

Head & Neck Tumours
Part I



Content



- **Neck Masses**
- **Thyroid & Parathyroid Glands**
- **Salivary Glands**

Evaluation and Management of the Patient with a Neck Mass

- **Introduction**
- **Anatomical Consideration**
- **Diagnostic Steps**
- **DDX**
- **Some Examples**
- **Summary**

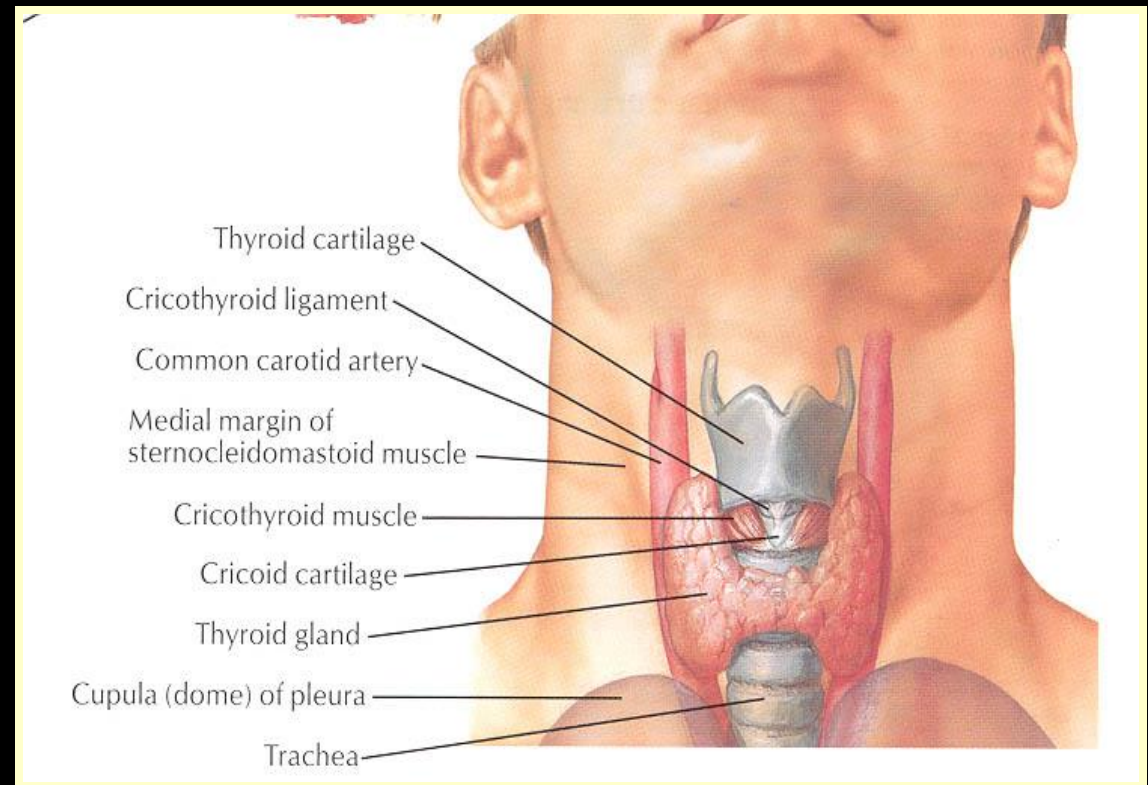
Introduction



- **Common clinical finding**
- **All age groups**
- **Very complex differential diagnosis**
- **Systematic approach essential**

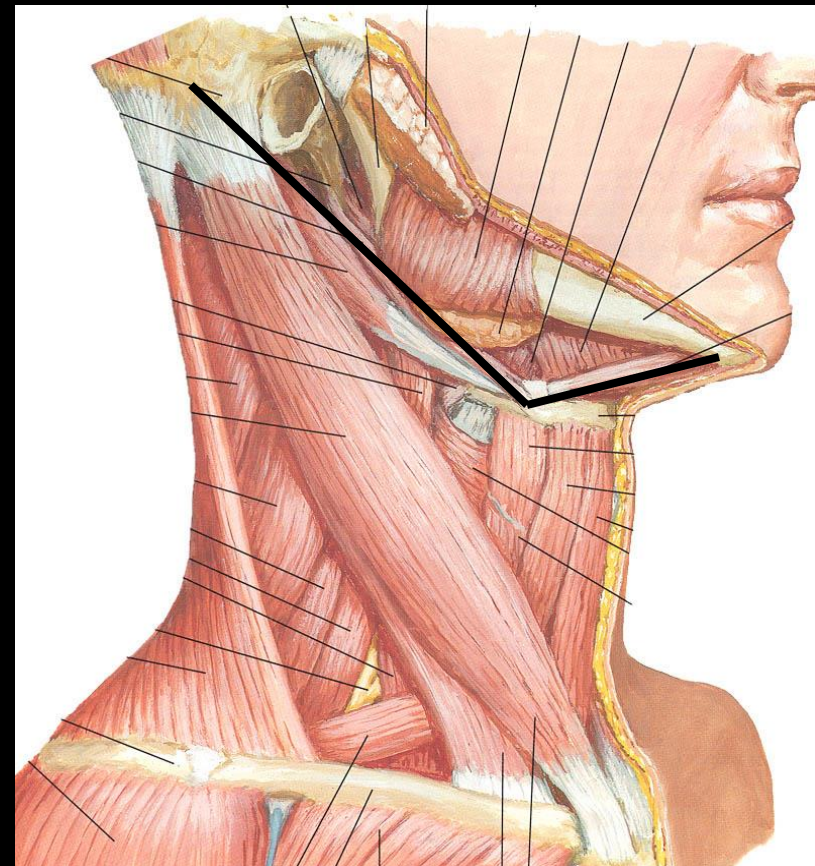
Anatomical Considerations

- **Prominent landmarks**
- **Triangles of the neck**
 - Lymphatic levels
- **Carotid bulb**



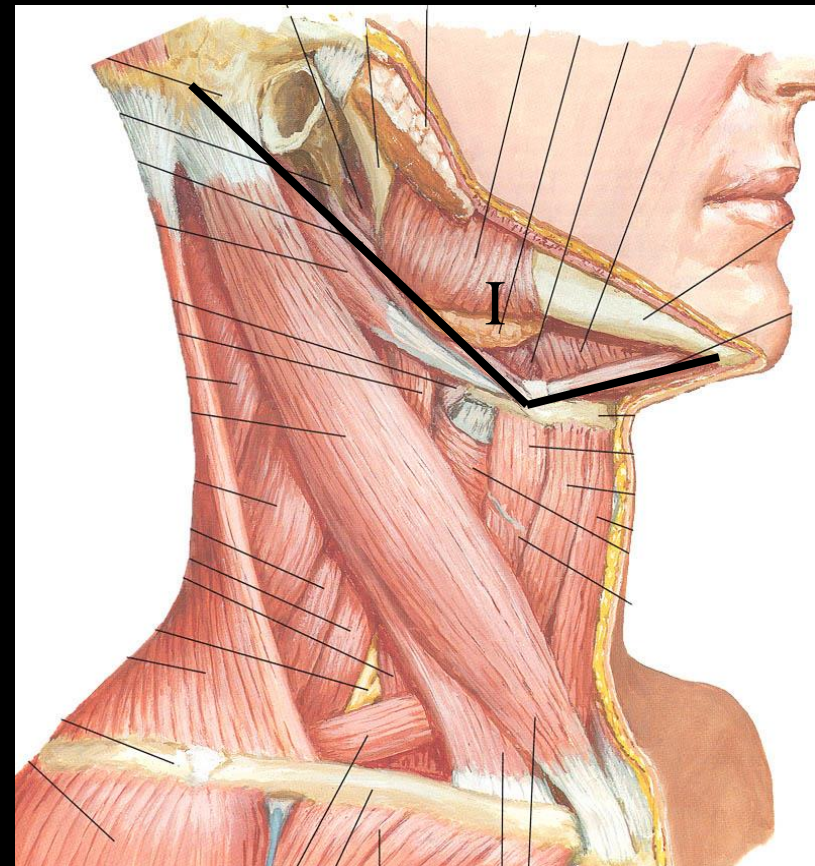
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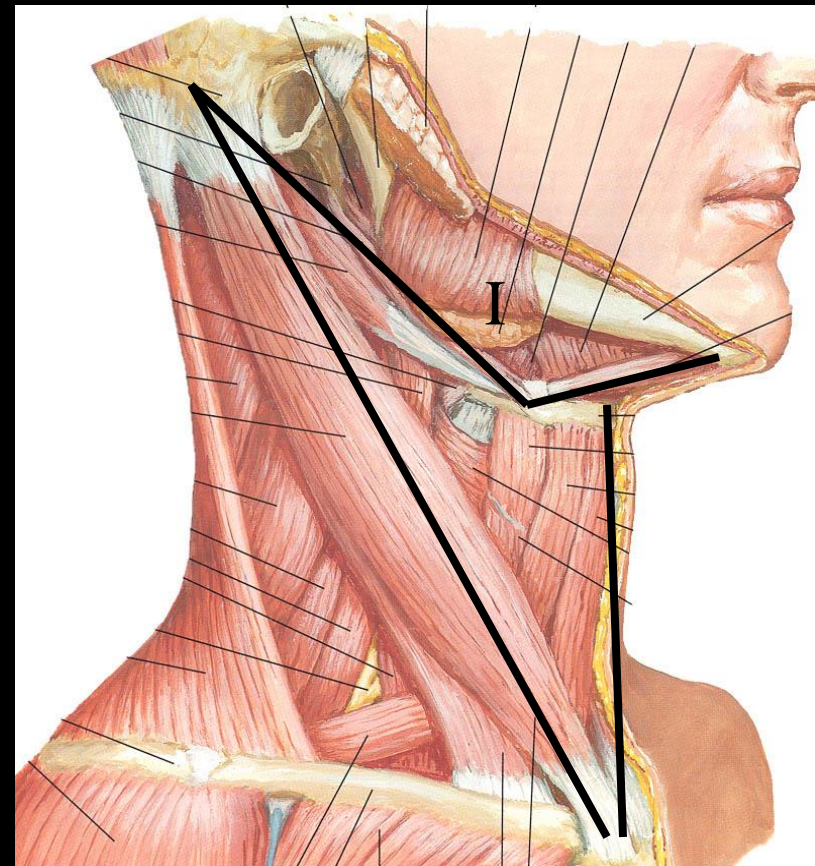
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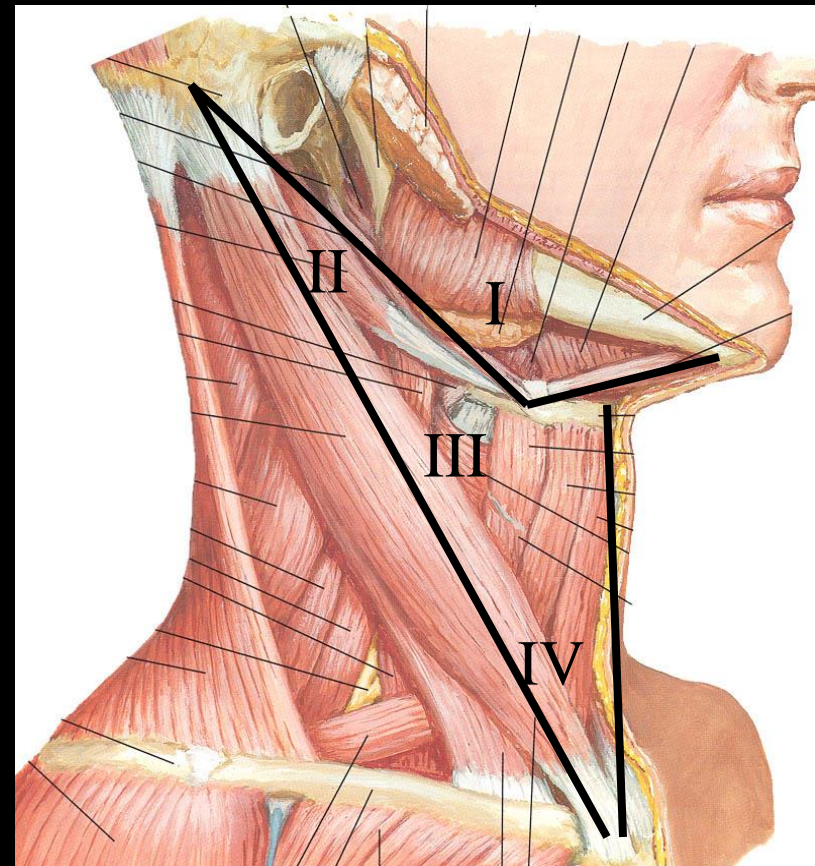
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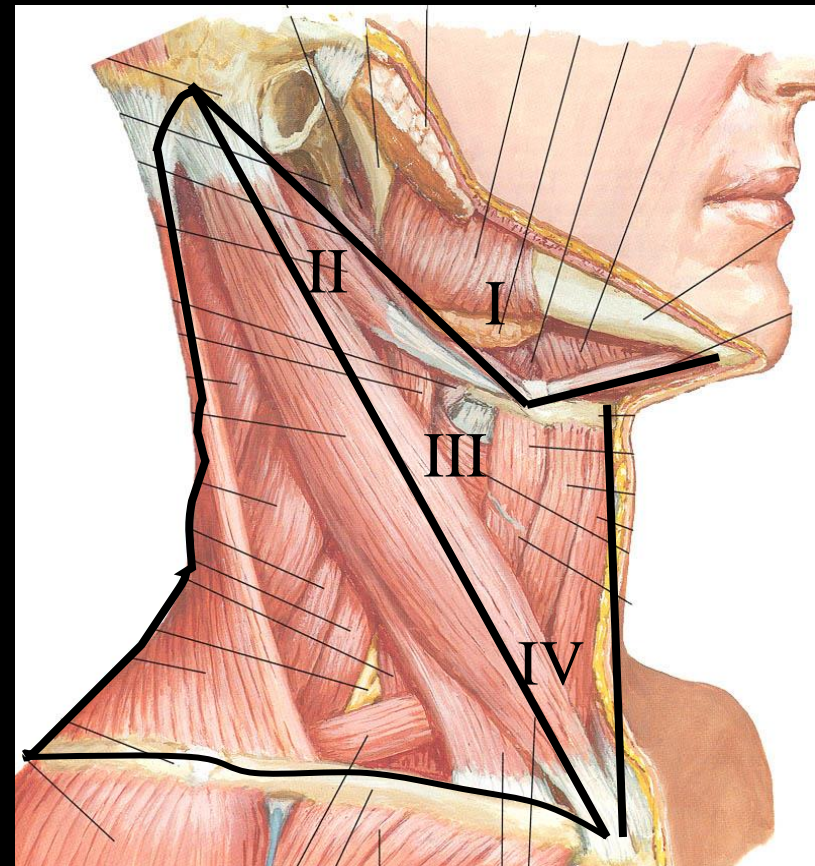
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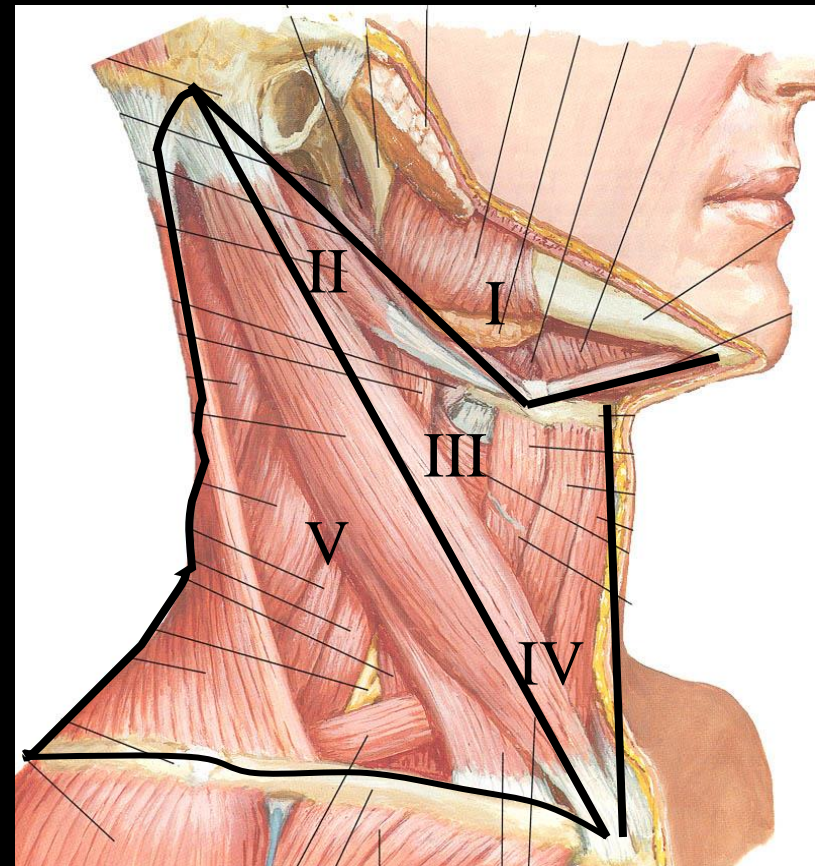
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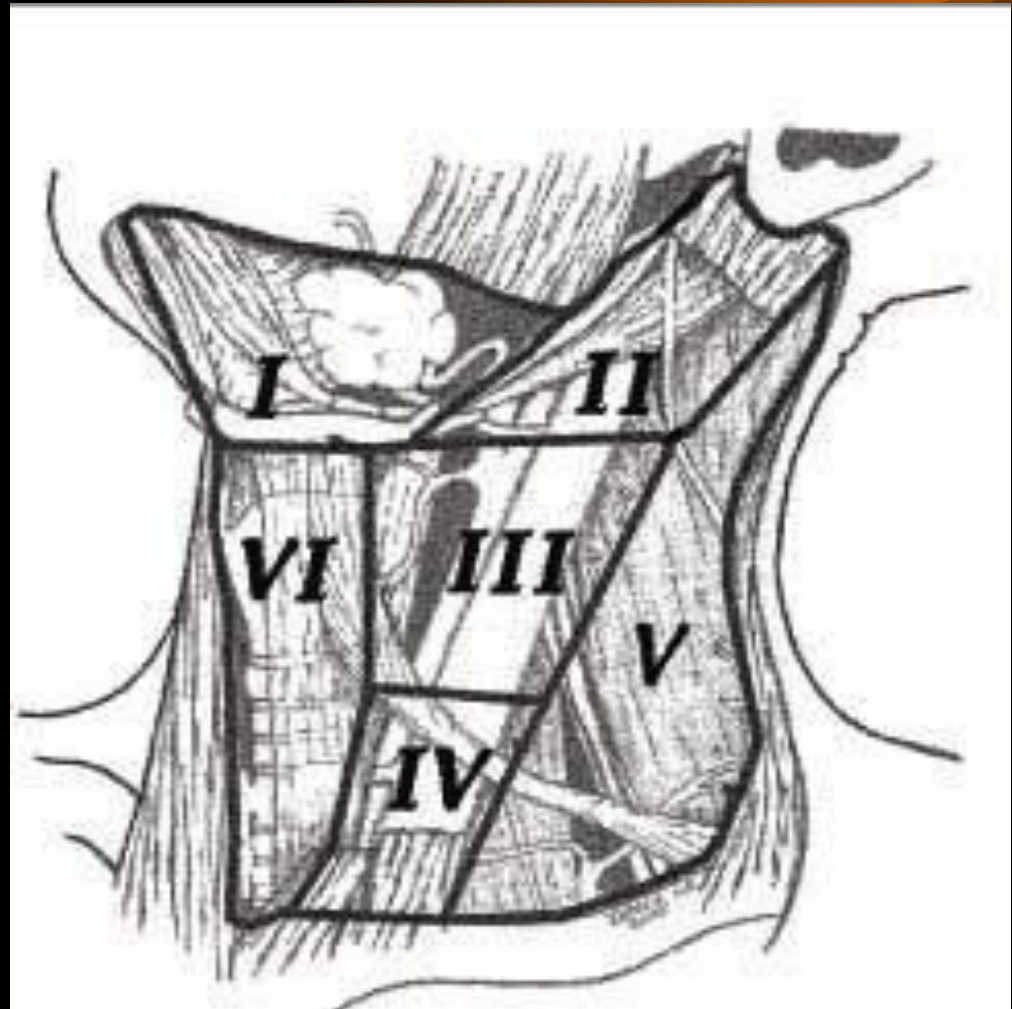
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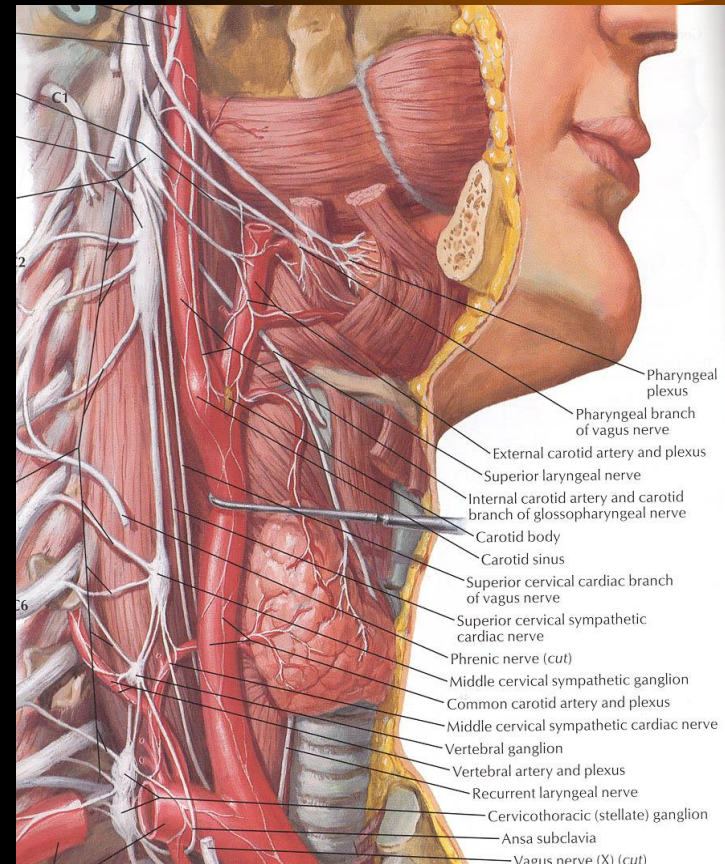
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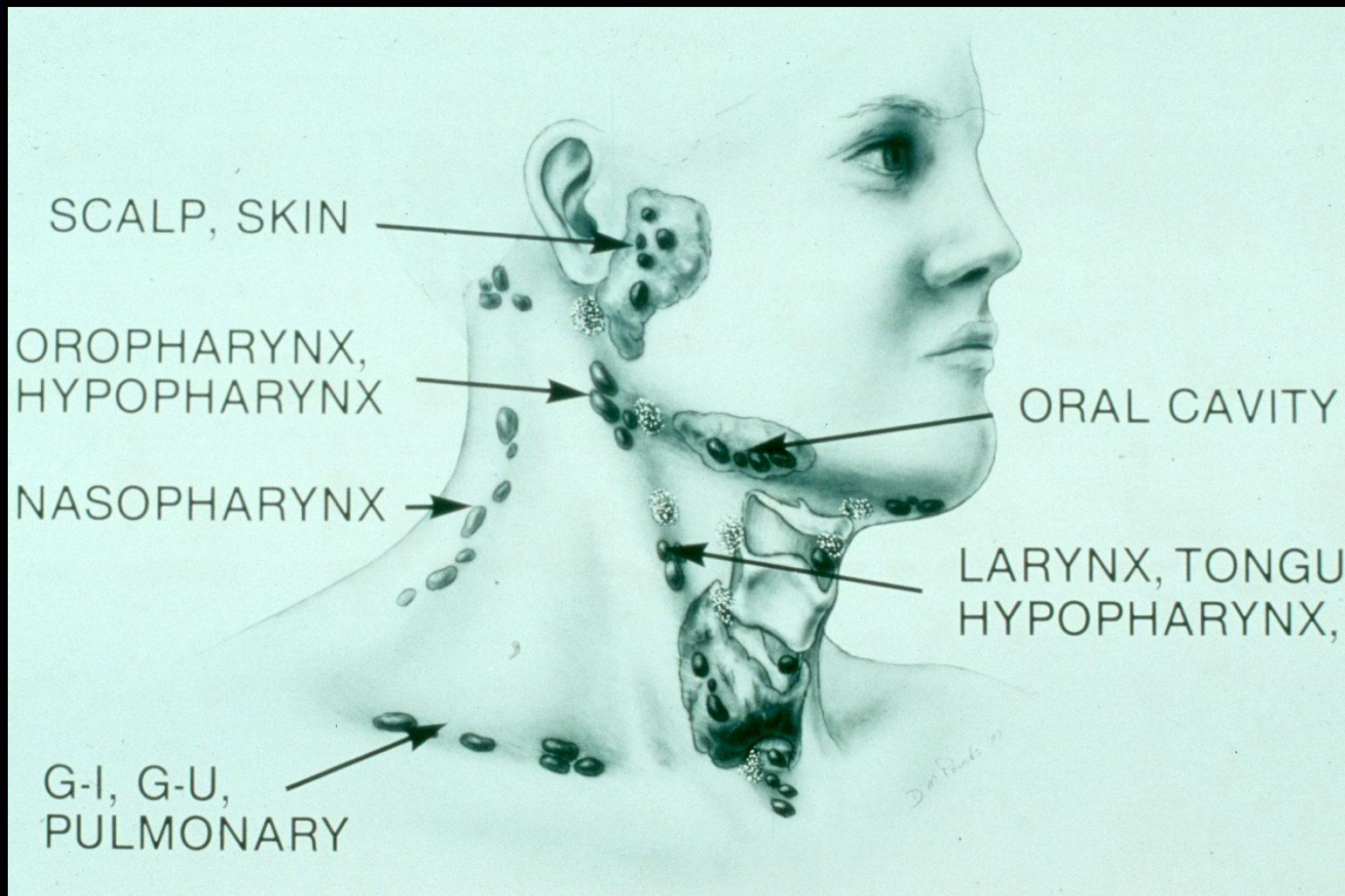


General Considerations



- **Patient age**
 - Pediatrics (0 – 15 years): mostly benign
 - Young adults (16 – 40 years): similar to pediatric
 - old adults (>40 years): High risk of malignancy
- **Location**
 - Congenital masses: consistent in location
 - Metastatic masses: key to primary lesion

Metastasis Location according to Various Primary Lesions



Diagnostic Steps



- **History**
 - Developmental time course
 - Associated symptoms (dysphagia, otalgia, voice)
 - Personal habits (tobacco, alcohol)
 - Previous irradiation or surgery
- **Physical Examination**
 - Complete head and neck exam (visualize & palpate)
 - Emphasis on location, mobility and consistency

Empirical Antibiotics



- **Inflammatory mass suspected**
- **Two week trial of antibiotics**
- **Follow-up for further investigation**

Diagnostic Tests



- **Fine needle aspiration biopsy (FNAB)**
- **Computed tomography (CT)**
- **Magnetic resonance imaging (MRI)**
- **Ultrasonography**
- **Radionucleotide scanning**

Fine Needle Aspiration Biopsy

A decorative graphic of a needle tip, rendered in a gradient of colors from dark purple to bright yellow, pointing towards the right side of the slide.

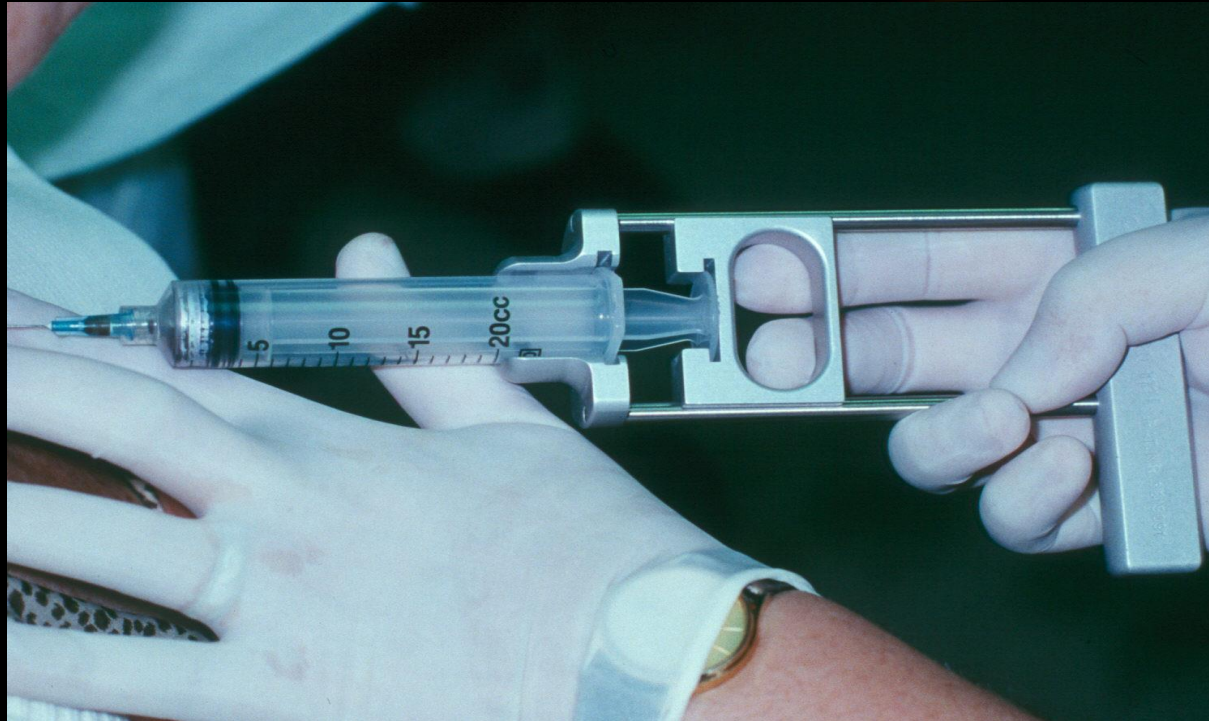
- **Standard of diagnosis**
- **Indications**
 - Any neck mass that is not an obvious abscess
 - Persistence after a 2 week course of antibiotics
- **Small gauge needle**
 - Reduces bleeding
 - Seeding of tumor – not a concern
- **No contraindications (vascular ?)**

Fine Needle Aspiration Biopsy



- **Proper collection required**
- **Minimum of 4 separate passes**
- **Skilled cytopathologist essential**
- **On-site review best**

Fine Needle Aspiration Biopsy



Computed Tomography



- **Distinguish cystic from solid**
- **Extent of lesion**
- **Vascularity (with contrast)**
- **Detection of unknown primary (metastatic)**
- **Pathologic node (lucent, >1.5cm, loss of shape)**
- **Avoid contrast in thyroid lesions**

Computed Tomography

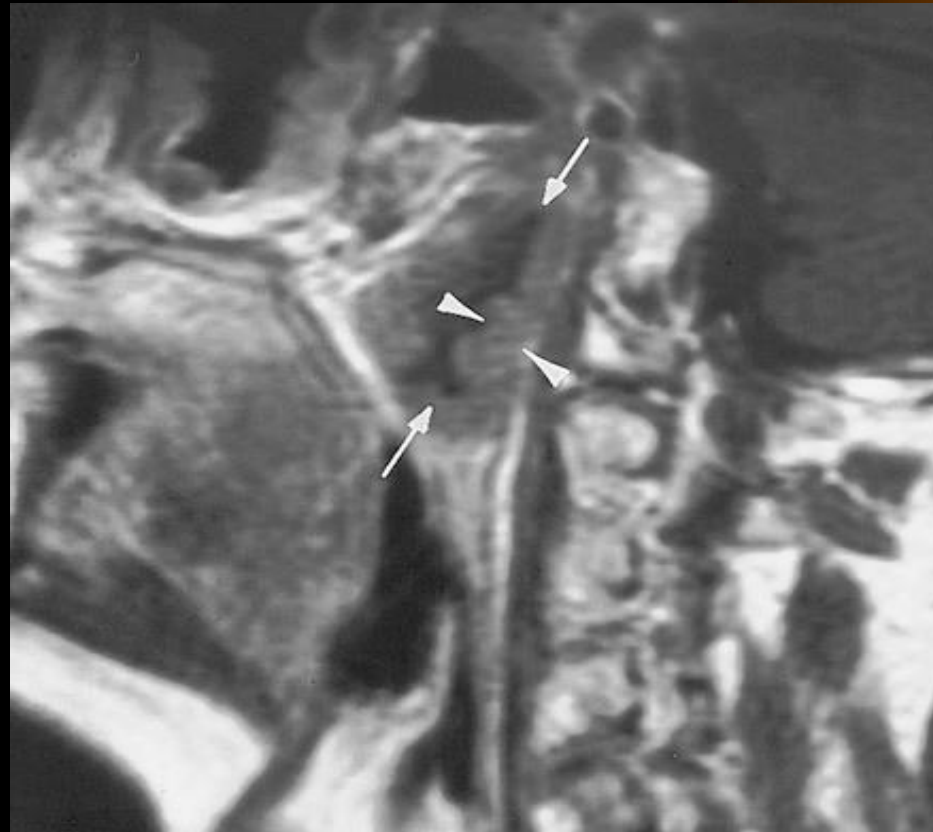


Magnetic Resonance Imaging



- **Similar information as CT**
- **Better for upper neck and skull base**
- **Vascular delineation with infusion**

Magnetic Resonance Imaging

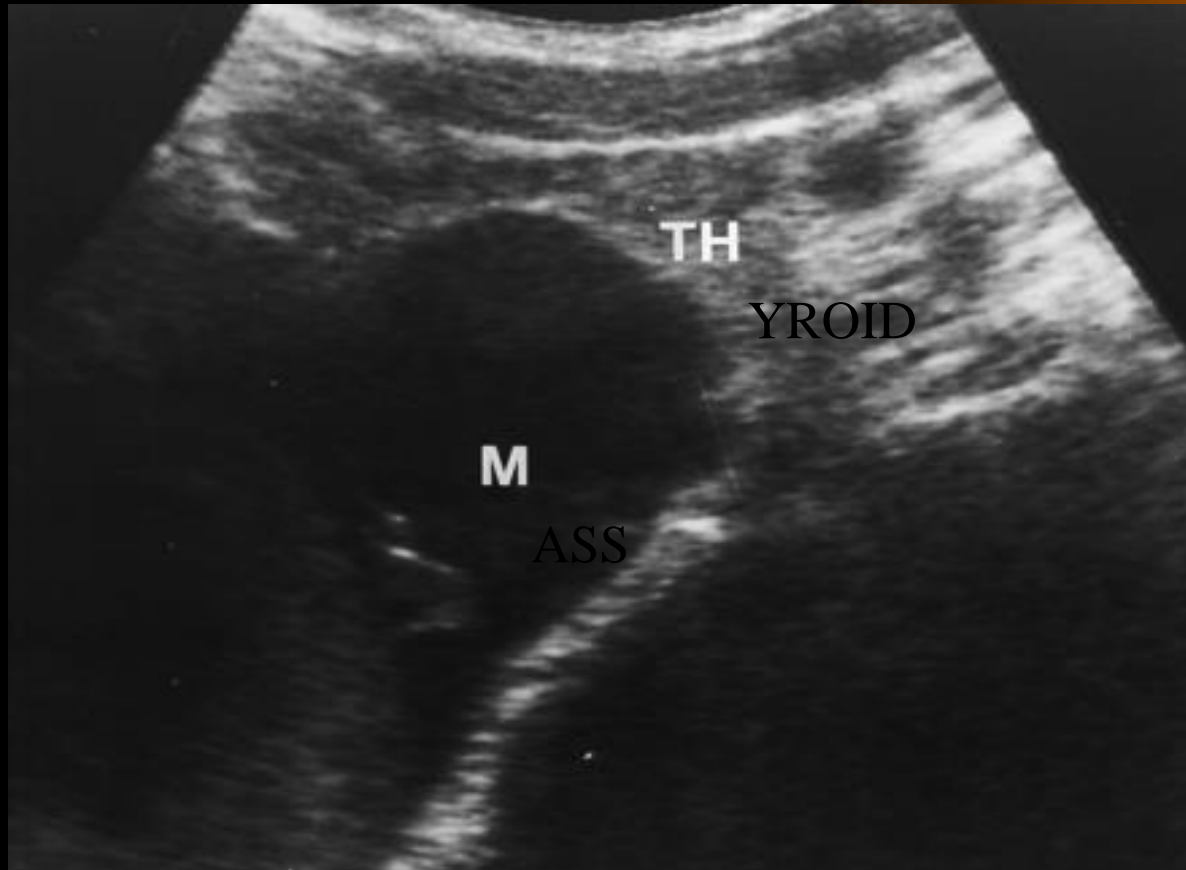


Ultrasonography



- **Less important now with FNAB**
- **Solid versus cystic masses**
- **Congenital cysts from solid nodes/tumors**
- **Noninvasive (pediatric)**

Ultrasonography

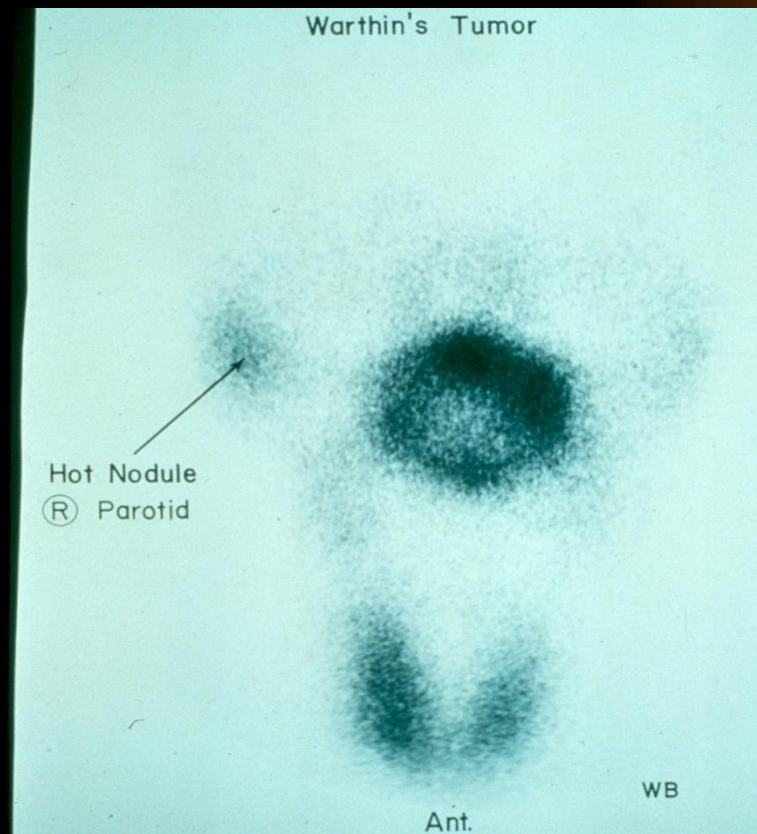


Radionuclide Scanning



- **Salivary and thyroid masses**
- **Location – glandular versus extra-glandular**
- **Functional information**
- **FNAB now preferred for for thyroid nodules**
 - Solitary nodules
 - Multinodular goiter with new increasing nodule
 - Hashimoto's with new nodule

Radionuclide Scanning



Differential Diagnosis

Table 1. Common Neck Masses

Neoplastic	Congenital/Developmental	Inflammatory
Metastatic Unknown primary epidermoid carcinoma	Sebaceous cysts Branchial cleft cysts	Lymphadenopathy Bacterial Viral Granulomatous
Primary head and neck epidermoid carcinoma or melanoma	Thyroglossal duct cysts	
Adenocarcinoma	Lymphangioma/hemangioma	Tuberculous
Thyroid	Dermoid cysts	Catscratch
Lymphoma	Ectopic thyroid tissue	Sarcoidosis
Salivary	Laryngocele	Fungal
Lipoma	Pharyngeal diverticulum	Sialadenitis
Angioma	Thymic cysts	Parotid Submaxillary
Carotid body tumor		Congenital cysts
Rhabdomyosarcoma		Throtrast granulomas

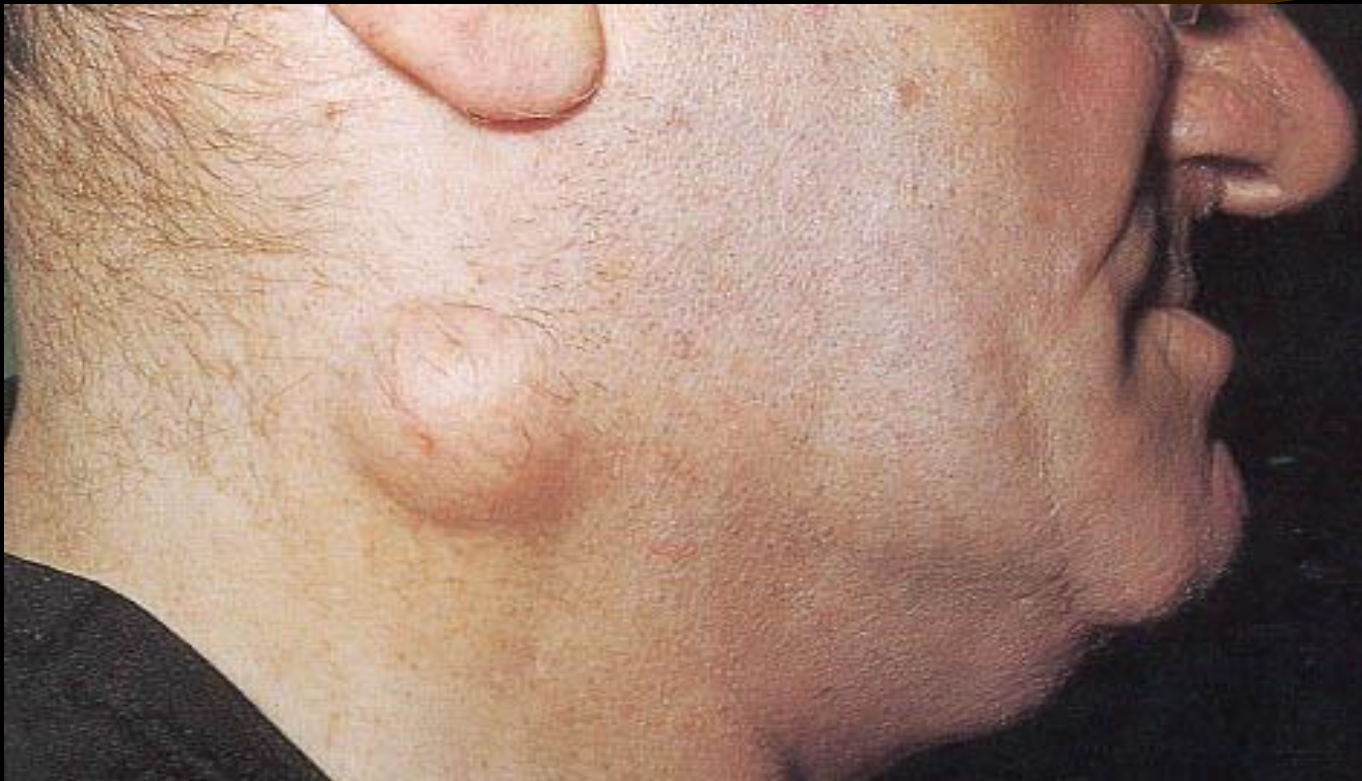
Congenital and Developmental Mass

- **Epidermal and sebaceous cysts**
- **Branchial cleft cysts**
- **Thyroglossal duct cyst**
- **Vascular tumors**

Epidermal and Sebaceous Cysts

- **Most common congenital/developmental mass**
- **Older age groups**
- **Clinical diagnosis**
 - Elevation and movement of overlying skin
 - Skin dimple or pore
- **Excisional biopsy confirms**

Epidermal and Sebaceous Cysts



Branchial Cleft Cysts



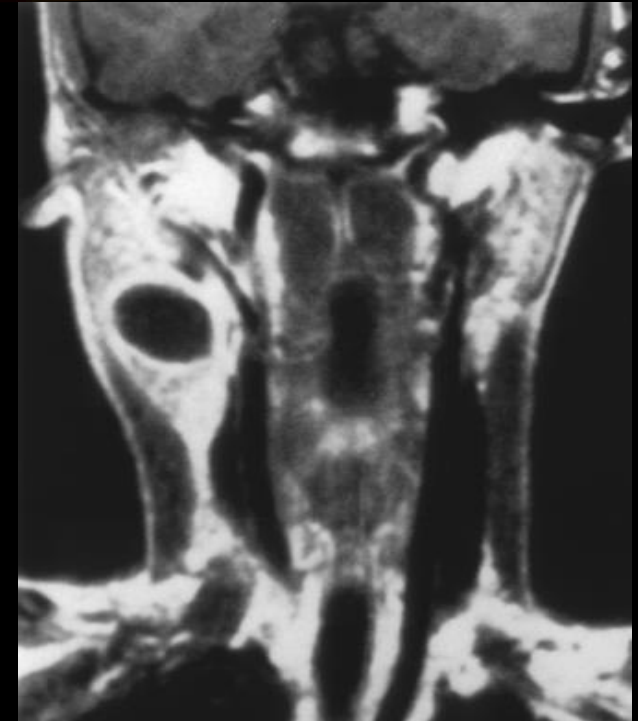
- **Branchial cleft anomalies**
- **2nd cleft most common (95%) – tract medial to XII nerve between internal and external carotids**
- **1st cleft less common – close association with facial nerve possible**
- **3rd and 4th clefts rarely reported**
- **Present in older children or young adults often following URI**

Branchial Cleft Cysts



- **Most common as smooth, fluctuant mass underlying the SCM**
- **Skin erythema and tenderness if infected**
- **Treatment**
 - Initial control of infection
 - Surgical excision, including tract
- **May necessitate a total parotidectomy (1st cleft)**

Branchial Cleft Cysts



Thyroglossal Duct Cyst

- **Most common congenital neck mass (70%)**
- **50% present before age 20**
- **Midline (75%) or near midline (25%)**
- **Usually just inferior to hyoid bone (65%)**
- **Elevates on swallowing/protrusion of tongue**
- **Treatment is surgical removal (Sis trunk) after resolution of any infection**

Thyroglossal Duct Cyst



Vascular Tumors



- **Lymphangiomas and hemangiomas**
- **Usually within 1st year of life**
- **Hemangiomas often resolve spontaneously, while lymphangiomas remain unchanged**
- **CT/MRI may help define extent of disease**

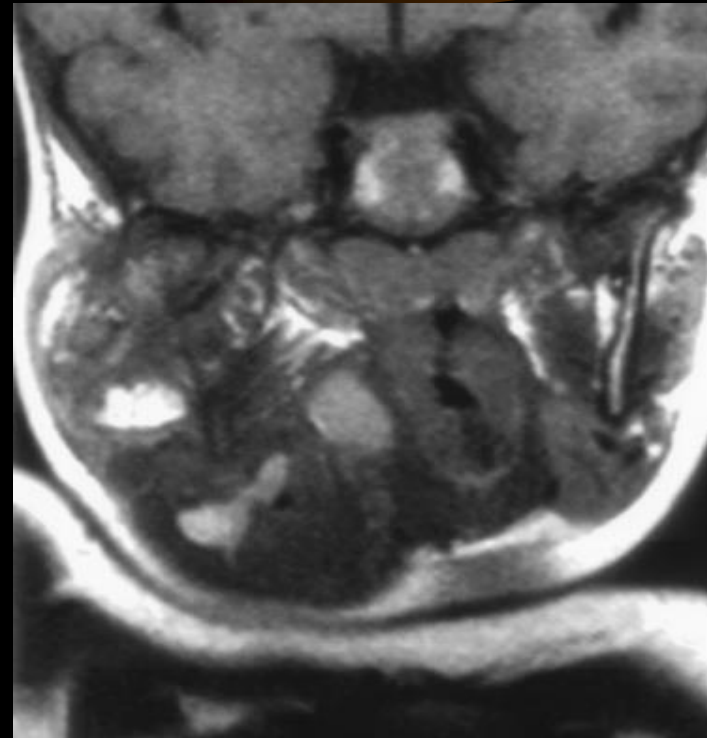
Vascular Tumors



- **Treatment**

- Lymphangioma – surgical excision for easily accessible or lesions affecting vital functions; recurrence is common
- Hemangiomas – surgical excision reserved for those with rapid growth involving vital structures or associated thrombocytopenia that fails medical therapy (steroids, interferon)

Vascular Tumors (lymphangioma)



Vascular Tumors (hemangioma)



Inflammatory Disorders



- **Lymphadenitis**
- **Granulomatous lymphadenitis**

Lymphadenitis

- **Very common, especially within 1st decade**
- **Tender node with signs of systemic infection**
- **Directed antibiotic therapy with follow-up**
- **FNAB indications (pediatric)**
 - Actively infectious condition with no response
 - Progressively enlarging
 - Solitary and asymmetric nodal mass
 - Supraclavicular mass (60% malignancy)
 - Persistent nodal mass without active infection

Lymphadenopathy



- **Equivocal or suspicious FNAB in the pediatric nodal mass requires open excisional biopsy to rule out malignant or granulomatous disease**

Granulomatous lymphadenitis

- **Infection develops over weeks to months**
- **Minimal systemic complaints or findings**
- **Common etiologies**
 - TB, atypical TB, cat-scratch fever, actinomycosis, sarcoidosis
- **Firm, relatively fixed node with injection of skin**

Granulomatous lymphadenitis



- **Typical *M. tuberculosis***
 - more common in adults
 - Posterior triangle nodes
 - Usually responds to anti-TB medications
 - May require excisional biopsy for further workup

Granulomatous lymphadenitis

- **Atypical *M. tuberculosis***
 - Pediatric age groups
 - Anterior triangle nodes
 - Brawny skin, induration and pain
 - Usually responds to complete surgical excision or curettage

Granulomatous lymphadenitis



- **Cat-scratch fever (*Bartonella*)**
 - Pediatric group
 - Preauricular and submandibular nodes
 - Spontaneous resolution with or without antibiotics

Granulomatous lymphadenitis



Summary



- **Extensive differential diagnosis**
- **Age of patient is important**
- **Accurate history and complete exam essential**
- **FNAB – important diagnostic tool**
- **Possibility for malignancy in any age group**
- **Close follow-up and aggressive approach is best for favorable outcomes**

Thyroid and Parathyroid Glands



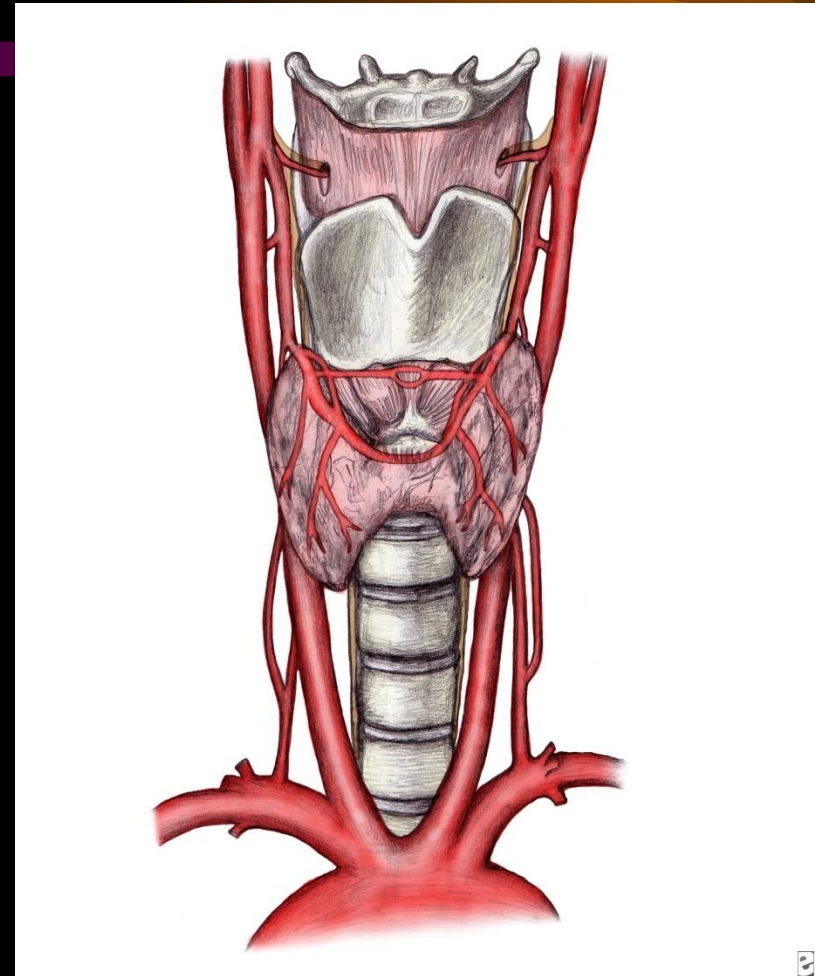
Thyroid Gland



- **Anatomy**
- **Evaluation of Thyroid Nodule**
- **Thyroid Cancer: Types & Treatment**

Thyroid Anatomy

- **Shield shaped, may be H- or U-shaped**
- **2 lateral lobes connected by an isthmus**
- **Isthmus at level of 2nd to 4th tracheal cartilages (may be absent)**
- **Rarely, small muscle (levator of the thyroid gland) attaches gland to hyoid bone**



Lobes of Thyroid

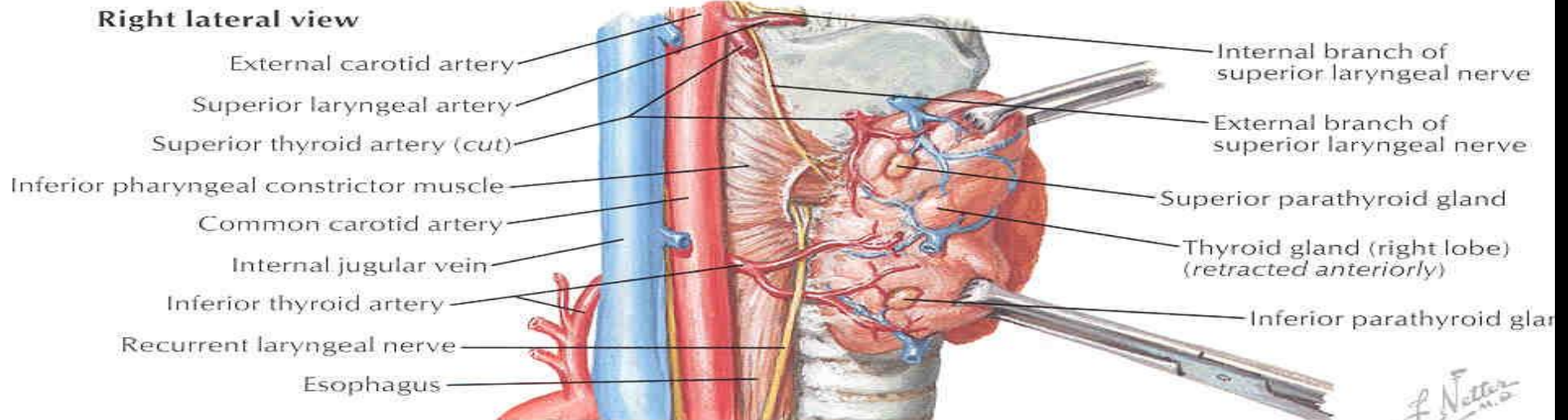
- **Each lobes measures approx 4cm high, 1.5cm wide, 2cm deep**
 - Lobes have superior and inferior poles
- **Superior pole: may extend as far as the oblique line of the thyroid cartilage**
- **Inferior pole: may extend inferiorly as far as the 5th or 6th tracheal rings**

Attachments of Thyroid

- **Firmly attached to larynx and trachea**
- **Elevated with deglutition**
 - May allow to distinguish between thyroid nodule and other mass (LN, dermoid, branchial cleft cyst)
- **Attached by anterior and posterior suspensory ligaments**
 - Anterior -> anterior trachea to undersurface of thyroid
 - Posterior (Ligament of Berry) → lateral upper tracheal rings to bilateral thyroid lobes

Arterial Blood Supply

- **Superior thyroid artery (STA)**
 - 1st branch of ECA
 - Followed by SLN until superior pole
 - Anastomoses with contralateral STA
- **Cricothyroid Artery**
 - Small branch off STA near superior pole to cricothyroid muscle
 - Anastomoses with contralateral artery
 - Cricothyroidotomy



Arterial Blood Supply Cont'd

- **Inferior thyroid artery (ITA)**
 - From thyrocervical trunk (1st part of subclavian at 1st rib)
 - Ascends anterior to vertebral artery
 - At C6 → ascending vertebral artery
 - Enters TE groove, runs next to RLN
 - Supplies posterior lateral lobes of thyroid
 - Anastomoses with STA near superior pole (Longitudinal branch)

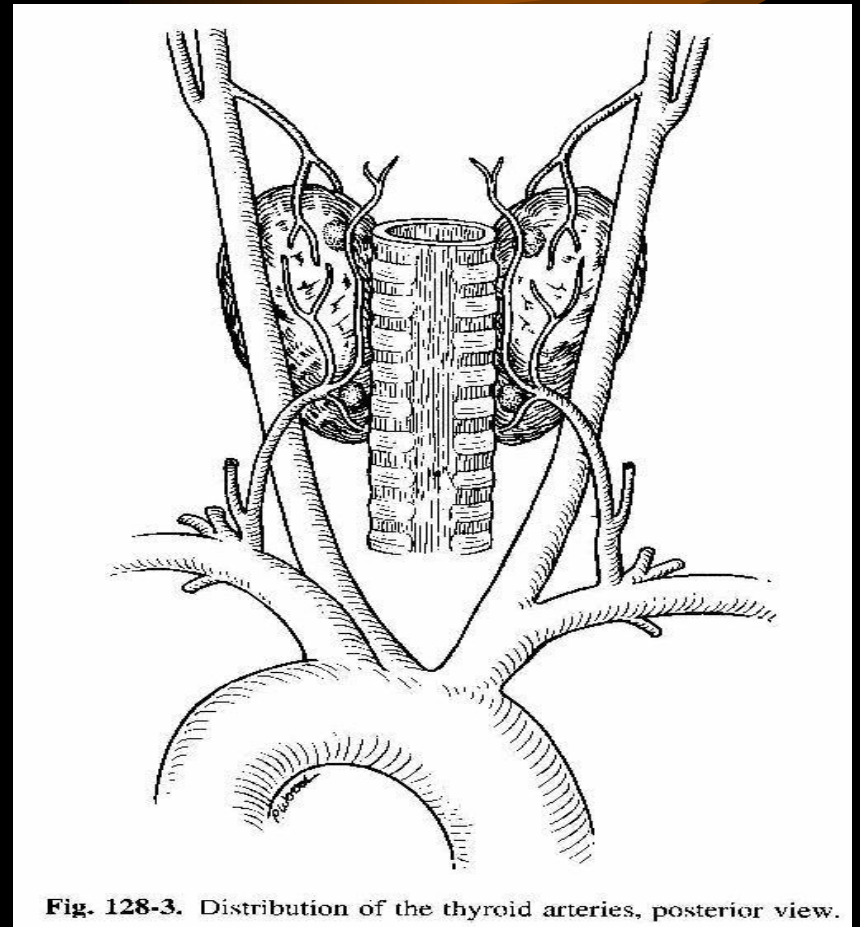


Fig. 128-3. Distribution of the thyroid arteries, posterior view.

Venous Drainage

- **3 pairs of veins**
 - Superior thyroid vein
 - Parallels course of STA on ant surface thyroid
 - Ascends to drain into internal jugular vein (IJV)
 - Middle thyroid vein
 - Direct lateral course from thyroid to IJV
 - Shortest of 3 veins
 - Inferior thyroid vein
 - Ant surface thyroid (opposite of ITA)
 - Vertical downward course to brachiocephalic v.

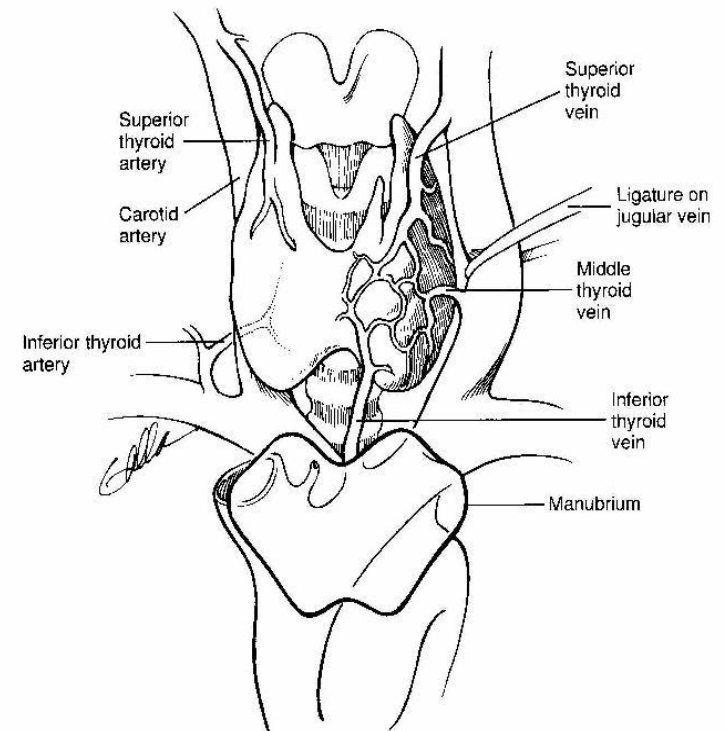


Figure 28-3. Superior thyroid and inferior thyroid arteries (left figure) and superior, middle, and inferior thyroid veins (right figure).

Thyroid Nodule - Evaluation



- **Start with P/E, Hx**
- **Thyroid function tests**
 - thyroxine (T4)
 - triiodothyronin (T3)
 - thyroid stimulating hormone (TSH)
- **Serum Calcium, Calcitonin**
- **Thyroglobulin (TG)**

Thyroid Nodule - Evaluation

- **U/S**
- **Pre-operative Laryngoscopy**
 - Assess RLN function / infiltration
 - Essential in revision cases (6.7% of patients with previous thyroid surgery had VC paralysis)
- **Bx**
- **Other Imaging**

Thyroid Imaging



- U/S
 - Often first modality, helps delineate architecture
 - Accessible, inexpensive, safe
 - Help locate nodule, assist with FNA
 - Micro-calcifications and central blood flow
 - Suggests CA
 - Not useful for large masses

Thyroid Imaging Cont'd

- **CT**

- Useful for cervical lymphadenopathy
- Dye can interfere with function testing and radioactive treatment for up to 8 weeks
- Can provoke hyperthyroidism from dye
- Recommended for FNA showing PTC

- **MRI**

- Used less commonly

Thyroid Imaging Cont'd

- **Scintigraphy**
 - Hard to distinguish benign vs malignant nodule
 - 2D → difficult to localize lesion



Thyroid Biopsy



- **FNA**
 - Gold standard
 - Sensitivity → 65% to 98%
 - Specificity → 72% to 100%
- **Results**
 - Benign → adenoma, goitre, thyroiditis
 - Malignant → most common PTC
 - Indeterminate → FTC and Hurthle most common
 - Non-diagnostic → re-aspiration diagnostic in 50%

Thyroid Biopsy



- **FNA Disadvantages**

- Inability to distinguish benign microfollicular adenomas from differentiated FTC
- Inability to distinguish Hurthle cell lesion from adenoma or Hashimoto thyroiditis
- Papillary Carcinoma
 - Slide preparation may mimic PTC findings

Management of the Thyroid Nodule

Serial exam

- **Physical examination**
 - Benign
 - Asymptomatic palpable nodule
- **U/S**
 - F/u a benign, non palpable nodule
 - F/u a cystic nodule for reaccumulation

Management of the Thyroid Nodule

- **Trial of suppression of TSH**
 - Benign or indeterminate FNA (controversial)
 - Maintain TSH level between 0.1 and 0.5 mIU/L per day
 - Decrease tumor volume up to 50% in 40% pts.
 - A shrinking tumor is not likely malignant

Malignant Thyroid Lesions

1. Well Differentiated (85%)

- Papillary Thyroid Carcinoma (PTC)
- Follicular Thyroid Carcinoma (FTC)
- Hurthle Cell Carcinoma (HCC)

2. Poor differentiated malignant neoplasms

- Medullary thyroid carcinoma (MTC)
- Anaplastic thyroid carcinoma (ATC)

3. Other malignant tumors:

- Lymphoma
- Metastatic tumors

Malignant Thyroid Lesions

- **Risk factors for Thyroid Cancer**
 - Age (<20 or >60)
 - Male (Female > risk of nodules)
 - Rapid Growth
 - Invasive or compressive Symptoms
 - Previous Radiation exposure
 - Prior Thyroid disease
 - Goiter, Hashimoto, Grave's, adenomas
 - Family Hx

Malignant Lesions



- **Papillary Carcinoma**
 - Ill defined margins
 - Histology = papillae and typical nuclear features
 - Psammoma bodies (concentric calcified layers)
 - Multicentric involvement of thyroid
 - Extra-thyroidal extension common
 - Muscle, RLN and Trachea

PTC Cont'd



- **Lymph node involvement in 30%**
- **Distant mets least common**
 - 1 - 25% during illness or 1 - 7% at Dx
- **Predisposing Factors**
 - Ionizing radiation
 - Familial (Cowden Syndrome = hamartomas, breast tumors and follicular / papillary tumors)
 - 5 - 10% of pts have +ve Family Hx
- **Clinical presentation**
 - Young females, palpable mass in thyroid or cervical LN (1/3rd have lymphadenopathy)

Follicular Carcinoma

- **13% of all thyroid carcinomas**
- **More aggressive, well differentiated compared to PTC**
- **10 yr survival = 60% (PTC = 95%)**
- **More hypercellular**
- **Malignant lesion = capsular +/- vascular invasion**
- **No characteristic cytology**
 - Impossible to dx on FNA, difficult with Frozen

FTC Cont'd

- **Hematogenous spread more common than PTC**
- **Two variants : Minimally invasive vs Widely invasive**
- **Predisposing Factor**
 - Radiation exposure
 - Goitre endemic areas
- **Clinical Presentation**
 - Solitary neck nodule or mass
 - Distant mets in 10 - 15% of cases

Hurthle Cell Carcinoma

- **Subtype of FTC (15% of FTC's)**
- **Like FTC, cannot exclude carcinoma vs adenoma based of FNA or frozen**
- **Clinical Presentation**
 - Thyroid nodule or mass
 - 35 % will have distant mets during illness
 - Higher rate of nodal mets than FTC

Management WDTC

Surgical options

- **Total thyroidectomy (>1.5cm)**
- **Thyroid lobectomy (<1.5cm)**
- **+/- Neck dissection**
- **Bailey's**
 - High risk patients → total thyroidectomy
 - Low risk → total thyroidectomy if gross nodules in contralateral lobe, otherwise lobectomy

Adjuvant Therapy

- **Post-op I-131**
- **External beam RT**
 - Tumors that do not pick up I-131
 - Advanced disease (mets, residual disease)

Medullary Thyroid Carcinoma

- **Sporadic (80%)**
 - More aggressive type
 - Late presentation (age 40 – 60)
 - Worst prognosis with spindle cell variant, increased CEA staining, decreased calcitonin staining
 - Early mets to regional lymph nodes (50%)
 - Larger tumors (>1.5cm) often have distant mets (70%)

Medullary Thyroid Carcinoma

- **Familial (20%)**
 - MEN IIA, MEN IIB, Non-endocrinopathic
 - Mutation in RET-protooncogene
 - Autosomal Dominant
 - Early presentation (birth – 20's)

TABLE 115.4. MULTIPLE ENDOCRINE NEOPLASIA SYNDROMES

Wermer syndrome (MEN type I)
Parathyroid adenomas or hyperplasia, usually adenomas
Pituitary tumors
Pancreatic tumors
Miscellaneous
Carcinoid tumors
Ovarian tumors
Differentiated thyroid carcinoma
Melanoma
Sipple syndrome
Type IIA
Parathyroid hyperplasia or adenoma
Medullary thyroid carcinoma (100%)
Pheochromocytoma (bilateral in 60%–75% of patients)
Type IIB
Same as type IIA except for
Presence of mucosal neuromas
Marfanoid habitus with pectus excavatum
No hyperparathyroidism

MEN, multiple endocrine neoplasia.

Treatment of MTC

- **Total thyroidectomy with bilateral SLND**
- **Prophylactic surgery for relatives with RET mutation (preferably before age 7)**
- **No adjuvant therapy advocated**
- **Radiotherapy and chemotherapy for palliation (usually ineffective)**

Anaplastic Thyroid Carcinoma

- **Less than 5% of thyroid malignancies**
- **Highly aggressive and fatal**
- **Median survival 3 - 6 months**
- **Distant mets common (lung)**
- **Grossly, large and bulky tumors**
 - Invade into surrounding tissue
- **Clinical Presentation**
 - Rapid expansion
 - Horner's Syndrome (ptosis, miosis, enophthalmos, anhidrosis)

ATC Cont'd



- **P/E**
 - Firm, irregular mass fixed to surrounding structures
 - RLN involvement and VC paralysis common
- **Tx (often palliative intent)**
 - Surgery
 - Adjuvant RT
 - Chemotherapy

Lymphoma



- **Rarely presents within thyroid gland**
- **Dx in 60's**
- **Females > males**
- **Low - intermediate grade B-cell NHL**
- **Increased risk wth Hashimoto**
- **Clinically**
 - Rapidly expanding mass on background of Hashimoto
 - Hoarsness, dysphagia, VC paralysis, Horner Syndrome
- **Tx**
 - RT, Chemo

Post Op Complications



- **RLN Injury**
- **Hypocalcemia**
- **Hematoma**

Parathyroid Gland

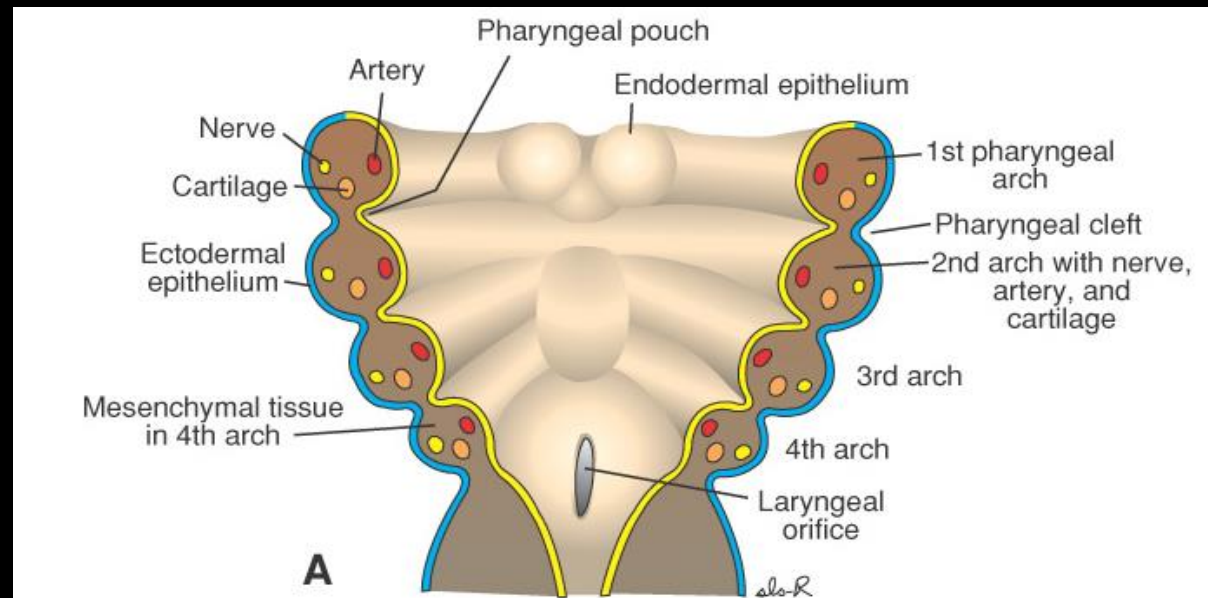


- **Embryology & Anatomy**
- **Evaluation of Hyperparathyroid**
- **Treatment of Hyperparathyroidism**

Parathyroid

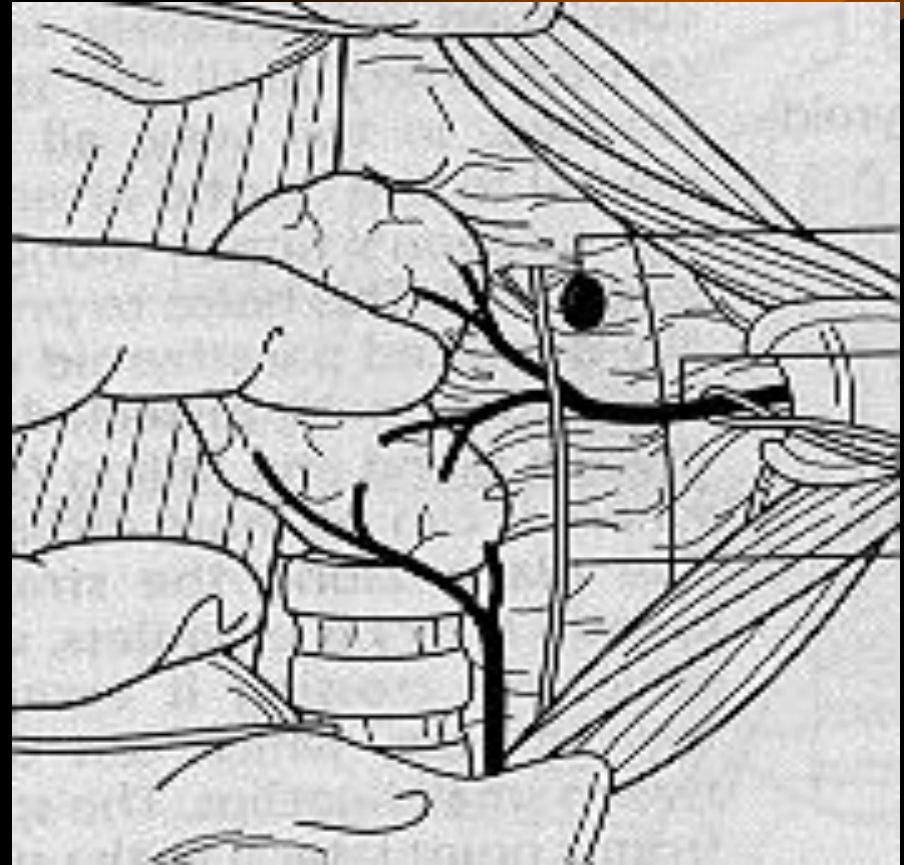
Embryology and Anatomy

- **3rd Branchial Arch (endoderm) – inferior Parathyroid glands and the thymus**
- **4th Branchial Arch (endoderm) – superior Parathyroid glands**



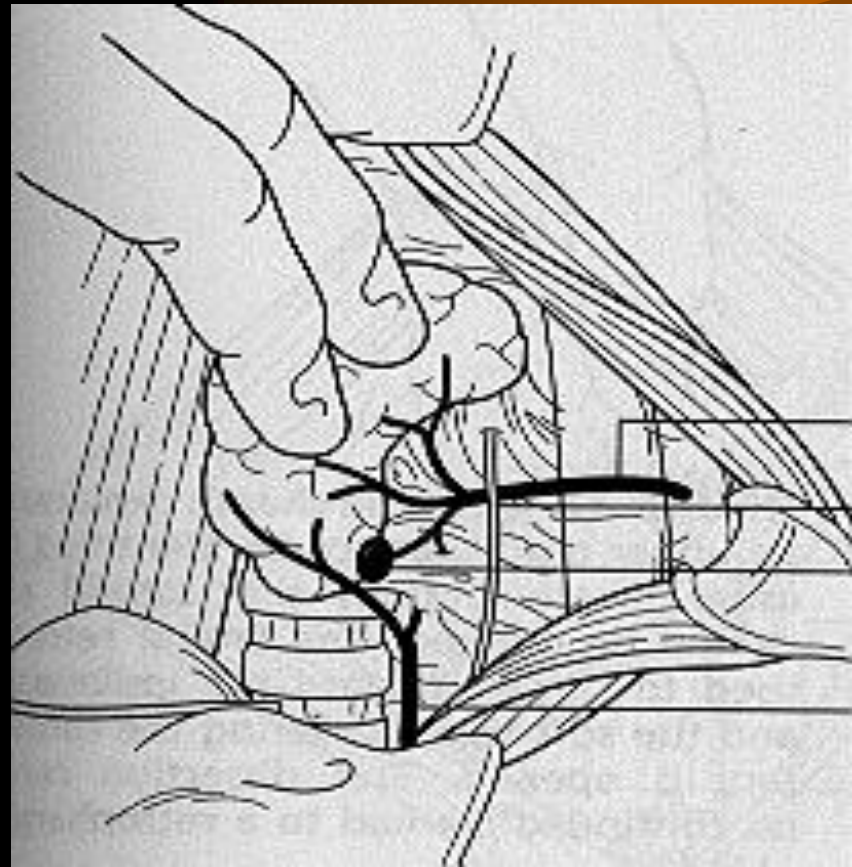
Parathyroid Anatomy

- **Superior gland**
 - Most consistent location
 - superior to inferior thyroid artery
 - posterior to RLN
 - Posterior aspect of thyroid
 - Within 1 cm of RLN pierce cricothyroid membrane



Parathyroid Anatomy

- **Inferior gland**
 - inferior to inferior thyroid artery (usually found within 1-2 cm of ITA entrance into thyroid gland)
 - anterior to RLN



Aberrant Sites



- **Seen in 15-20% of patients**
- **Bailey's**
 - Anterior mediastinum, usually thymus (3rd arch)
 - Posterior mediastinum (4th arch)
 - Aorto pulmonary window, middle mediastinum (3rd or 4th arch)
 - Retroesophagus, prevertebral
 - Tracheoesophageal
 - Intrathyroid
 - Carotid bifurcation

Parathyroid Blood Supply

- Inferior thyroid artery most common
- Rarely
 - superior parathyroid receives blood supply from both the ITA and STA, or
 - STA supplies both superior and inferior parathyroid glands

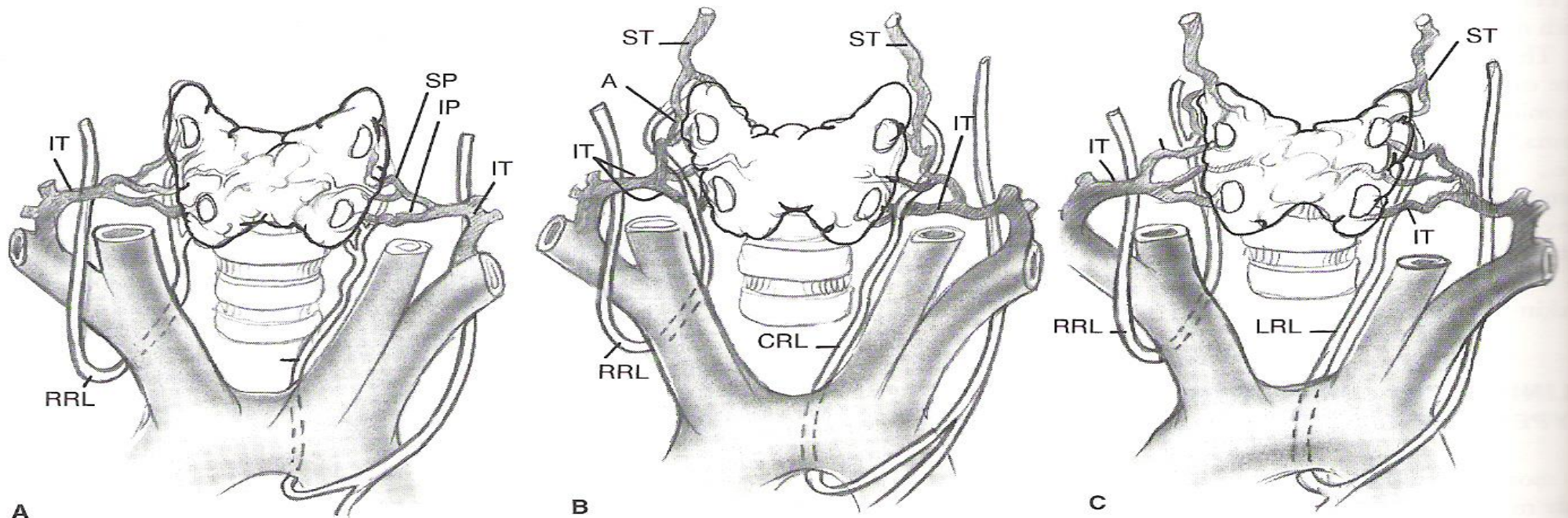


FIGURE 115.1. Variations in the blood supply to the parathyroid glands. Most of the time the blood

Parathyroid Lesions



- **Benign**

- Parathyroid Adenoma

- Most common cause of Hyperparathyroidism (80-90%)
 - Typically involve single gland
 - Superior and inferior glands affected equally

- Primary Chief Cell Hyperplasia

- 5 – 15% of cases, Women > Men
 - Proliferation of chief cells and oncocytes in multiple glands
 - Needs multiple gland sampling to distinguish from adenoma

Hyperparathyroidism

- **Primary vs Secondary vs Tertiary**
- **Clinical Presentation**
 - Primary often found on routine screening
 - Female:Male 3:1
 - Weakness, fatigue, depression
 - Muscle pain, Renal stones, gout
 - “Bones, Moans, Stones, Groans and Psych overtones”

HPT Cont'd



- **Surgical Indications**

- Serum Calcium > 1.0 mg/dl above N
- Hypercalciuria >400 mg/day
- Cr Clearance $<30\%$ of Normal
- Bone Density T-score < -2.5
- Age less than 50 without symptoms
- Pts with difficult follow up / surveillance

HPT - Pre-Operative Work Up

- **U/S**
 - Operator dependant
 - Adenomas → usually solid
- **Sestamibi Scan**
 - Retained by abnormal parathyroid tissue but rapid clearance from normal thyroid tissue
 - Delayed images useful
- **CT / MRI**
 - Better visualization of anterior mediastinum

Surgical Principles

- **Bloodless field to identify parathyroid**
- **Extreme care with RLN**
- **Avoid removal of normal parathyroids**
- **Intraoperative PTH**
 - 10 minute post excision
 - Should be normal
 - Should be 50% decreased from baseline

Post-op hypocalcemia



- **Seen in 20-30%**
- **Lowest levels seen in 1-3d post op**
 - Ca (po and iv)
 - Vit D
 - Check Mg (especially in bone wasting HPT)

Parathyroid Carcinoma



- **Rare**
- **4th – 6th decade**
- **No sex difference of incidence**
- **Death caused by severe hypercalcemia, not tumor**
- **Metastatic disease → remove as much tumor as possible to lower serum calcium**
- **Biopsy leads to seeding**
- **Need wide margin, en bloc resection**

Salivary Glands



Content



- **Anatomy**
- **Physiology**
- **Acute and Chronic Infections**
- **Auto Immune Diseases**
- **Tumours of Salivary Glands**

Basics



- **6 major salivary glands: 2 parotid, 2 submandibular, 2 sublingual.**
- **100's of minor salivary glands lining the upper aerodigestive tract**
- **Main job.... Saliva!!!!**

Anatomy-Parotid

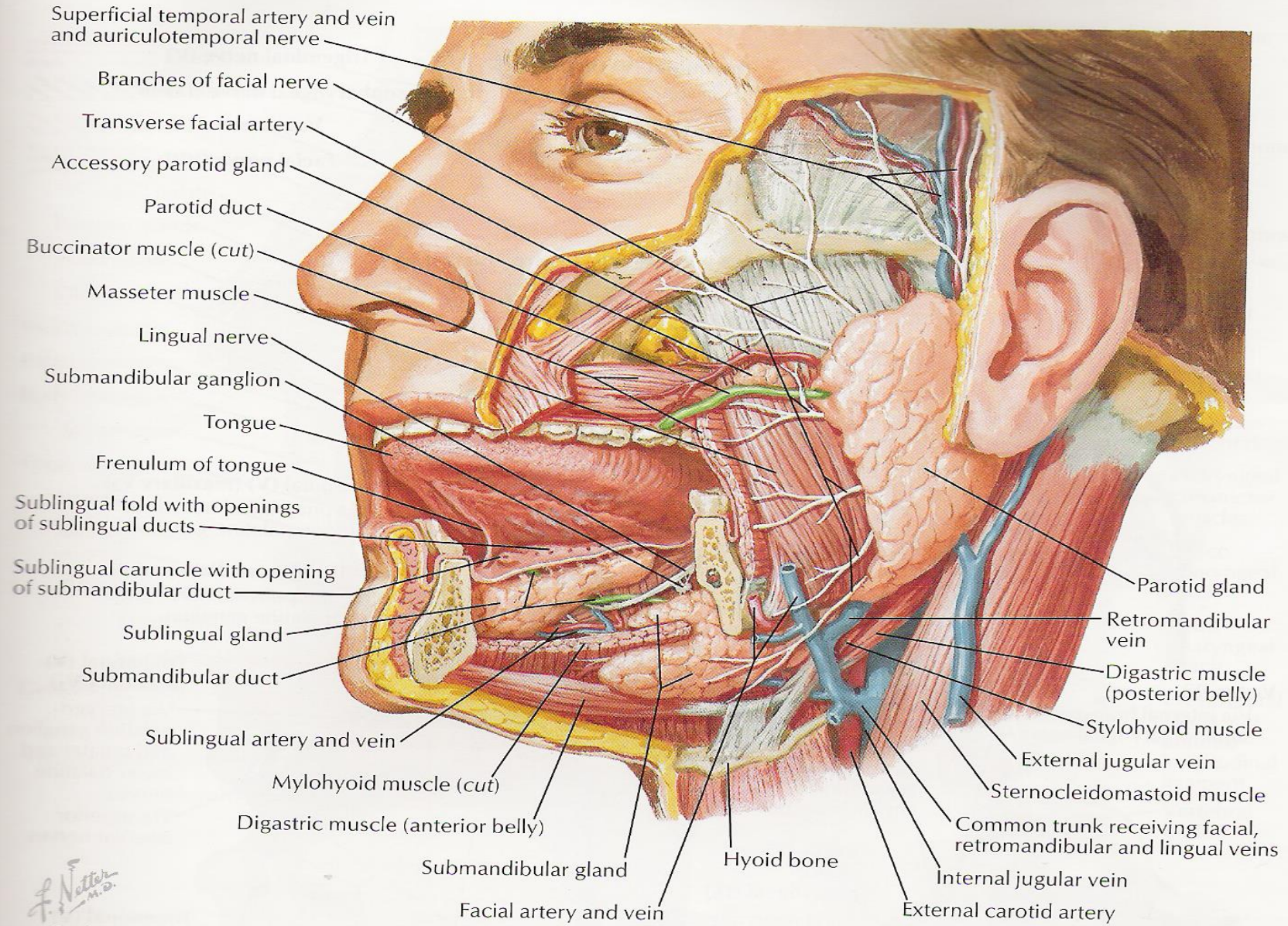


- Serous cells only
- On side of the face, deep to skin, subcutaneous tissue, superficial to the masseter.
- Parotid compartment borders superior-zygoma, posterior-external auditory canal, inferior-styloid process, styloid muscles, internal carotid and jugular.
- Tale of parotid extends superficial to SCM.

Parotid duct



- **Stensen's duct begins at anterior border of the gland 1.5cm below the zygoma. Traverses the masseter 5-6cm, pierces the buccinator.**
- **Opens in mouth lateral to 2nd upper molar.**



Superficial temporal artery and vein and auriculotemporal nerve

Branches of facial nerve

Transverse facial artery

Accessory parotid gland

Parotid duct

Buccinator muscle (*cut*)

Masseter muscle

Lingual nerve

Submandibular ganglion

Tongue

Frenulum of tongue

Sublingual fold with openings of sublingual ducts

Sublingual caruncle with opening of submandibular duct

Sublingual gland

Submandibular duct

Sublingual artery and vein

Mylohyoid muscle (*cut*)

Digastric muscle (anterior belly)

Submandibular gland

Facial artery and vein

Parotid gland

Retromandibular vein

Digastric muscle (posterior belly)

Stylohyoid muscle

External jugular vein

Sternocleidomastoid muscle

Common trunk receiving facial, retromandibular and lingual veins

Internal jugular vein

External carotid artery

Submandibular gland



- **Mucous and serous cells.**
- **Submandibular triangle: anterior and posterior bellies of digastric and inferior margin of the mandible.**
- **Medial and inferior to the mandible.**
- **Wraps around the mylohyoid. C-shaped, superficial and deep lobe.**
- **Superficial layer of deep cervical fascia splits to envelop the gland.**

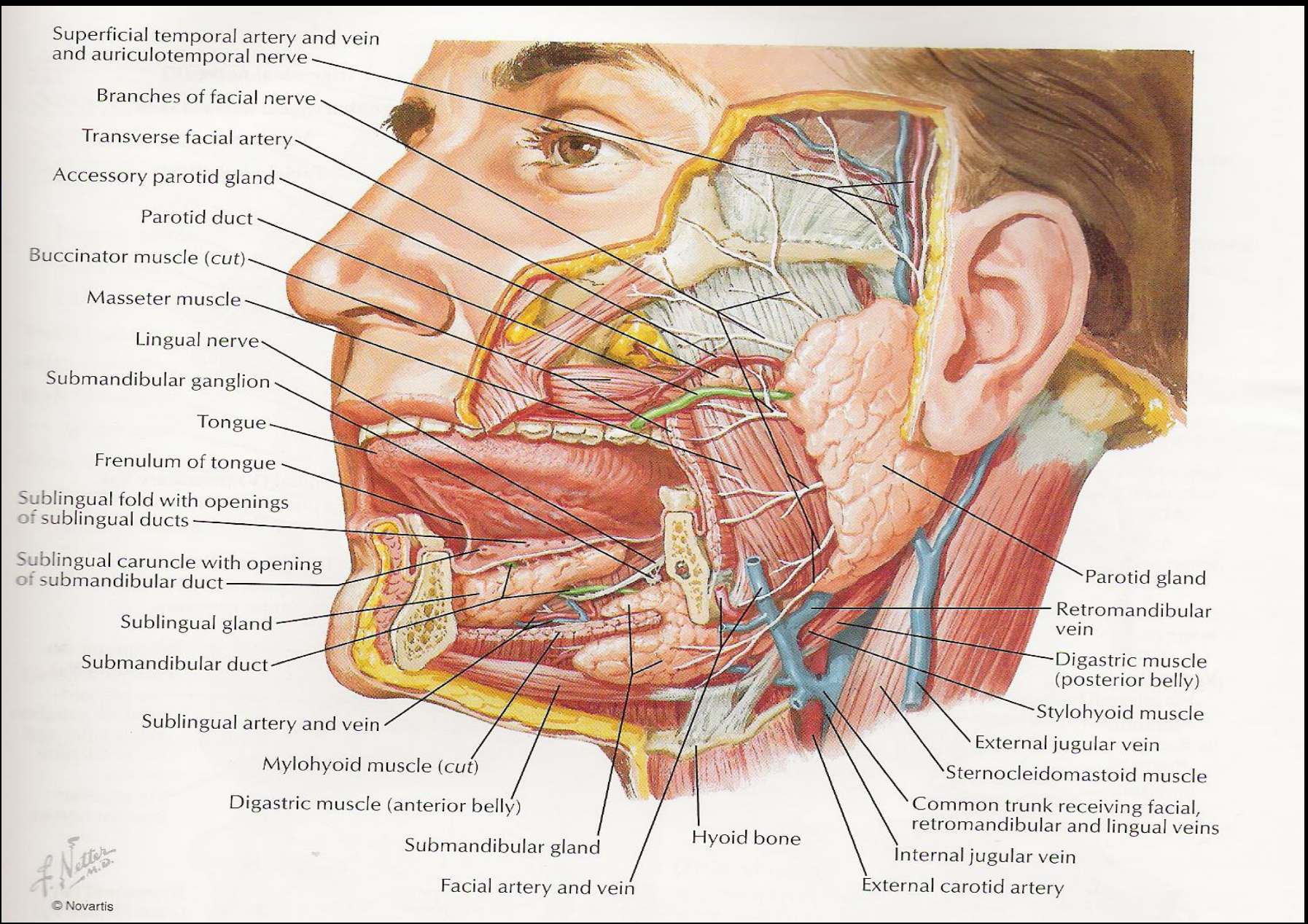
Wharton's duct



- **Exits the gland from the medial surface travels b/w the hyoglossus and mylohyoid muscles enters the genioglossus muscle and opens into mouth just lateral to lingual frenulum.**
- **CN XII inferior to the duct and lingual nerve is superior to the duct.**

SM gland innervation

- **Sympathetic stimulation stimulates mucoid saliva.**
- **Parasympathic stimulates watery saliva.**
- **PNS pre-ganglionic fibres come from the chorda tympani n. via the lingual n. to the submandibular ganglion. Then to the gland itself.**
- **SNS fibres originate in the superior cervical ganglion and travel with the lingual artery to the gland.**



Superficial temporal artery and vein and auriculotemporal nerve

Branches of facial nerve

Transverse facial artery

Accessory parotid gland

Parotid duct

Buccinator muscle (cut)

Masseter muscle

Lingual nerve

Submandibular ganglion

Tongue

Frenulum of tongue

Sublingual fold with openings of sublingual ducts

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Sublingual gland

Submandibular duct

Sublingual artery and vein

Mylohyoid muscle (cut)

Digastric muscle (anterior belly)

Submandibular gland

Facial artery and vein

Parotid gland

Retromandibular vein

Digastric muscle (posterior belly)

Stylohyoid muscle

External jugular vein

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Common trunk receiving facial, retromandibular and lingual veins

Internal jugular vein

External carotid artery

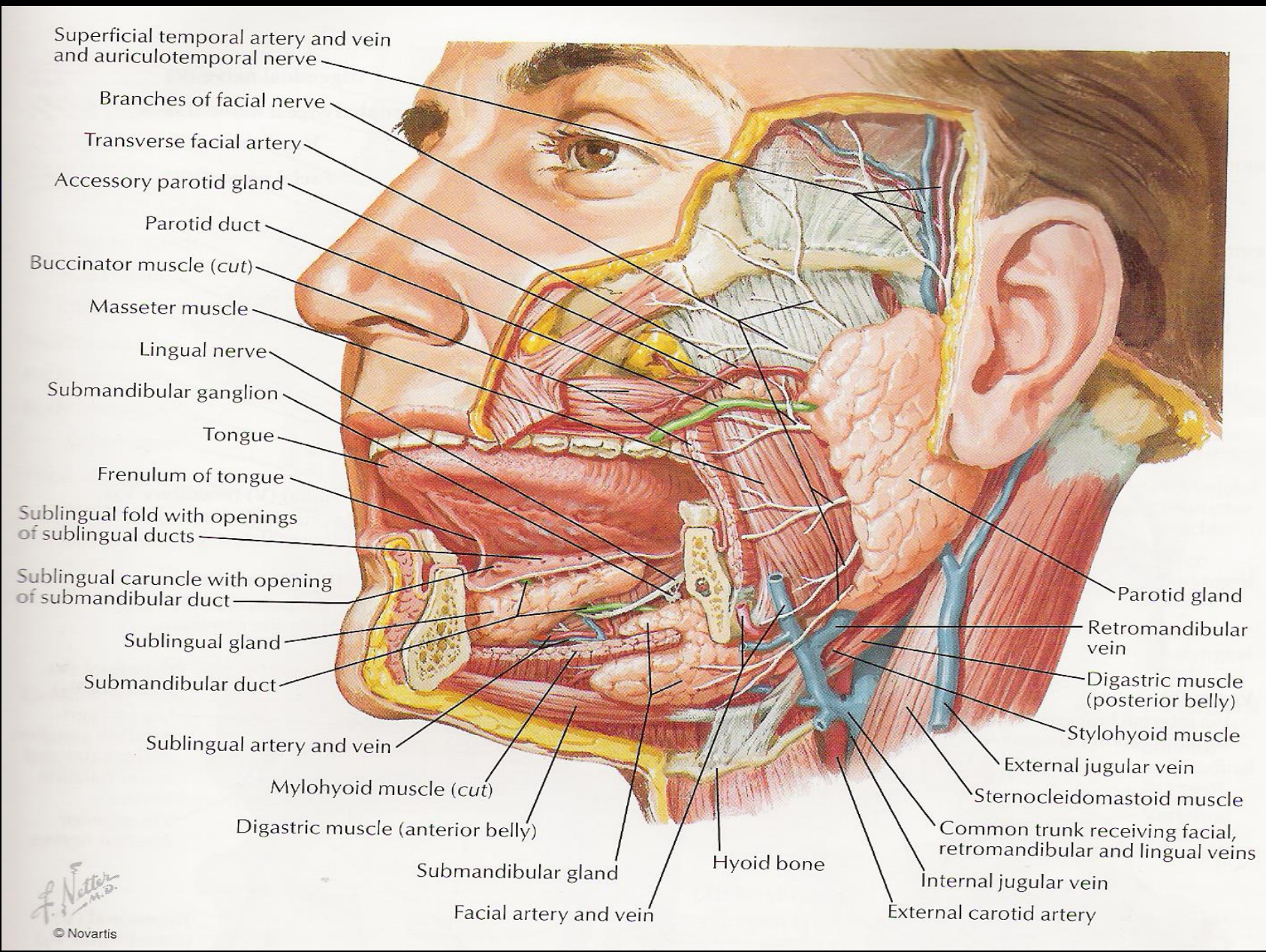
Sublingual glands



- **Mucous secreting.**
- **Just below the floor of mouth mucosa.**
- **Bordered by genioglossus/hyoglossus medially, mandible laterally, and mylohyoid inferiorly.**
- **Wharton's duct and lingual n. travel b/w SL gland and genioglossus muscle.**
- **No fascial capsule.**

SL glands cont'd

- **Ducts of Rivinus (~10) along the superior aspect of the gland open into the mouth along sublingual fold in the floor of mouth.**
- **Innervated by the PNS/SNS systems in the same way as the SM gland.**
- **Gland supplied by sublingual branch of the lingual a. and the submental branch of the facial a. Drained by the corresponding veins.**
- **Lymphatic drainage is primarily by the submandibular nodes.**



Minor salivary glands



- **Either mucous serous or both**
- **600-1000 /person**
- **Each gland has it's own duct.**
- **Found most commonly in buccal, labial, palatal, and lingual regions.**

Physiology



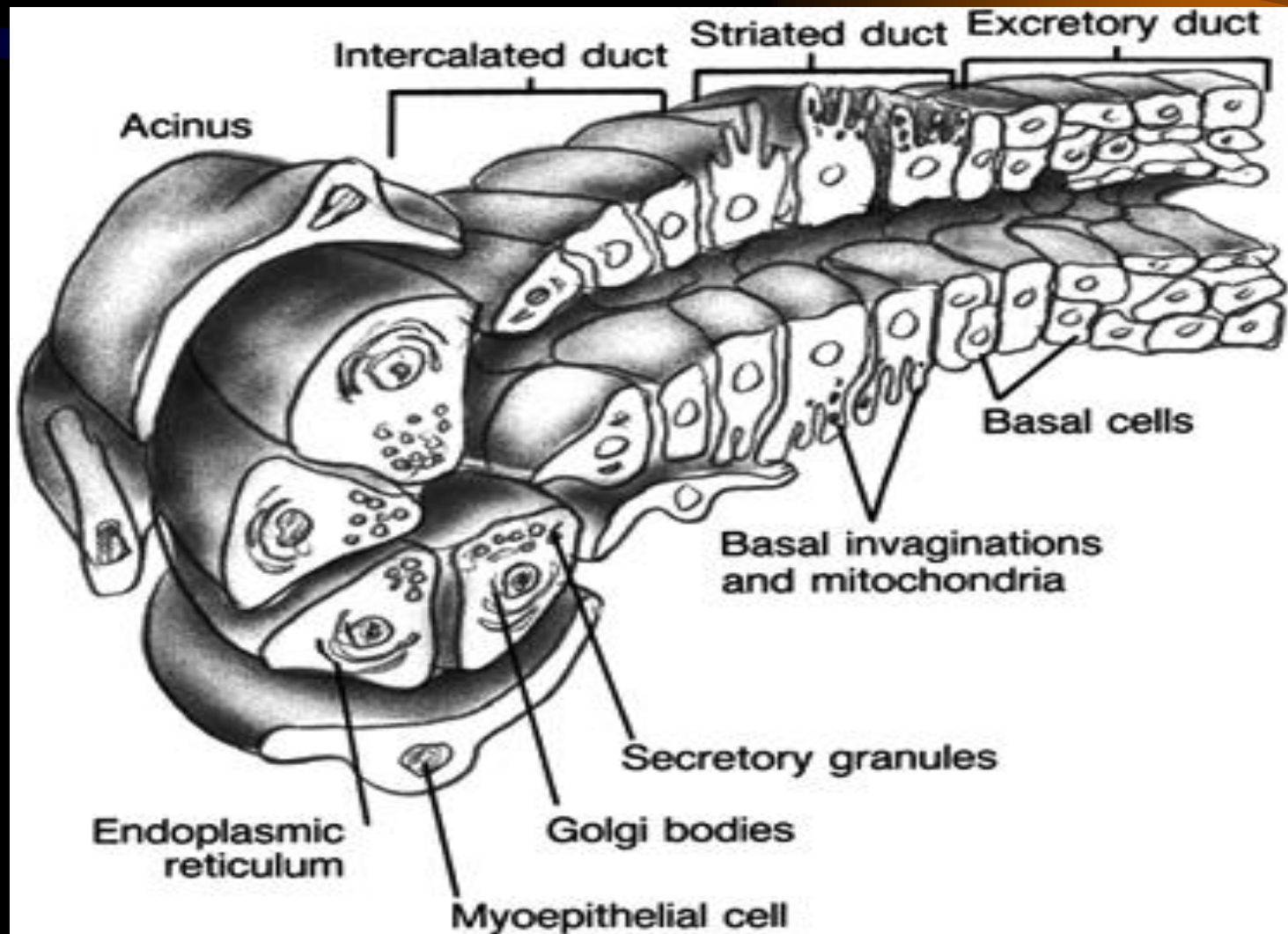
- **Role of saliva:**
 - Lubricates
 - Moistens, help with mastication
 - Cools hot food
 - Buffers chemicals
 - Cleans the mouth (lavage)
 - Protects mucosa
 - Prevent dental caries
 - Helps form enamel, provides inorganic ions
 - Antibacterial (lysozyme, IgA, peroxidase)
 - Homeostasis

Physl. Cont'd



- **Secretory unit: acinus, secretory tubules, and the collecting duct.**
- **Secrete saliva, hypotonic solution (compared to plasma).**

Secretory Unit



Secretory Process

- **Active process involving cell synthesis and active transport.**
- **Primary secretion: produced by acinar cells composition and osmolality more similar to plasma.**
- **Ductal secretion: tubule modifications make it more hypotonic.**
- **Degree of modification depends on flow rate. Fast rate less time for modification. It's still hypotonic.**
- **Serous acinar cell granules contain amylase, mucous acinar cells contain mucin.**

Autonomic Nervous System



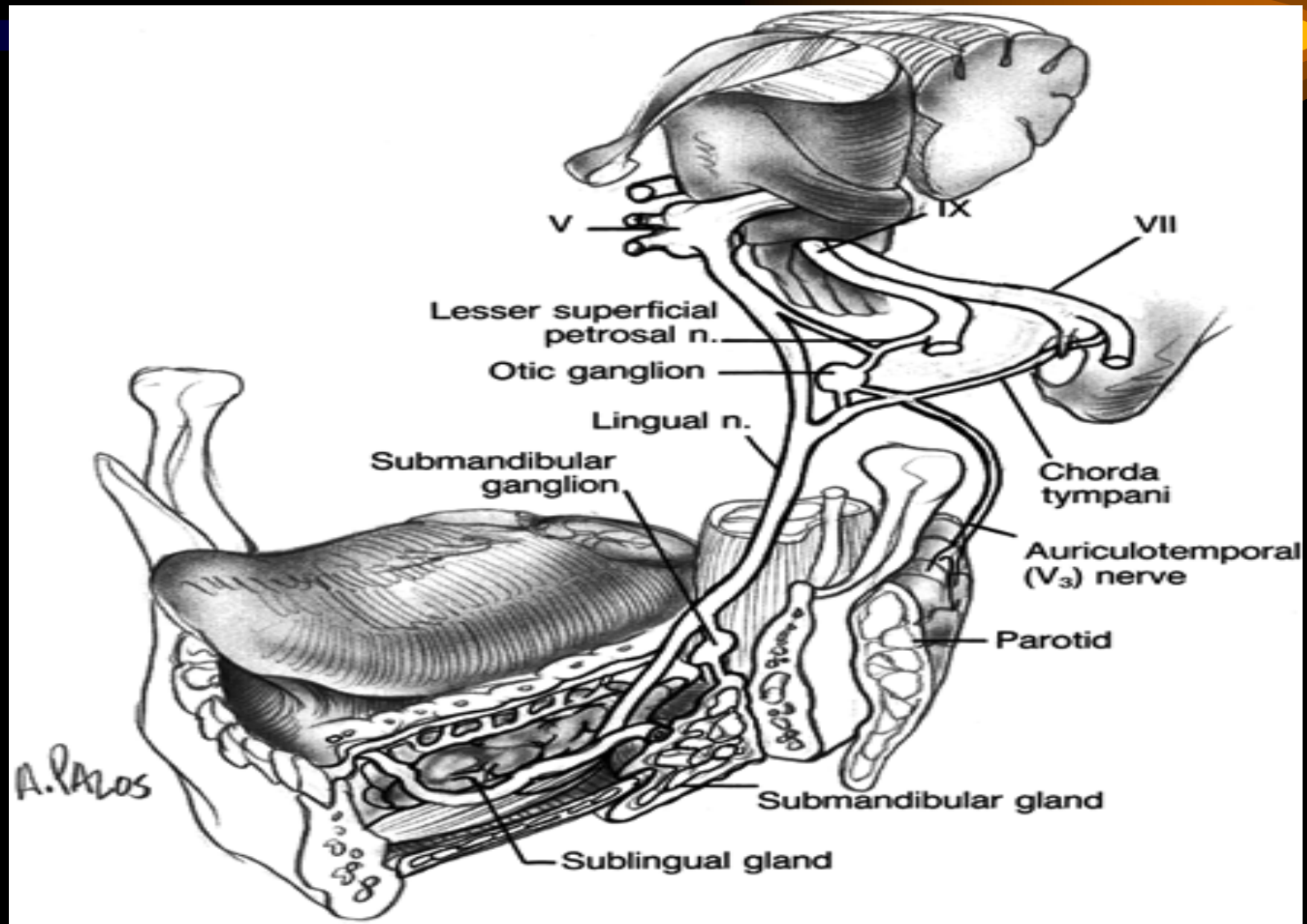
- **Anatomy above**
- **ANS stimulation causes hyperpolarization (more -), K out into saliva, Cl into cells. Known as the secretory potential.**

Parasympathetic NS



- **Pre-ganglionic PNS fibers originate from the salivary nucleus in the brainstem.**
- **No true synapses b/w post-ganglionic fibers and the SL/SM glands. ACh passively diffuses into glands.**
- **ACh main transmitter.**
- **Muscarinic solely involved in saliva production.**

PNS innervation



Sympathetic NS



- **Norepinephrine is the main transmitter.**
- **All synapses are adrenergic.**
- **SNS stimulation produces scant viscous saliva.**
- **SNS stimulation augments that of the PNS.**

Salivary flow rates

- **No ANS stimulation 0.001-0.2 ml/min/gland, 0.8-1.7 ml/min/gland with ANS stimulation.**
- **~1000-1500 ml/24hrs, or 1 ml/min.**
- **Unstimulated 69% of flow from SM gland, 26% parotid, 5% SL.**
- **Stimulated parotid and SM reverse contributions.**
- **Minor glands independent of stimulation usually account for 7-8% total flow.**
- **Flow independent of age. Acinar cells degenerate with age, flow still constant. Xerostomia in elderly likely due to meds.**

Infections of the Salivary Glands



Viral Infections - Mumps

- **Most common nonsuppurative infection**
- **Children**
- **Parotid (occ. SMG)**
- **bilateral, generalized swelling**
- **Paramyxovirus**
 - Highly contagious
 - Air-borne droplet spread
 - Incubation 18 days
 - Virus spread for 1 week following swelling

Mumps



- **Ductal epithelial desquamation leads to obstruction and secondary infection**
- **Low grade fever, arthralgia, HA, malaise**
- **Hydration**
- **Rest**
- **Modify diet to decrease gland stimulation**
- **Complications**
- **Parainfluenza, echovirus, EBV, choriomeningitis virus**

Acquired Immunodeficiency Syndrome

- **HIV-SGD**
- **Lymphoproliferative and cystic enlargement of the major salivary glands**
- **High suppressor T-cells and lymphocytosis**
- **Can be initial presentation**
- **Parotid (15- 30% bilateral) with lymphocytic interstitial pneumonitis**
- **HIV in saliva**

HIV – Clinical Features

- **Infected newborns or adults (20-60 yo)**
- **Gradual nontender enlargement of glands**
- **Xerostomia, dry eyes, arthralgia**
- **Glandular swelling fluctuates**
- **Surgical treatment**
 - Ddx: lymphoma, Kaposi's
- **CT, MRI, FNA - observation**
- **Steroids and zidovudine**
- **Good oral hygiene, sialagogues, topical fluoride**

Acute Suppurative Sialoadentitis

- **“Surgical parotitis”, “Surgical mumps”**
- **0.01-0.02% of all admissions**
- **0.002-0.04% of all postops**
- **Retrograde migration of bacteria from the oral cavity**
- **Parotid gland most frequently involved**
 - Inferior bacteriostatic properties

Pathogenesis of Acute infections

- Normal healthy flow flushes ducts
- Stasis permits retrograde flow
- Compromised host resistance
- Poor oral hygiene (increase oral bacteria)
- Chronic disease or prolonged recovery
- **DEHYDRATION**
- Anticholinergics or diuretics
- Anorexia reduces salivation
- **25% bilateral**

Symptoms of Acute infections

- **Rapid onset of pain, swelling, induration**
- **Fever, chills, malaise**
- **Increased WBC count**
- **Suppurative discharge from the gland**
- **S. aureus**
- **Streptococcus spc**
- **Strept pyogenes**
- **Strept viridans**
- **Strept pneumo**
- **H. influenzae**
- **anaerobes**

Treatment



- **Antibiotics**
- **Steroids**
- **Analgesics**
- **Local heat application**
- **Massage**
- **Increased fluid intake**
- **Surgical treatment if no improvement**
- **CT or US to rule out abscess**
- **Sialogram C/I in acute phase**

Chronic Sialoadenitis



- **Repeated episodes of pain and inflammation**
- **Parenchymal degeneration and fibrous replacement of the gland**
- **Initial severe acute infection**
- **Duct obstruction**
- **Depressed glandular secretion**
- **Parotid**
- **More infections = more damage to gland and duct**

Pathophysiology and Treatment

- **Obstruction of salivary flow**
- **Intraductal calculus**
- **Stricture**
- **Mucous plug**
- **Ductal papilla lesion**
- **Extrinsic compression**
- **No consistent Tx**
- **Tympanic neurectomy**
- **Duct ligation**
- **Gland excision**

Sialolithiasis



- **Formation of hardened intraluminal deposits in the ductal system**
- **Common with chronic sialoadenitis**
- **Causes:**
 - Stagnation of saliva
 - Focus for formation from duct injury
 - Biologic factors (Calcium salts)
- **Hilus of the gland most common site**

Location



- **80% Wharthon's duct**
- **19% Stenson's**
- **1% sublingual**
- **Why Wharthon's?**
 - Alkaline and viscous saliva
 - Increased Ca and Phos
 - Angulation of the duct at Mylohyoid
 - Vertical orientation at the distal segment

Composition



- **Calcium phosphate and carbonate**
- **Mg, Zn, NH₃**
- **Glycoproteins, mucopolysaccharides, cellular debris**
- **No correlation with calcium and phosphate levels**

Symptoms and Management

- **Colicky postprandial pain**
- **Swelling**
- **Erosive extrusion**
- **Plain films**
- **Sialography**
- **Like sialoadenitis**
- **Avoid vigorous probing**
- **Incise duct orifice**
- **Sialodochoplasty**
- **Stenting**
- **Surgical excision**
- **ECSL**

Salivary Gland Neoplasms

- **The Tumors**
 - Benign
 - Malignant
- **Work Up**
 - Hx, Px & Imaging (previously covered)
 - FNAs
- **Management**
 - Surgery
 - Superficial Parotidectomy
 - Submandibular Gland Resection
 - Complications
 - Contraversial
 - The N0 Neck

Salivary Gland Neoplasms

- **Diverse histopathology**
 - Determines Aggressiveness
- **Relatively uncommon**
 - 2% of head and neck neoplasms
- **Distribution**
 - 95% in adults
 - Parotid: 80% overall; 80% benign
 - Submandibular: 15% overall; 50% benign
 - Sublingual/Minor: 5% overall; 40% benign

Most Common Parotid Tumours

- **Benign**
 - 1) Pleomorphic adenoma
 - 2) Warthin tumour
- **Malignant**
 - 1) MEC
 - 2) AdenoCa

Most Common SMG Tumours

- **Benign**
 - 1) Pleomorphic adenoma
- **Malignant**
 - 1) ACC
 - 2) MEC
 - 3) Malignant mixed

Most Common Minor Salivary Gland Tumours



- **Benign**
 - 1) Pleomorphic adenoma
 - 2) Monomorphic adenoma
- **Malignant**
 - 1) ACC
 - 2) MEC
 - 3) AdenoCa
 - 4) SCC

Common Salivary Gland Tumours in Children

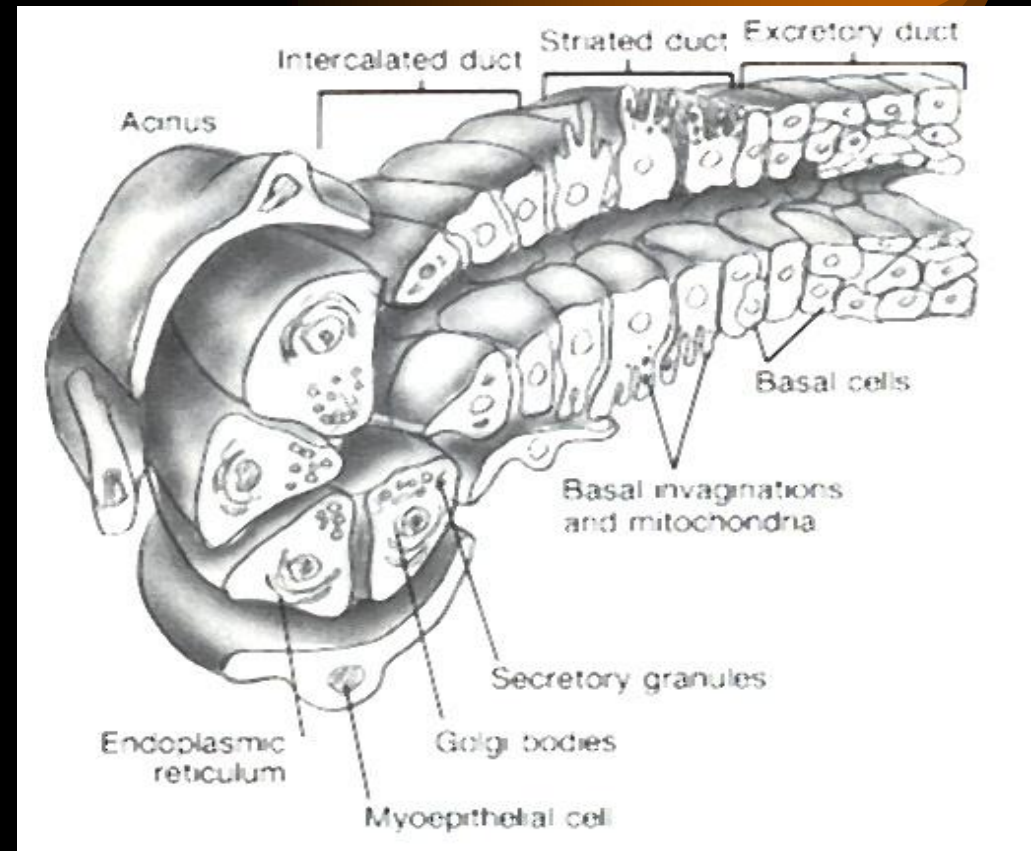


- **Benign**
 - 1) Hemangioma (mesenchymal)
 - 2) Pleomorphic adenoma (epithelial)
 - 3) Lymphangioma
- **Malignant**
 - 1) 85% in parotid
 - 2) MEC
 - 3) Acinic cell carcinoma
 - 4) AdenoCa

Multicellular Theory

Neoplastic cells originate from secretory unit counterparts

- **Striated duct—oncocytic tumors, Warthin's, adenoca**
- **Acinar cells—acinic cell carcinoma**
- **Excretory Duct—squamous cell and mucoepidermoid carcinoma**
- **Intercalated duct and myoepithelial cells—pleomorphic tumors, adenoid cystic & adenoca**



Bicellular Theory

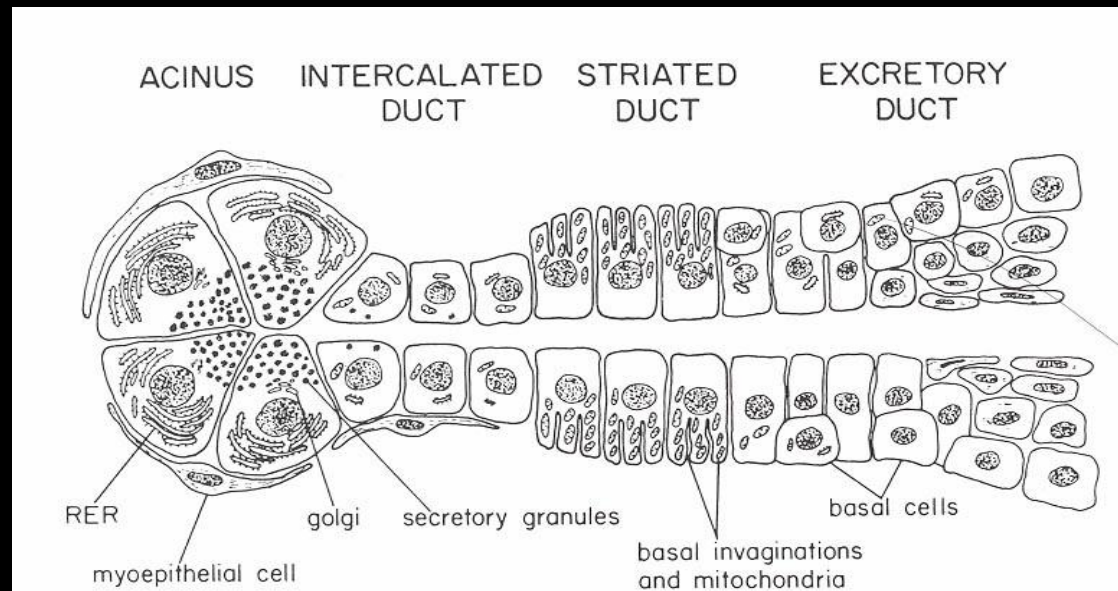
Neoplastic cells originate from basal cells in intercalated and excretory ducts

- **Intercalated Ducts**

- Pleomorphic adenoma
- Warthin's tumor
- Oncocytoma
- Acinic cell
- Adenoid cystic

- **Excretory Ducts**

- Squamous cell
- Mucoepidermoid





Benign Neoplasms

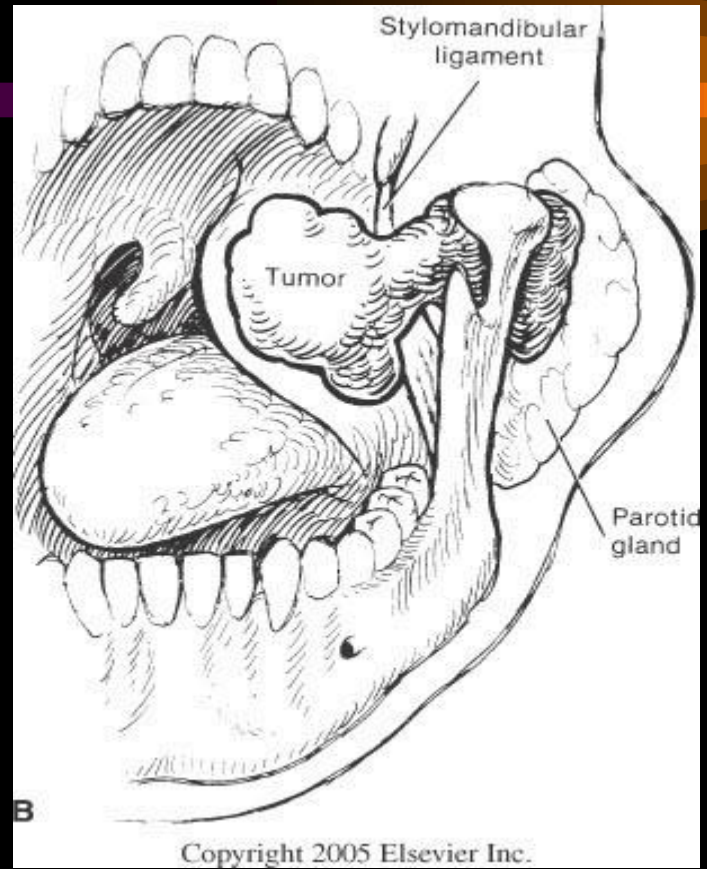
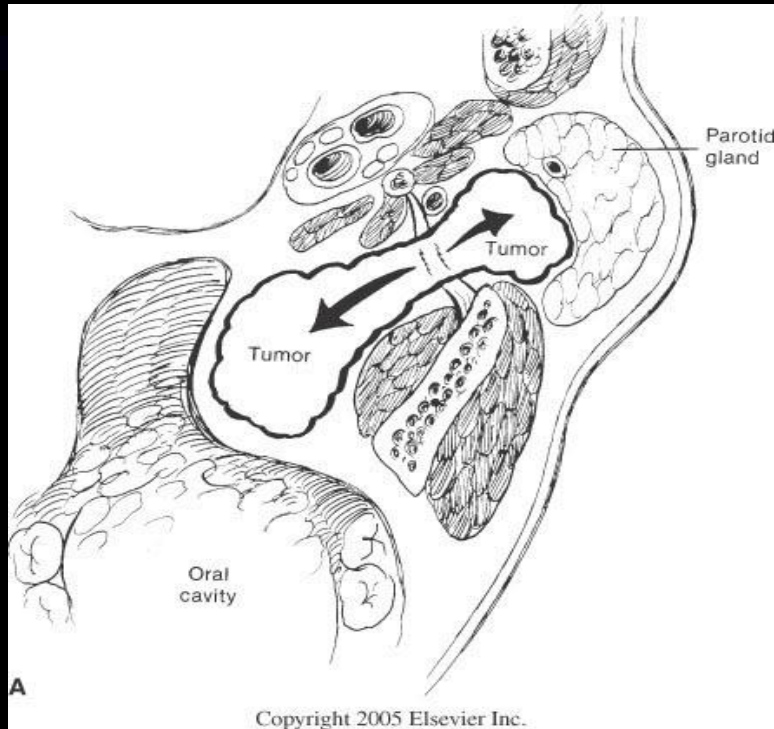
Pleomorphic Adenoma

- **Most common of all salivary gland neoplasms**
 - 70% of parotid tumors
 - 50% of submandibular tumors
 - 45% of minor salivary gland tumors
 - 6% of sublingual tumors
- **4th-6th decades**
- **F:M = 3-4:1**

Pleomorphic Adenoma



- **Slow-growing, painless mass**
- **Parotid: 90% in superficial lobe, most in tail of gland**
- **Minor salivary gland: lateral palate, submucosal mass**





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Pleomorphic Adenoma



- **Treatment: complete surgical excision**
 - Parotidectomy with facial nerve preservation
 - Submandibular gland excision
 - Wide local excision of minor salivary gland
- **Avoid enucleation and tumor spill**
 - 20-45% recurrence
- **can metastasize and yet remain benign histologically**

Warthin's Tumor

- **AKA: papillary cystadenoma lymphomatosum**
- **6-10% of parotid neoplasms**
- **Older, Caucasian, males**
- **Incidence increasing in women (smoking)**
- **10% bilateral; 20% multicentric**
- **3% with associated neoplasms**
- **Presentation: slow-growing, painless mass in parotid tail**



Malignant Tumors

BOX 61-4

**MALIGNANT NEOPLASMS
OF MAJOR SALIVARY GLANDS** **HOCWALD
2001⁶²**

Mucoepidermoid carcinoma	28 (36%)
Adenocarcinoma	11 (14%)
Adenoid cystic carcinoma	16 (20%)
Carcinoma ex-pleomorphic adenoma	4 (5%)
Acinic cell carcinoma	7 (9%)
Squamous cell carcinoma	6 (8%)
Other	6 (8%)

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Mucoepidermoid Carcinoma

- **Most common salivary gland malignancy**
- **5-9% of salivary neoplasms**
- **Parotid 45-70% of cases**
- **Palate 18%**
- **3rd-8th decades, peak in 5th decade**
- **F>M**
- **Caucasian > African American**

Mucoepidermoid Carcinoma

- **Presentation**

- Low-grade: slow growing, painless mass
- High-grade: rapidly enlarging, +/- pain
- **Minor salivary glands: may be mistaken for benign or inflammatory process
 - Hemangioma
 - Papilloma
 - Tori

Mucoepidermoid Carcinoma

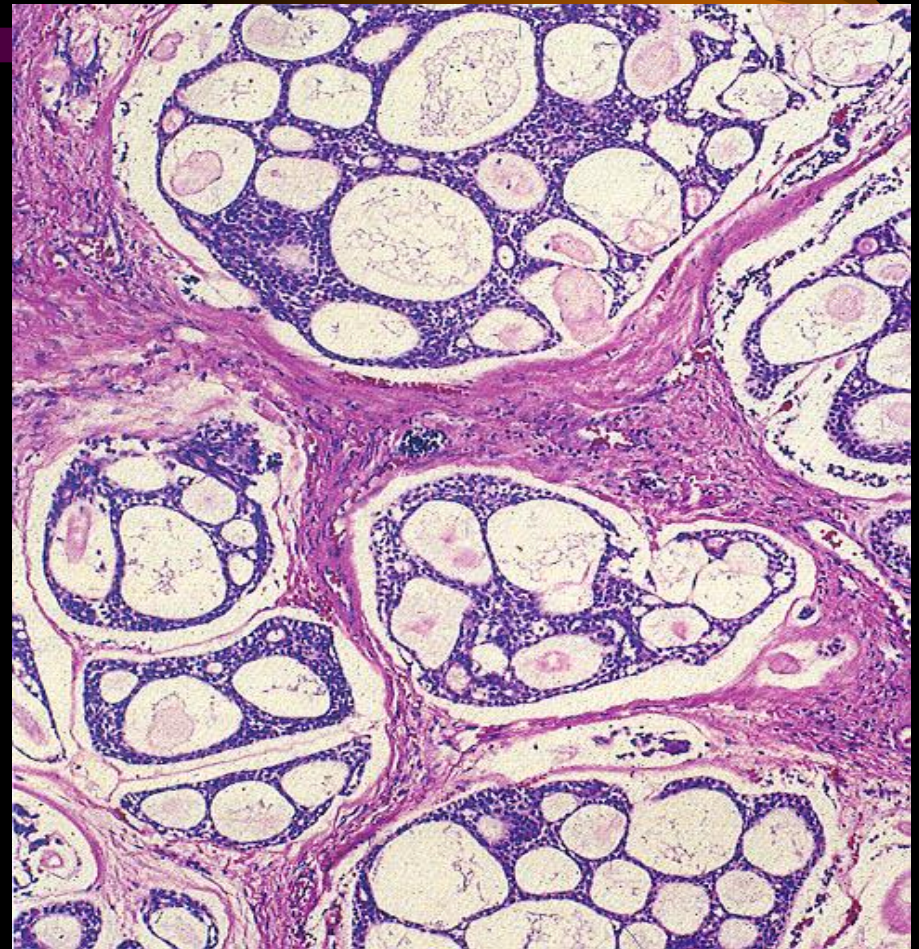
- **Treatment**
 - Influenced by site, stage, grade
 - Low-grade tumors: complete resection by parotidectomy
 - High-grade: parotidectomy, neck dissection (N0 neck) & RTX

Adenoid Cystic Carcinoma

- Overall, 2nd most common salivary gland malignancy
- 2nd most common of parotid
- Most common in submandibular, sublingual and minor salivary glands
- M = F
- 5th decade
- Presentation
 - Asymptomatic enlarging mass
 - Pain, paresthesias, facial weakness/paralysis

Adenoid Cystic Carcinoma

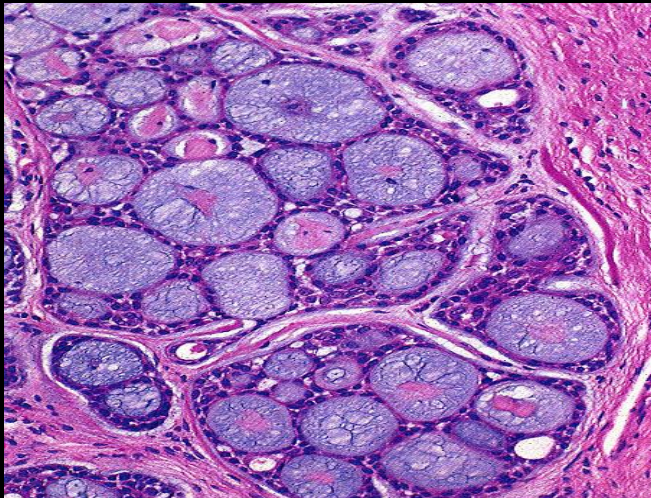
- **Histology**
- **i) cribriform pattern**
 - Most common
 - “swiss cheese” appearance



Adenoid Cystic Carcinoma

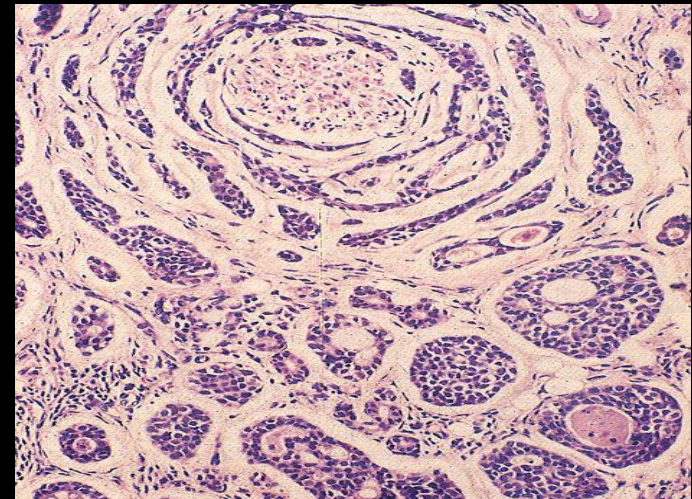
- **ii) tubular pattern**

- Layered cells forming duct-like structures
- Basophilic mucinous substance



- **iii) solid pattern**

- Solid nests of cells without cystic or tubular spaces



Adenoid Cystic Carcinoma

- **Treatment**

- Complete local excision
- Tendency for perineural invasion: facial nerve sacrifice
- Postoperative *Neutron Beam XRT*
- Long-term F/U mandatory

- **Prognosis**

- Local recurrence: 42%
- Distant metastasis: lung, bone
- Indolent course: 5-year survival 75%, 20-year survival 13%



Complications



TABLE 107.8. COMPLICATIONS PAROTIDECTOMY

Early Complications	Long-term Complications
Facial nerve paralysis	Frey's syndrome
Hemorrhage or hematoma	Recurrent tumor
Infection	Cosmetic deformity
Skin flap necrosis	Soft-tissue deficit
Trismus	Hypertrophic scar or keloid
Salivary fistula or sialocele	
Seroma	



FIGURE 107.17. Right facial paralysis after parotidectomy.

Frey's syndrome (aka. Gustatory sweating)

- Aberrant reinnervation of postganglionic parasympathetic nerves to the sweat glands of the face
- 10% of patients overtly symptomatic
- Diagnosis: Minor's starch iodine test
- Afferent pathway
 - Parotid and sweat glands
 - Auriculotemporal nerve
 - Otic ganglion
 - LSPN (enters skull base via foramen ovale)
 - Jacobson's nerve (leaves skull base via inferior tympanic canaliculus)
 - CN IX
 - Inferior salivatory nucleus

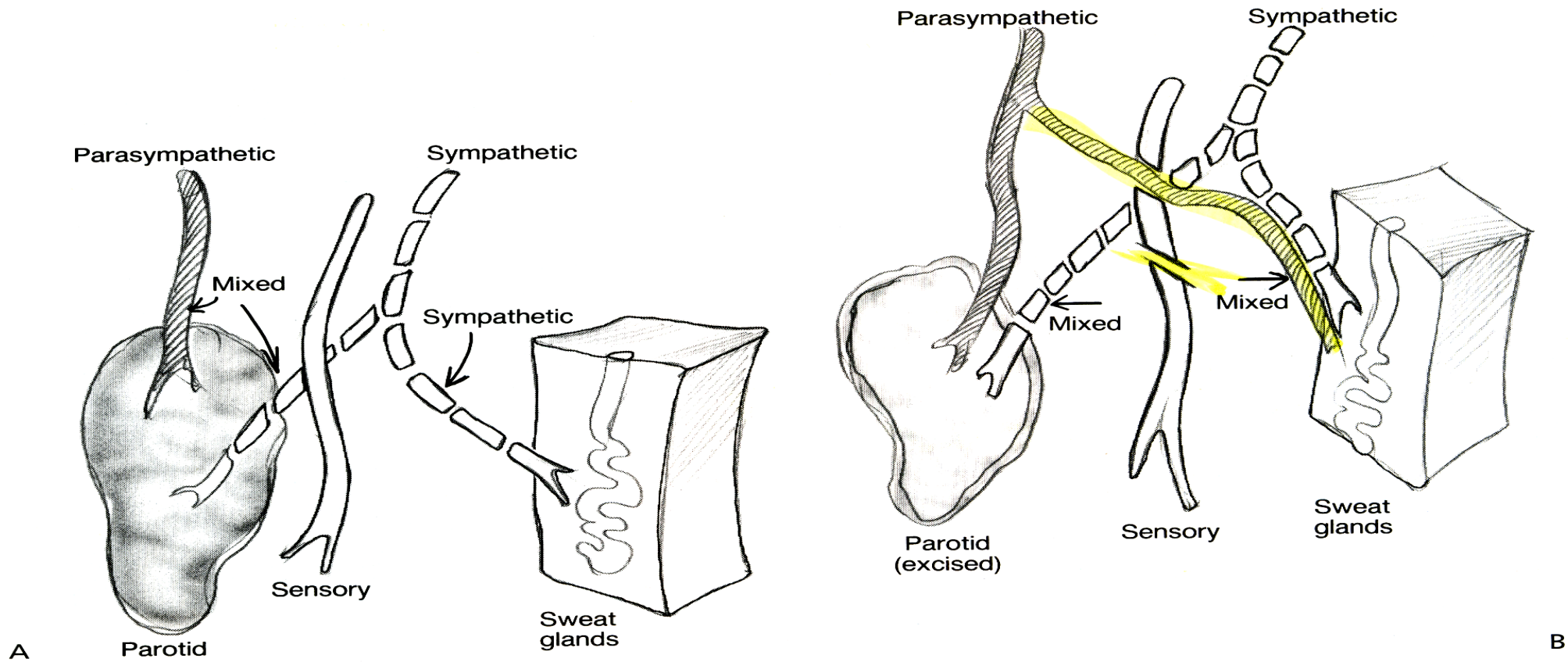


FIGURE 107.18. A: Normal innervation of parotid and sweat glands. **B:** Proposed mechanism of gustatory sweating (Frey's syndrome).



Figure 3. The Minor's test showed areas where the secretion of sweat gland diluted with iodine, which reacted with the starch.

BOX 61-13

TREATMENT OF GUSTATORY SWEATING

Nonsurgical

- Topical glycopyrrolate
- Topical antiperspirant

Botox injection

Surgical

- Fat grafting
- Dermal grafting
- Temporalis fascia interposition flap
- Sternocleidomastoid interposition flap
- Tympanic neurectomy



Thank You