 11: RLN crossing Simon's triangle formed by oesophagus, inferior thyroid artery (ITA) and common carotid artery (right neck, thyroid reflected medially)

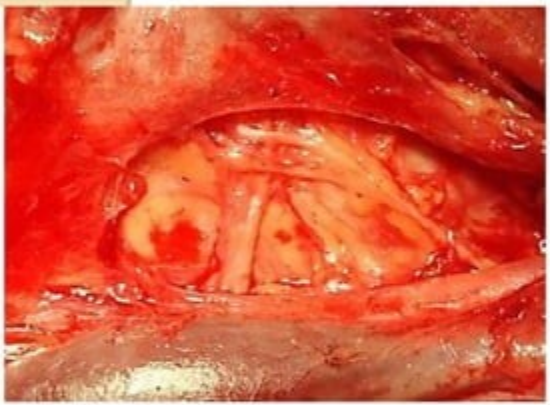


Figure 10: RLN passing over the inferior thyroid artery (right neck, thyroid reflected medially)

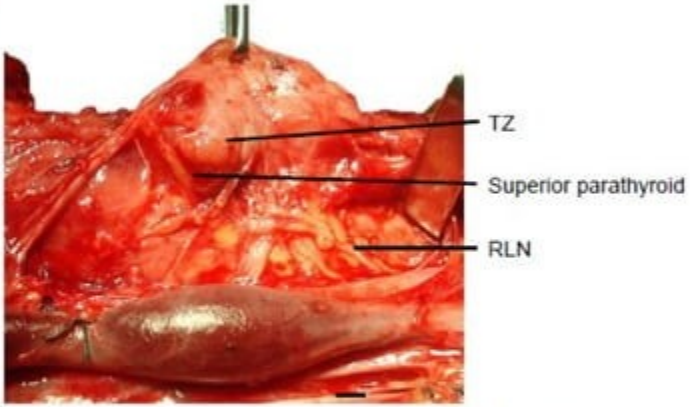


Figure 6: Tubercle of Zuckerkandl (TZ) and its relationship to the superior parathyroid gland and RLN

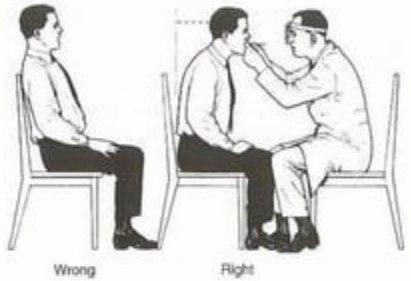


Figure **1.3**
Position of the patient's head and neck for indirect laryngoscopy to create the best angle for a comprehensive view of the laryngeal structures.





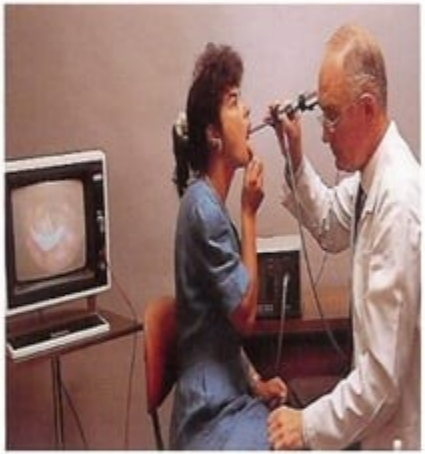








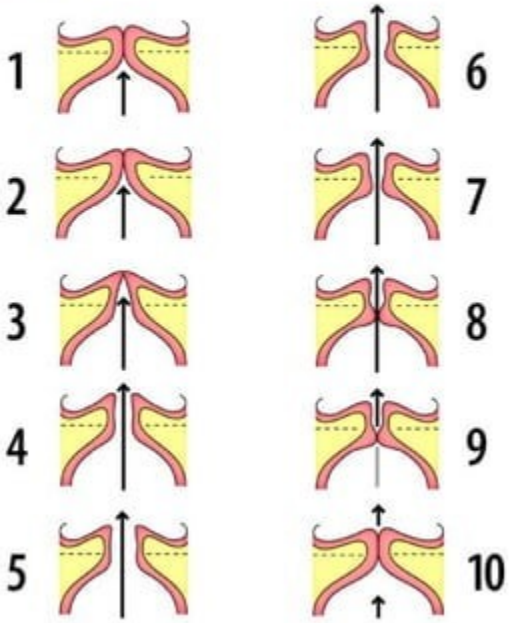


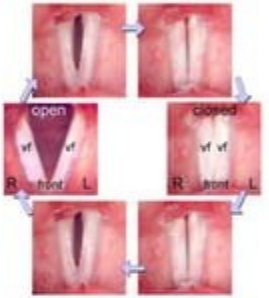




Vocal cord vibration

- Bernoulli effect





RLN

- The incidence of permanent RLN paralysis is approximately 1% to 1.5% for total thyroidectomy and less for near-total procedures
- Temporary dysfunction because of nerve traction occurs in 2.5% to 5% of patients.
- Incidence increases with second and third procedures. RLN injury is also more common in thyroidectomy with neck dissection,

RLN

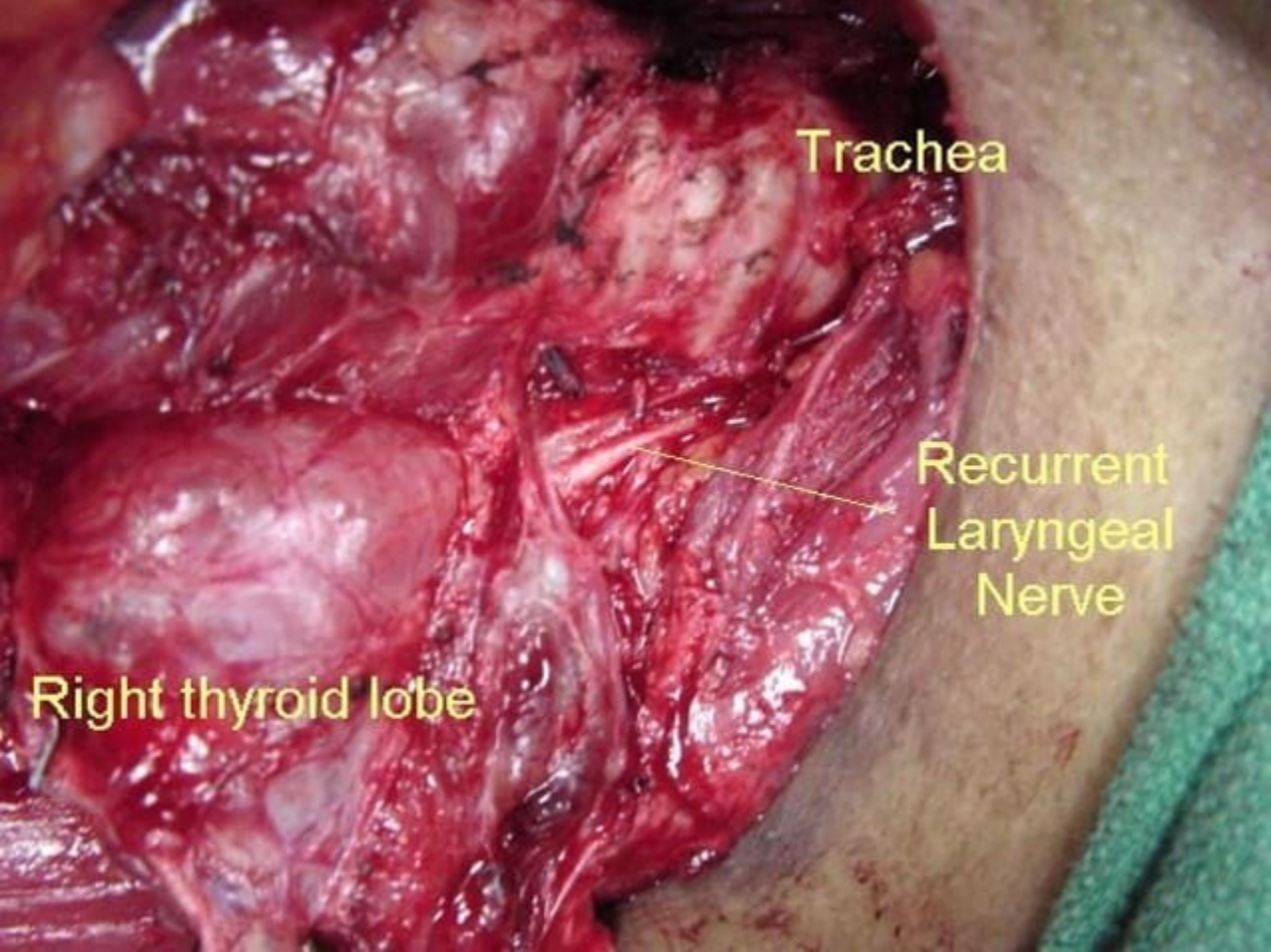
- Disease-specific risk factors for permanent nerve damage include :
- recurrent thyroid carcinoma, substernal goiter, and various thyroiditis conditions.
- Vocal cord function should be evaluated and documented by indirect laryngoscopy, especially in patients who have had previous surgery.

RECURRENT LARYNGEAL NERVE PARALYSIS

- **Unilateral –**
  - 1/3 rd are asymptomatic
  - Change in voice
  - Improves due to compensation by the healthy cord.
- **Bilateral- dyspnea & biphasic stridor**

RECURRENT LARYNGEAL NERVE PARALYSIS

- Prevent injury to the nerve by
  - Identify
  - ITA ligated far from lobe
  - Posterior layer of pretracheal fascia kept intact.
- Laryngoscopy, laryngeal EMG
- For bilateral paralysis
  - Tracheostomy (with speaking valve.
  - Lateralization of cord
    - Arytenoidectomy
    - Through endoscope
    - Thyroplasty type 2
    - Cordectomy
    - Nerve muscle implant


Trachea
Recurrent
Laryngeal
Nerve
Right thyroid lobe

RLN PARALYSIS

- **Unilateral**
  - **Vocal cord lies in *cadaveric* position**
  - **Hoarseness of voice & aspiration of liquids.**
  - **Ineffective cough**

- **Bilateral**
  - **Aspiration**
  - **Ineffective cough**
  - **Bronchopneumonia**

  - Concurrent injury of the SLN results in a more laterally positioned vocal cord and worsens voice quality and glottic competence.Occasionally, patients may have difficulty with aspiration and pneumonia

RLN PARALYSIS

- Unilateral
  - Speech therapy
  - Medialise of cord
    - Teflon paste injection
    - Thyroplasty type I
    - Muscle or cartilage implant
    - Arthrodesis of arytenoid joint
- Bilateral
  - Tracheostomy
  - Epiglottopexy
  - Vocal cord plication
  - Total laryngectomy

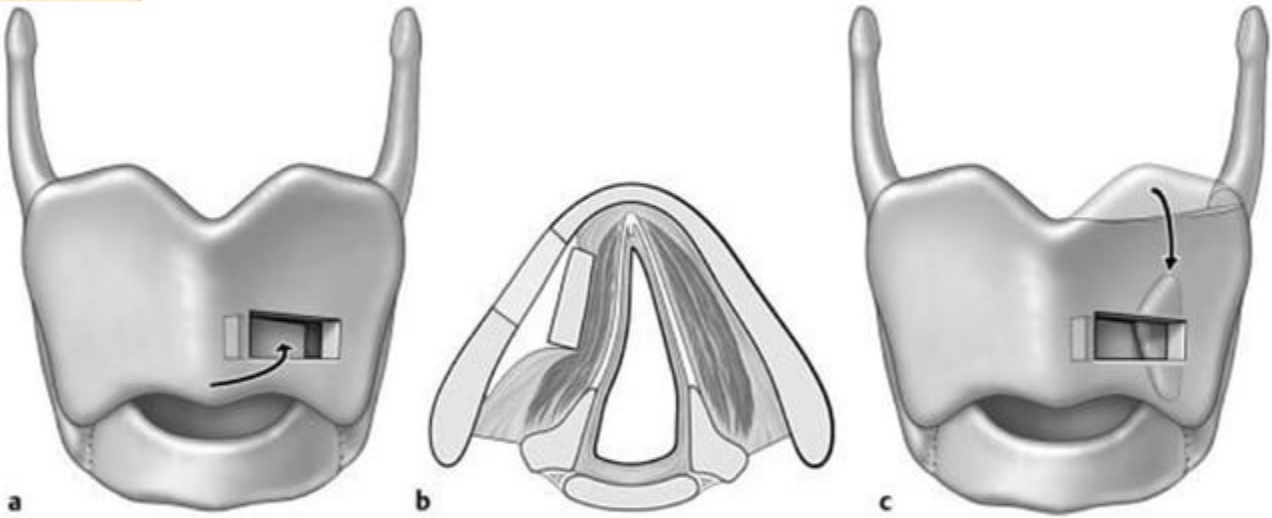
- SLN: speech therapy

RLN

- The surgeon should also be aware of the possibility of a nonrecurrent nerve, most commonly on the right side.
- If the nerve is transected during surgery, microsurgical repair of the nerve is recommended.
- Although the repair is unlikely to restore normal function, reanastomosis of the RLN may decrease the extent of vocal cord atrophy

RLN

- Return of normal vocal cord function occurs 6 to 12 months after temporary RLN injury occurs,
- and speech therapy can be valuable
- In unilat. Par.treatment directed toward vocal cord medialization may consist of vocal cord injection, thyroplasty
- In cases of bilateral RLN injury, management is directed at improving the airway



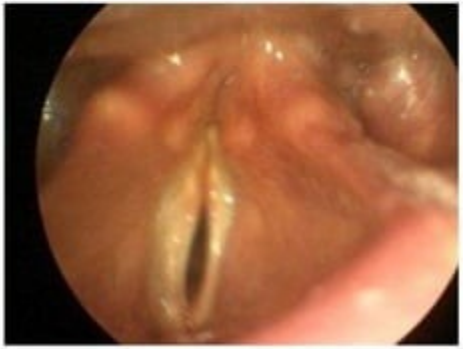
Medialization thyroplasty

Type I Thyroplasty: Indications

- Dysphonia or aspiration due to Vocal Fold Paralysis/Paresis







- Dysphonia due to Vocal Fold Atrophy

http://www.voicemedicine.com/unilateral.htm

http://www.gbmc.org/home_voicecenter.cfm?id=1563

SLN

- Often disturbance of SLN function is temporary and unrecognized by the patient and the surgeon
- Injury to the SLN alters function of the cricothyroid muscle.
- Patients may have difficulty shouting, and singers find difficulty with pitch variation, especially in the higher frequencies.

SLN

- The external branch of the SLN is not often visualized and lies near the superior pole vessels.
- Adequate exposure of the superior thyroid pole and close ligation of the individual vessels on the thyroid capsule may prevent SLN injury

THYROID CRISIS / STORM

- Acute exacerbation of hyperthyroidism as the patient has not been brought to the euthyroid state before operation.
- Tachycardia, fever(>105^{0}C) , restlessness, delirium
- Mortality is 10%

THYROID CRISIS / STORM

- Ensure euthyroid state before operation
- Sedation – morphine / pethidine
- Hyperpyrexia – ice bags. Tepid sponging, hypothermic blanket, rectal ice irrigation
- Oxygen administration
- IV glucose-saline for dehydration
- Potassium for tachycardia
- Cortisone – 100mg IV
- Carbimazole – 10- 20 mg 6th hourly
- Lugol's iodine 10 drops 8th hourly by mouth or potassium iodide 1g IV
- Propranolol – 20-40mg 6th hourly
- Digoxin for atrial fibrillation
- Diuretics for cardiac failure

RESPIRATORY OBSTRUCTION

- Laryngeal edema due to
  - Tension hematoma
  - Endotracheal intubation & surgical handling
  - More chance in vascular goiters.
- Collapse / kinking of the trachea
- Bilateral recurrent nerve paralysis can aggravate obstruction if edema is present.

RESPIRATORY OBSTRUCTION

- Open the wound & release the tension hematoma
- Endotracheal tube if no improvement. **INTUBATION TO BE DONE BY AN EXPERIENCED ANESTHETIST** as repeated attempts cause more edema leading to cerebral anoxia.
- The tube is left in place for several days & steroids

Identification of parathyroid glands

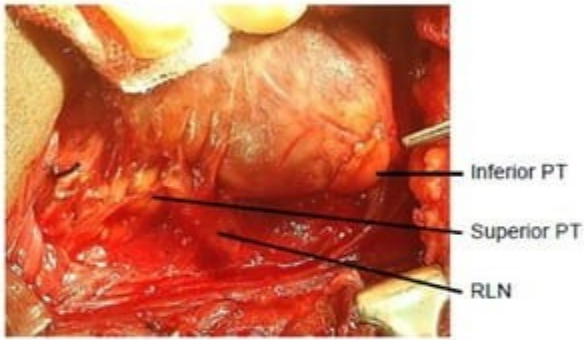


Figure 14b: The superior parathyroid gland lies deep (dorsal) and the inferior parathyroid superficial (ventral) to a coronal plane along the course of the RLN

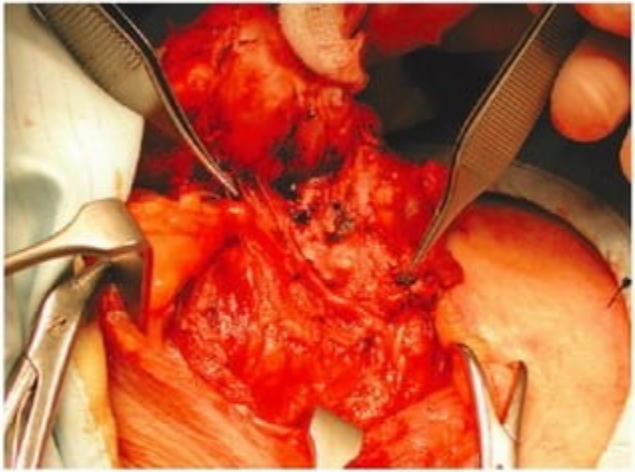


Figure 7 Identification of the recurrent laryngeal nerve and parathyroid glands.

Dissection of ITA and removal of gland

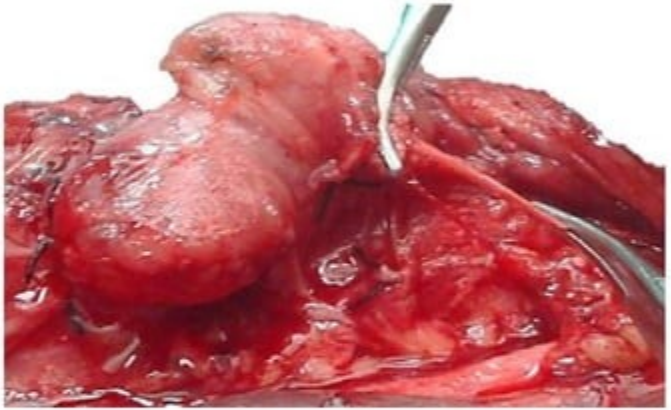


Figure 26: Inferior thyroid vein being divided



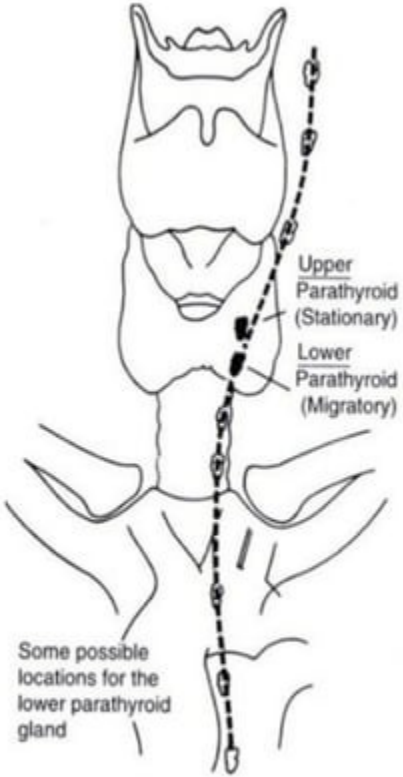
Figure 27: Ligament of Berry still needs to be divided

PARATHYROID GLANDS

- They are small semilunar shaped, ochre (yellow-brown)coloured glands,situated in a pad of fat generally outside surgical capsule secreting PTH, which controls serum Ca metabolism
- Gland are usually 4 in numbers, two on each side, occasionally 3-6.
- Superior parathyroid glands -
  - Develops from 4th pharyngeal pouch and descend only slightly during development and their position remains constant in adult life

- Generally found at level of pharyngo-oesophageal junction behind and seperate from posterior border of thyroid gland
- Supplied by branch from upper division of inferior thyroid artery

- Inferior parathyroid glands
  - Arise from 3rd pharyngeal pouch along with thymus
  - Descend along with thymus and have a wide range of distribution in adults
  - Usually located short distance from lower pole of thyroid
  - Supplied by inferior terminal branch of inferior thyroid artery



Pathway taken by the lower parathyroid gland and its possible position in the adult.

Ca

- Transient symptomatic hypocalcemia after total thyroidectomy occurs in approximately 7% to 25% of cases,
- but permanent hypocalcemia is less common (0.4% to 13.8%).
- Changes in serum calcium levels are often transient and may not always be related to parathyroid gland trauma or vascular compromise

Ca

- Transient hypocalcemia is often related to variations in serum protein binding caused by
- perioperative alterations in acid-base status, hemodilution, and albumin concentration.
- These changes do not produce hypocalcemic symptoms

Ca

- Sudden changes in levels of ionized serum calcium can result in perioral and distal extremity paresthesias,
- Lower ca: patients may experience tetany, bronchospasm, mental status changes, seizures, laryngospasm, and cardiac arrhythmias.
- Chvostek sign and Trousseau sign may develop with increased neuromuscular irritability as serum calcium levels decrease to less than 8 mg/dl

Ca

- Findings that should be worrisome for hypoparathyroidism include hypocalcemia, hyperphosphatemia, and metabolic alkalosis.
- PTH levels may also be measured to predict potential hypocalcemia.

PARATHYROID INSUFFICIENCY

- Due to removal of parathyroids or the parathyroid end artery.
- Incidence – 1-3%
- Occurs 2 – 5% after operation. Can be delayed for 2-3 weeks or hypocalcemia may be asymptomatic.
- Classic triad –
  - Carpopedal spasm
  - Stridor
  - Convulsions
- Latent tetany
  - Trousseau's sign
  - Chvostek's sign
- Persistent – grand mal epilepsy, cataracts, psychosis, calcification of basal ganglia, papilledema.

PARATHYROID INSUFFICIENCY

- Correct identification of the gland
- Ligate vessels distal to the parathyroids.
- Recognition of the parathyroid glands, which appear in a variety of shapes and have a caramel-like color, is critical. When they lose their blood supply, they turn black. The devascularized gland should be removed, cut into 1 to 2mm pieces, and reimplanted in the sternomastoid muscle or the forearm.
- Monitor serum Ca for 72 hrs post-operatively

Ca

- Parathyroid autotransplantation may be considered when:
- thyroid carcinoma that requires total thyroidectomy with central neck dissection,
- en bloc resections that require removal of the parathyroid glands, and
- reoperation after previous thyroid or parathyroid surgery

Ca

- Treatment for hypocalcemia is typically initiated if the patient is symptomatic or serum calcium levels decrease to less than 7 mg/dL.
- In these patients, cardiac monitoring is warranted.
- Patients should receive 10 mL of 10% calcium gluconate and 5% dextrose in water intravenously,

Ca

- Oral calcium supplementation should begin with 2 to 3 g of calcium carbonate per day.
- Calcitriol (1,25-dihydroxycholecalciferol) also should be initiated.
- Adjustments in supplemental calcium and vitamin D should be done in consultation with an endocrinologis

THYROID INSUFFICIENCY

- **INCIDENCE :20-25% of patients subjected to subtotal thyroidectomy for diffuse toxic goiter & toxic nodular goiters with internodular hyperplasia**
- **Time: <2 yrs. May be delayed >5yrs.**
- **Transient hypothyroidism may occur within 6 months which is asymptomatic.**
- **Due to change in nature of autoimmune response.**
- **More chance if less residual thyroid tissue**
- **Cold intolerance, fatigue constipation, weight gain, myxedema.**

THYROID INSUFFICIENCY

- Thyroxine – start with 50 mcg/d, 100mcg/d after 3 weeks, and 150 mcg/d thereafter. Taken as a single daily dose.
- Monitoring –
  - TSH in the lower end of reference range (0.15-3.5 mU / l)
  - T 4 normal or slightly raised. (10 – 27 pmol / l)
- Manage ischemic heart disease with beta blockers & vasodilators
- Increase thyroxine during pregnancy. (50 mcg)
- Myxedema coma: IV thyroxine 20mcg 8th hourly followed by oral.

RECURRENT THYROTOXICOSIS

- Incidence 5 – 10%
- Due to inadequate removal or hyperplasia of remaining thyroid tissue.

RECURRENT THYROTOXICOSIS

- **Less than 40 yrs – carbimazole**
  - 0-3wks 40-60mg/d
  - 4-8wks 20-40mg/d
  - 18-24 months 5-20mg/d
- **More than 40 yrs – radioiodine**
  - 5-10mCi oral; 75% respond in 4-12 weeks
  - Repeated after 12-24 weeks if no improvement.
  - Beta blocker / carbimazole cover during lag period.
  - Long term follow-up for hypothyroidism.

PROGRESSIVE / MALIGNANT EXOPHTHALMOS

- Occurs even when thyrotoxic features are regressing.
- Steroids & radiotherapy.

SCAR

- The prevention of scar widening or hypertrophy depends on proper placement of the incision,
- which can often be hidden within existing skin creases;
- to avoid the increased skin tension over the sternal notch, the incision should not be placed too low in the neck.

HYPERTROPHIC SCAR / KELOID

- Platysma to be divided at a higher level
- Occurs if scar overlies the sternum
- Some persons are more susceptible.
- May follow wound infection.
- Intradermal steroids, repeated monthly.

- Skin incision and creation of flaps

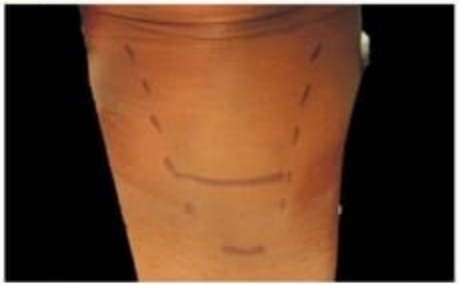


Figure 17: Curvilinear skin incision two fingerbreadths above the sternal notch



Figure 2 Injection of local anaesthetic.

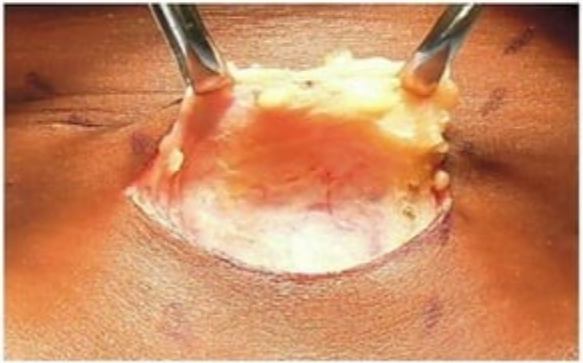


Figure 18: Subplatysmal flaps elevated

Closure

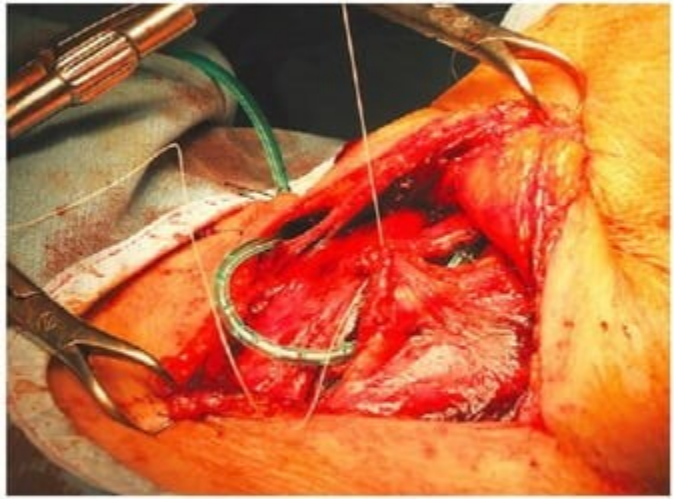




Figure 11 Closure in layers with a drain.

RARE COMPLICATIONS

- Pneumothorax is very rare and is often associated with extended procedures that involve subclavicular dissection.
- Chylous fistulas may occur more often on the left side but are usually self-limiting when wound drainage is adequate.

THANK YOU