

Neck Dissection



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Grand Rounds Presentation

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Outline

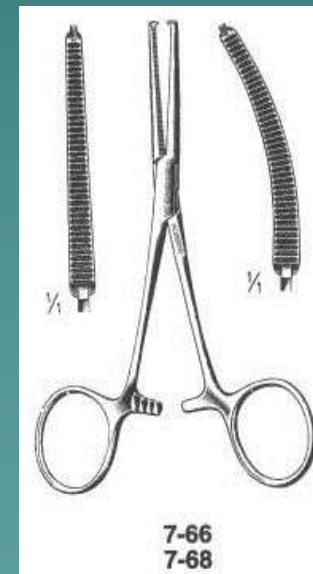
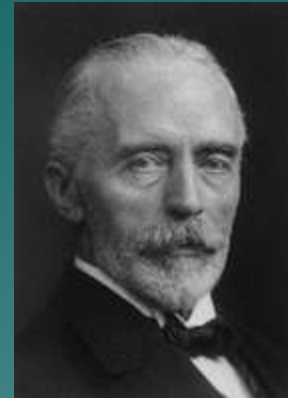
- ◆ History
- ◆ Anatomy
 - Nodal levels
 - Common nodal drainage patterns
- ◆ Staging
- ◆ Classification
- ◆ Sentinel Lymph Node

History

- ◆ Metastatic cervical lymph nodes
 - Early 19th Century → incurable disease
 - 20th Century → improved treatment of neck disease
 - 21st Century → second worst prognostic indicator for head and neck SCCA

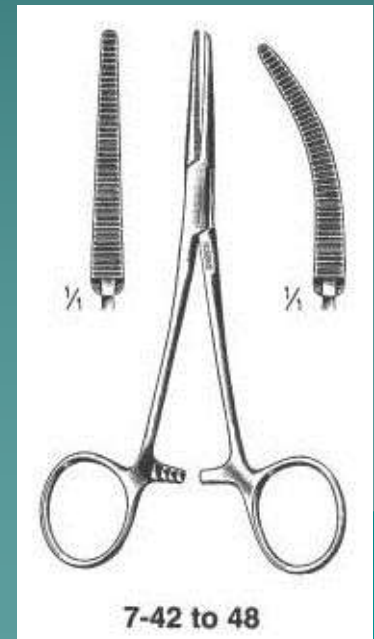
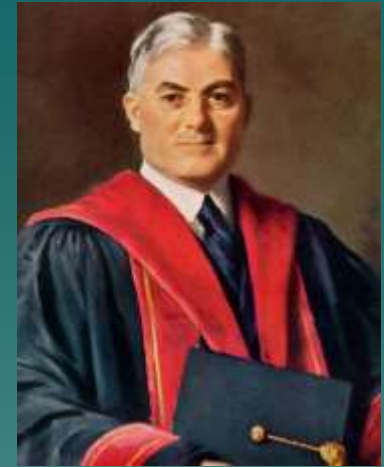
19th Century

- ◆ 1880 → Kocher advocates wide margin lymphadenectomy
- ◆ 1881 → Kocher and Packard recommend dissection of submandibular triangle for lingual cancer
- ◆ 1885 → Butlin questions RND for oral N₀ disease
- ◆ 1888 → Jawdyski describes en bloc resection with resection of carotid, IJV, SCM.



20th Century

- ◆ 1901 → Solis-Cohen advocate lymphadenectomy for N₀ laryngeal CA
- ◆ **1905 -1906 → Crile describes en bloc resection in JAMA**
- ◆ 1926 → Bartlett and Callander advocate preservation of XI, IJV, SCM, platysma, stylohyoid, digastric
- ◆ 1933 → Blair and Brown advocate removal of XI.

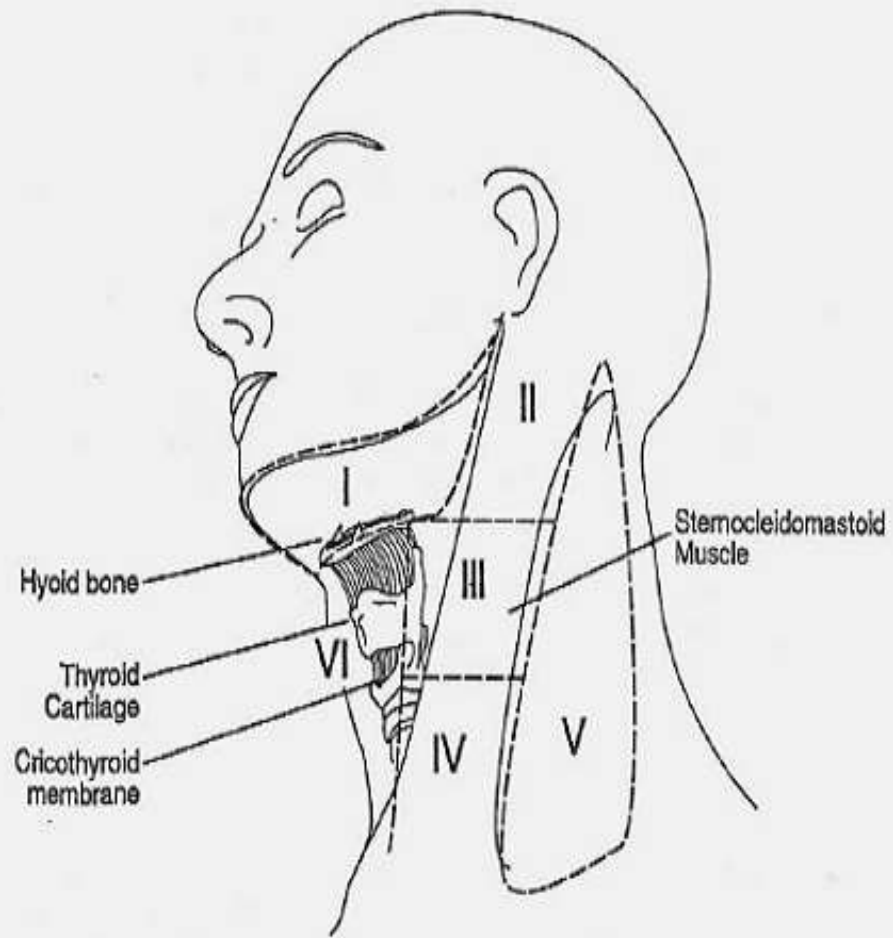


20th Century

- ◆ 1951 → Martin advocates Radical Neck Dissection after analysis of 1450 cases
 - Advocated RND for all cases.
 - Standardized the Radical Neck Dissection
- ◆ 1952 – Suarez describes a functional neck dissection
 - Preservation of SCM, omohyoid, submandibular gland, IJV, XI.
 - Enables protection of carotid.
- ◆ 1960's – MD Anderson advocate selective ND of highest risk nodal basins
- ◆ 1967 - Bocca and Pignataro describe the “functional neck dissection”
- ◆ 1975 – Bocca establishes oncologic safety of the FND compared to the RND

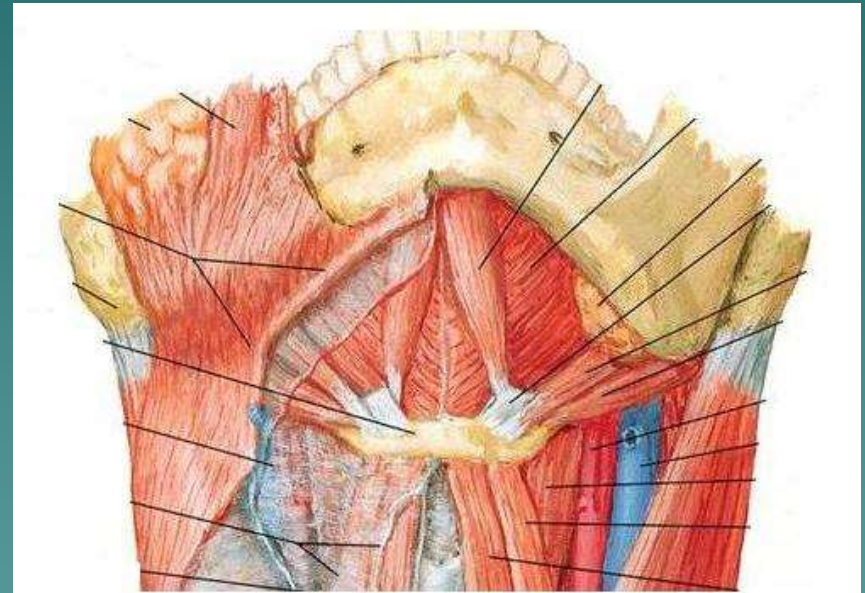
Anatomy

- ◆ Lymph Node Levels
 - Sloan Kettering nomenclature
 - Subgroups
- ◆ Common Nodal Drainage Patterns



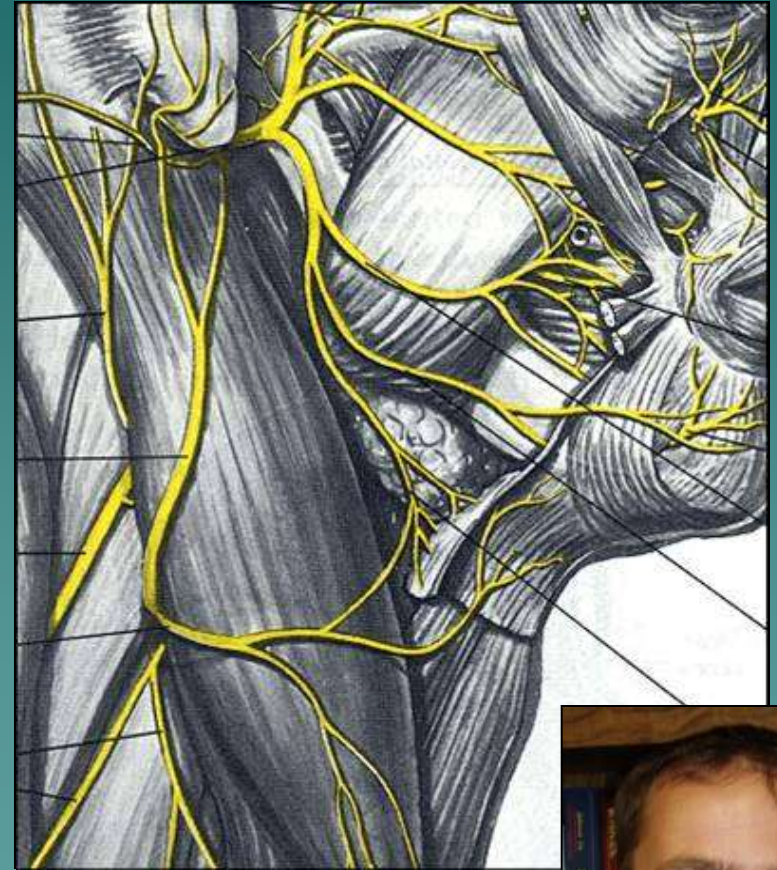
Level I

- ◆ Submental triangle (Ia)
 - Anterior digastric
 - Hyoid
 - Mylohyoid
- ◆ Submandibular triangle (Ib)
 - Anterior and posterior digastric
 - Mandible.

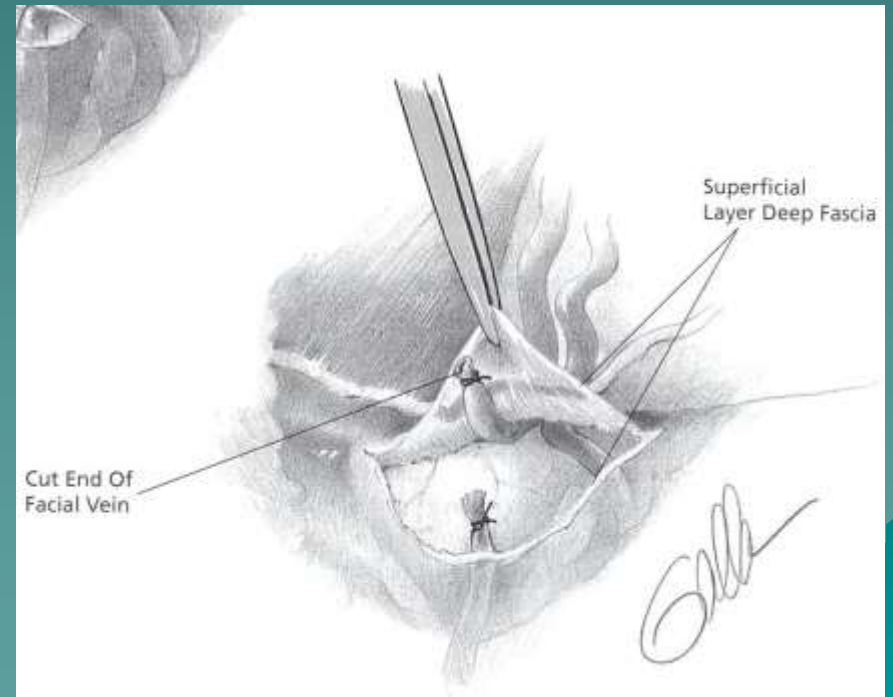
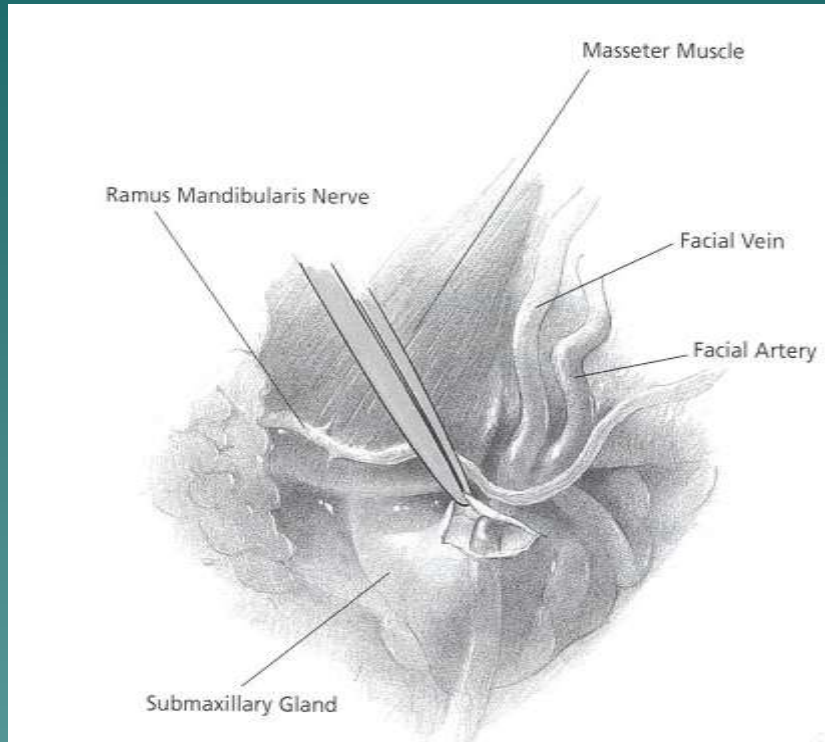


Marginal Mandibular Nerve

- ◆ Most commonly injury dissection level Ib
- ◆ Landmarks:
 - 1cm anterior and inferior to angle of mandible
 - Mandibular notch
- ◆ Subplatysmal
- ◆ Deep to fascia of the submandibular gland
- ◆ Superficial to facial vein

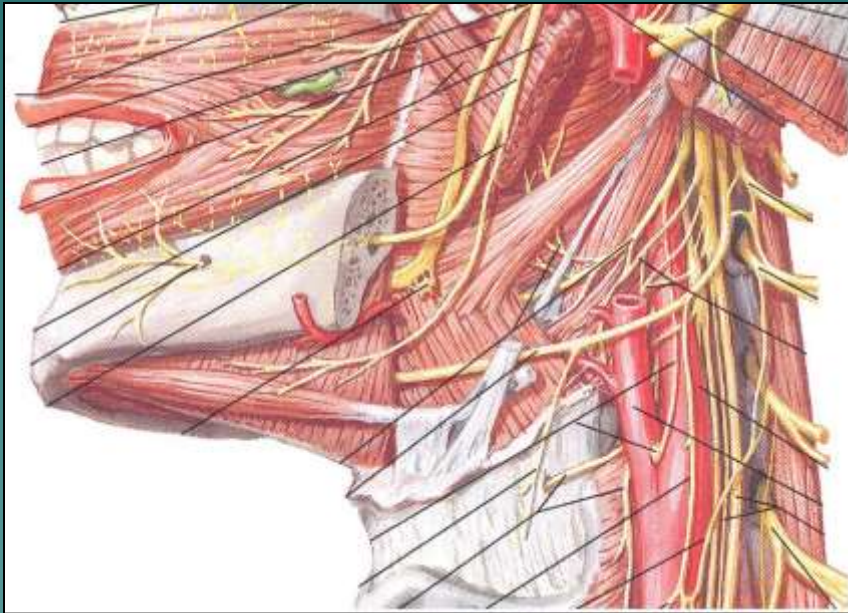


Marginal Mandibular Nerve





Hypoglossal nerve



- ◆ Lies deep to the IJV, ICA, CN IX, X, and XI
- ◆ Curves 90 degrees and passes between the IJV and ICA
- ◆ Ranine veins
- ◆ Lateral to hyoglossus
- ◆ Deep to mylohyoid

Level I

◆ Ia

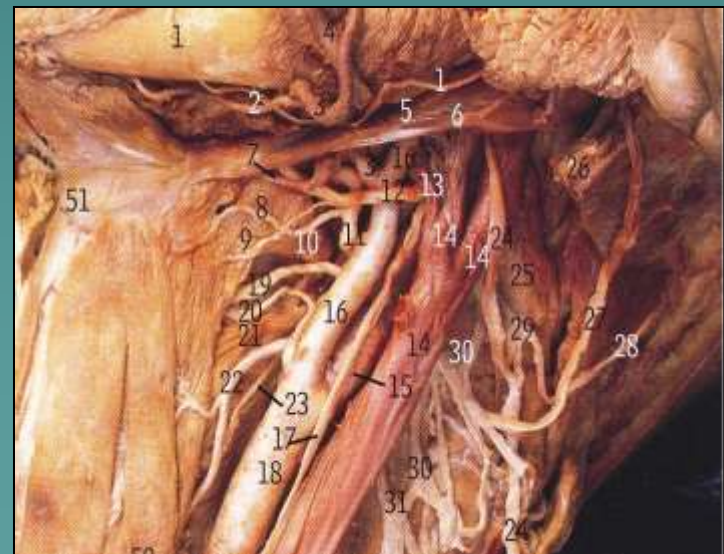
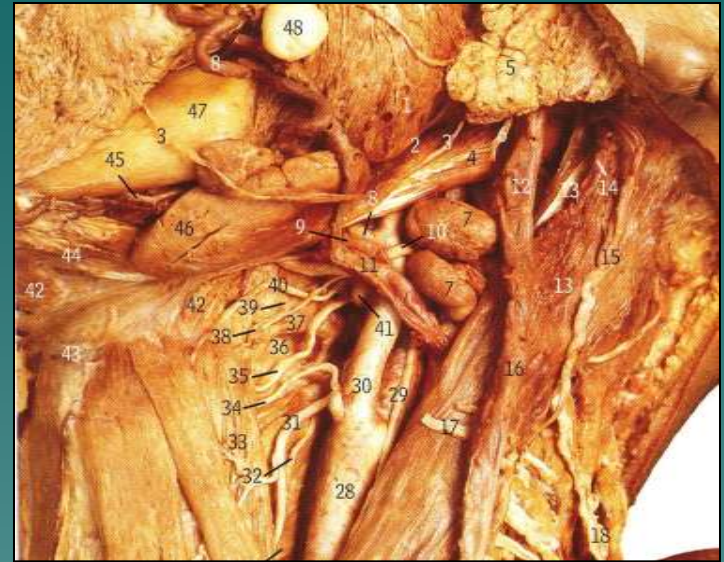
- Chin
- Lower lip
- Anterior floor of mouth
- Mandibular incisors
- Tip of tongue

◆ Ib

- Oral Cavity
- Floor of mouth
- Oral tongue
- Nasal cavity (anterior)
- Face

Level II

- ◆ Upper Jugular Nodes
 - ◆ Anterior → Lateral border of sternohyoid, posterior digastric and stylohyoid
 - ◆ Posterior → Posterior border of SCM
 - ◆ Skull base
 - ◆ Hyoid bone (clinical landmark)
 - ◆ Carotid bifurcation (surgical landmark)
- ◆ Level IIa anterior to XI
- ◆ Level IIb posterior to XI
 - Submuscular recess
 - Oropharynx > oral cavity and laryngeal mets



Spinal Accessory Nerve



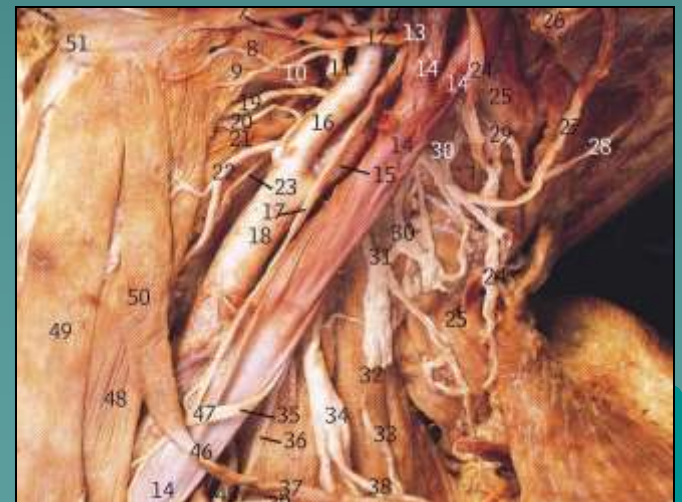
- ◆ CN XI – Relationship with the IJV

Level II

- ◆ Oral Cavity
- ◆ Nasal Cavity
- ◆ Nasopharynx
- ◆ Oropharynx
- ◆ Larynx
- ◆ Hypopharynx
- ◆ Parotid

Level III

- ◆ Middle jugular nodes
 - Anterior → Lateral border of sternohyoid
 - Posterior → Posterior border of SCM
 - Inferior border of level II
 - Cricoid cartilage lower border (clinical landmark)
 - Omohyoid muscle (surgical landmark)
 - ◆ Junction with IJV

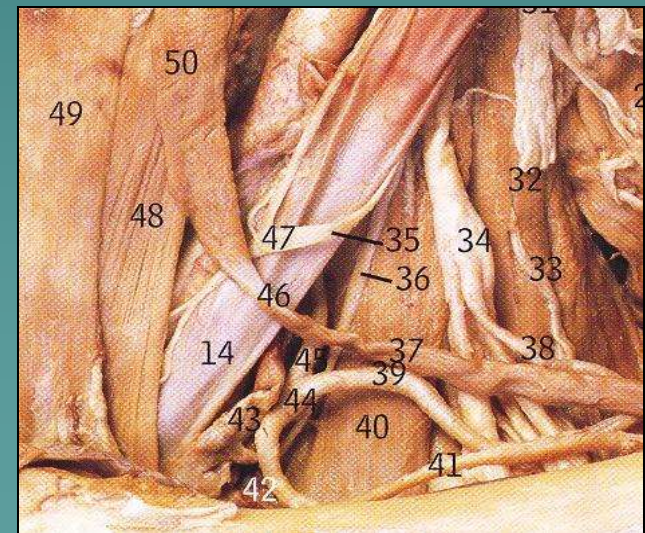
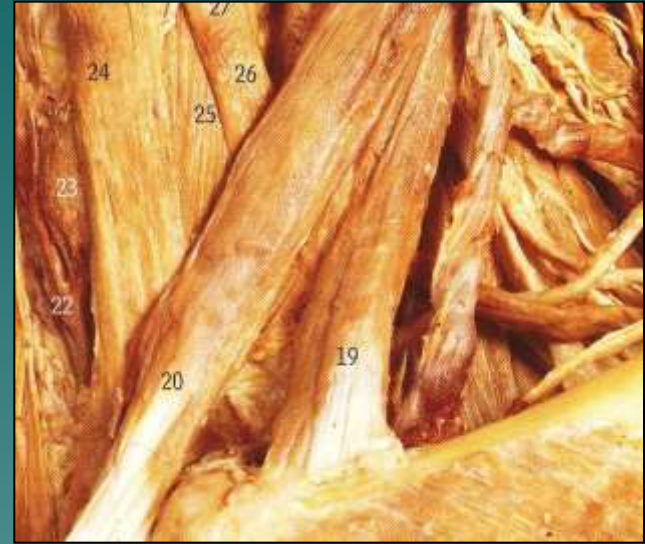


Level III

- ◆ Oral cavity
- ◆ Nasopharynx
- ◆ Oropharynx
- ◆ Hypopharynx
- ◆ Larynx

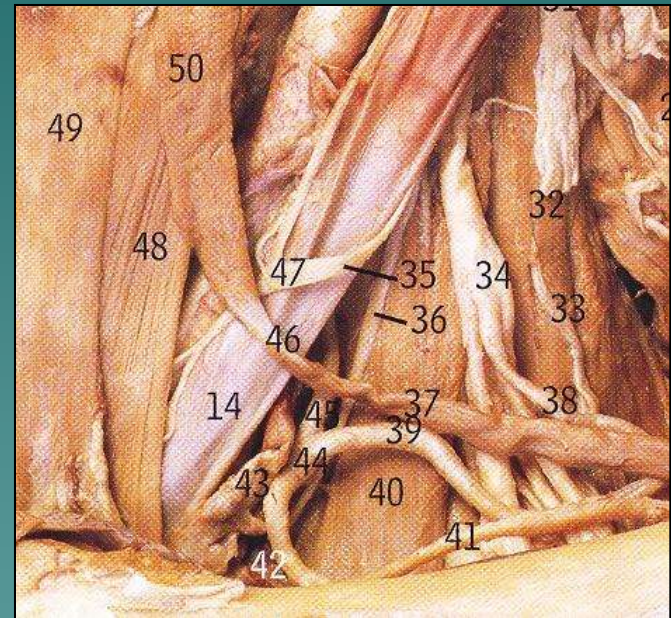
Level IV

- ◆ Lower jugular nodes
 - Anterior → Lateral border of sternohyoid
 - Posterior → Posterior border of SCM
 - Cricoid cartilage lower border (clinical landmark)
 - Omohyoid muscle (surgical landmark)
 - ◆ Junction with IJV
 - Clavicle



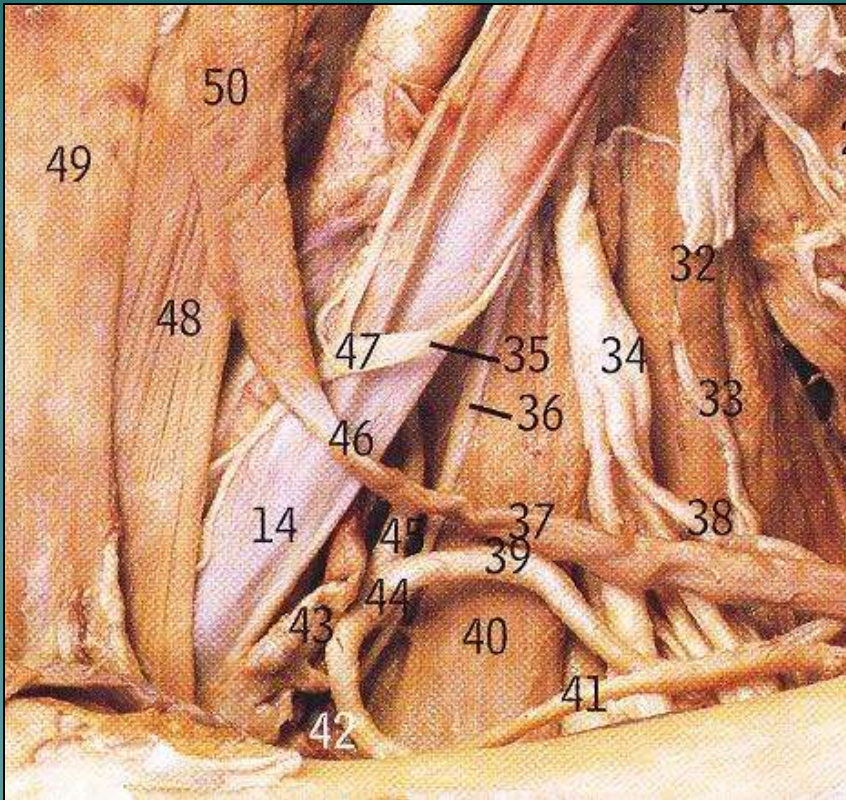
Phrenic Nerve

- ◆ Sole nerve supply to the diaphragm
- ◆ C3-5
- ◆ Anterior surface of anterior scalene
- ◆ Under prevertebral fascia
- ◆ Posterolateral to carotid sheath

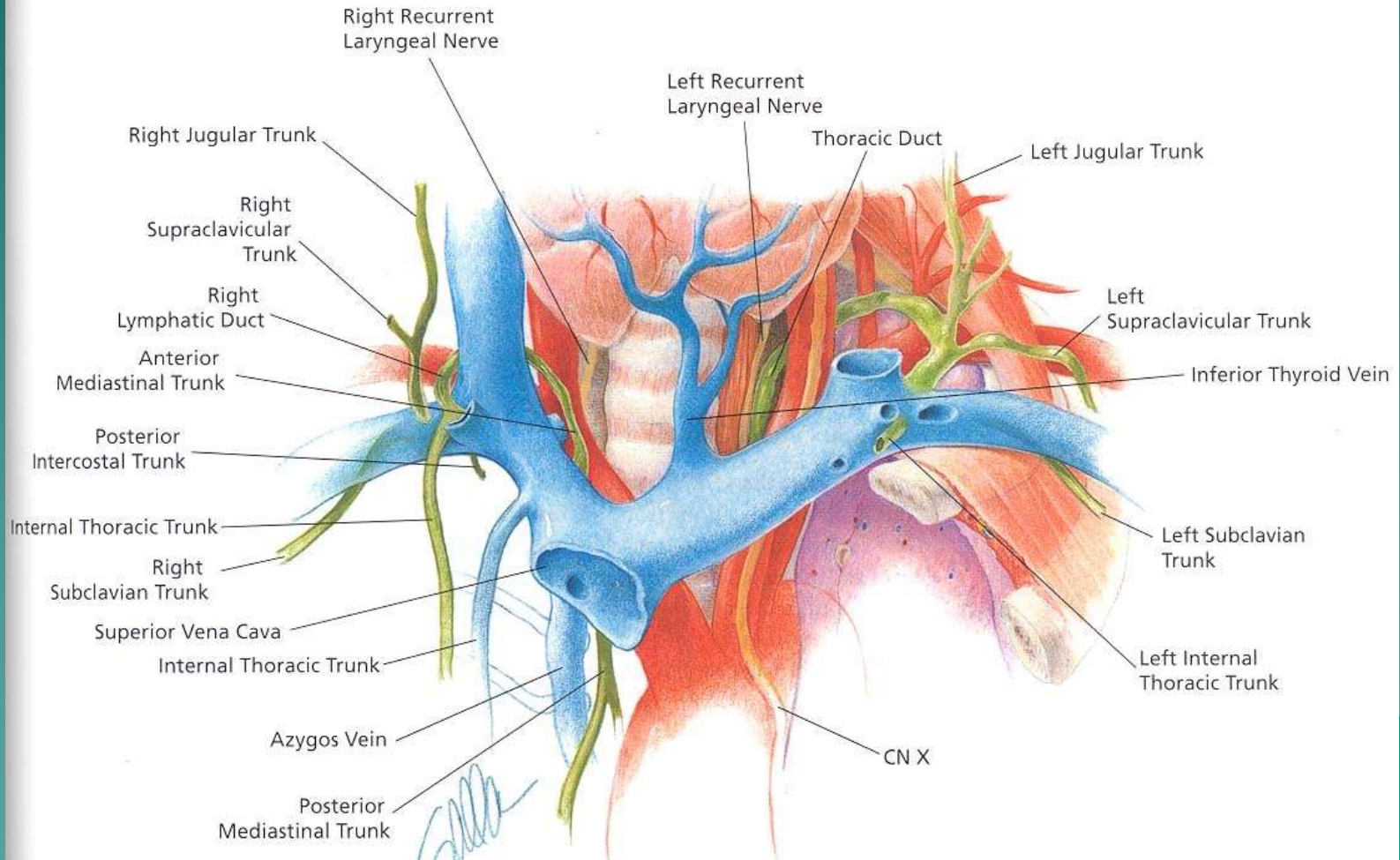


Thoracic duct

- ◆ Conveys lymph from the entire body back to the blood
 - Exceptions:
 - ◆ Right side of head and neck, RUE, right lung right heart and portion of the liver
 - Begins at the cisterna chyli
 - Enters posterior mediastinum between the azygous vein and thoracic aorta
 - Courses to the left into the neck anterior to the vertebral artery and vein
 - Enters the junction of the left subclavian and the IJV



Thoracic Duct



Level IV

- ◆ Hypopharynx
- ◆ Larynx
- ◆ Thyroid
- ◆ Cervical esophagus

Level V

- ◆ Posterior triangle of neck
 - Posterior border of SCM
 - Clavicle
 - Anterior border of trapezius
 - Va → Spinal accessory nodes
 - Vb → Transverse cervical artery nodes
 - ◆ Radiologic landmark
 - Inferior border of Cricoid
 - Supraclavicular nodes



Spinal Accessory Nerve

- ◆ Penetrates deep surface of the SCM
- ◆ Exits posterior surface of SCM deep to Erb's point
- ◆ Traverses the posterior triangle on the levator scapulae
- ◆ Enters the trapezius about 5 cm above the clavicle

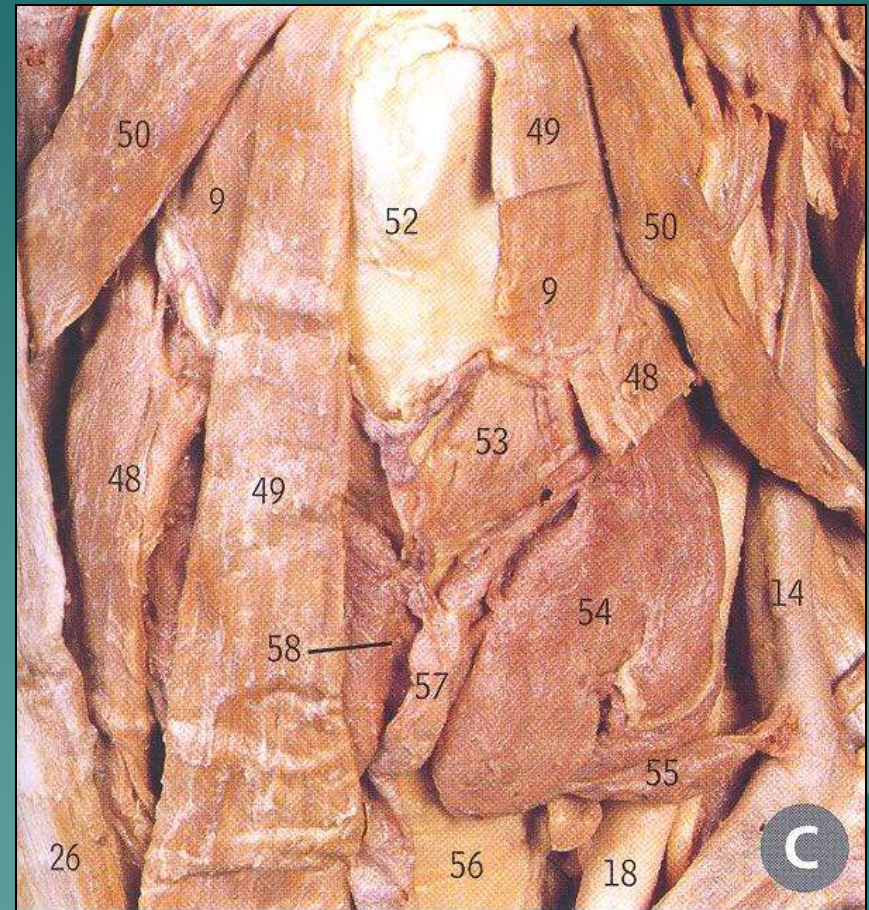


Level V

- ◆ Nasopharynx
- ◆ Oropharynx
- ◆ Posterior neck and scalp

Level VI

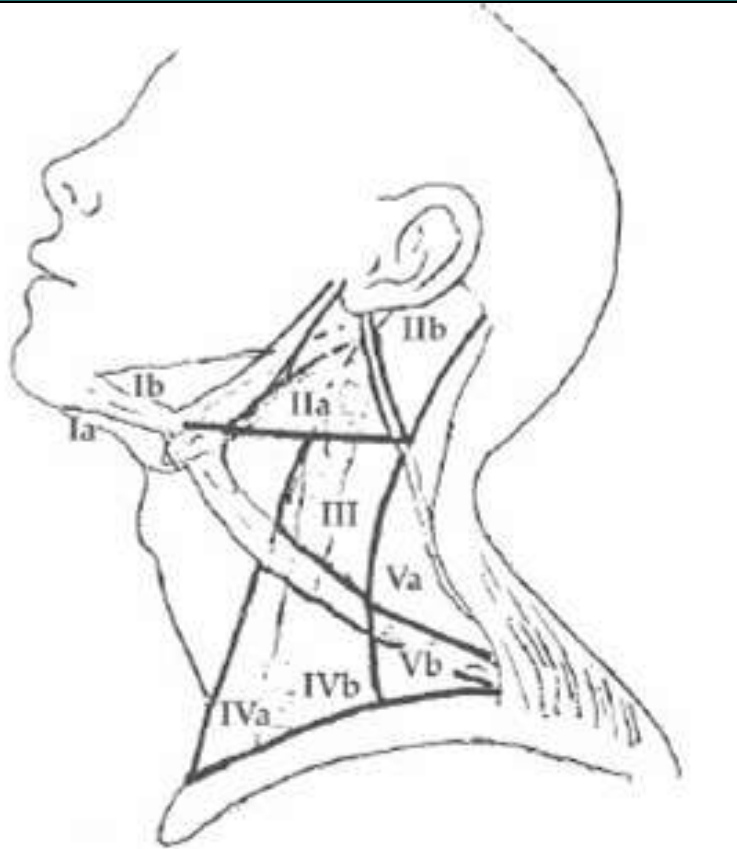
- ◆ Anterior compartment
 - Hyoid
 - Suprasternal notch
 - Medial border of carotid sheath
 - Perithyroidal lymph nodes
 - Paratracheal lymph nodes
 - Precricoid (Delphian) lymph node



Level VI

- ◆ Thyroid
- ◆ Larynx (glottic and subglottic)
- ◆ Pyriform sinus apex
- ◆ Cervical esophagus

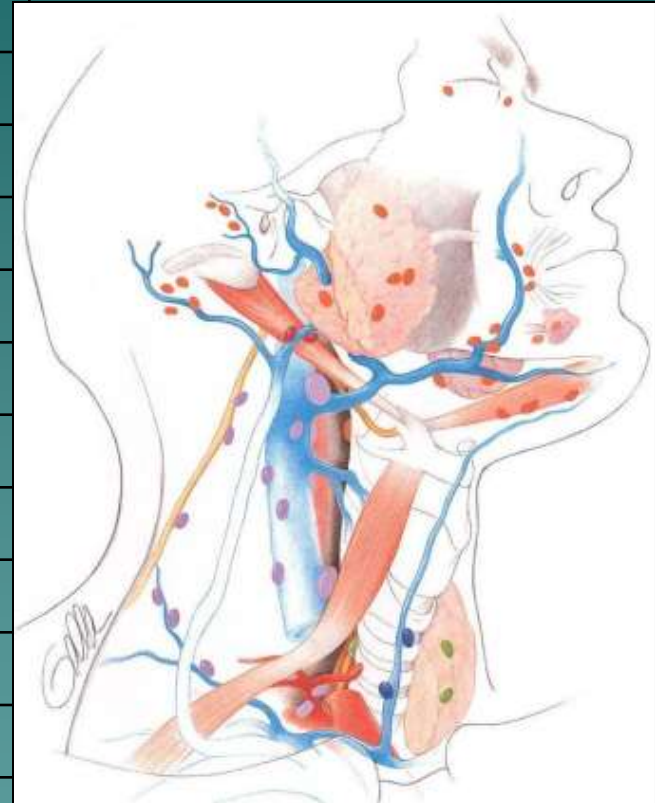
Subgroups



- ◆ Ia Submental
- ◆ Ib Submandibular
- ◆ IIa Upper jugular (Anterior to XI)
- ◆ IIb Upper jugular (Posterior to XI)
- ◆ III Middle jugular
- ◆ IVa Lower jugular (Clavicular)
- ◆ IVb Lower jugular (Sternal)
- ◆ Va Posterior triangle (XI)
- ◆ Vb Posterior triangle (Transverse cervical)
- ◆ VI Central compartment

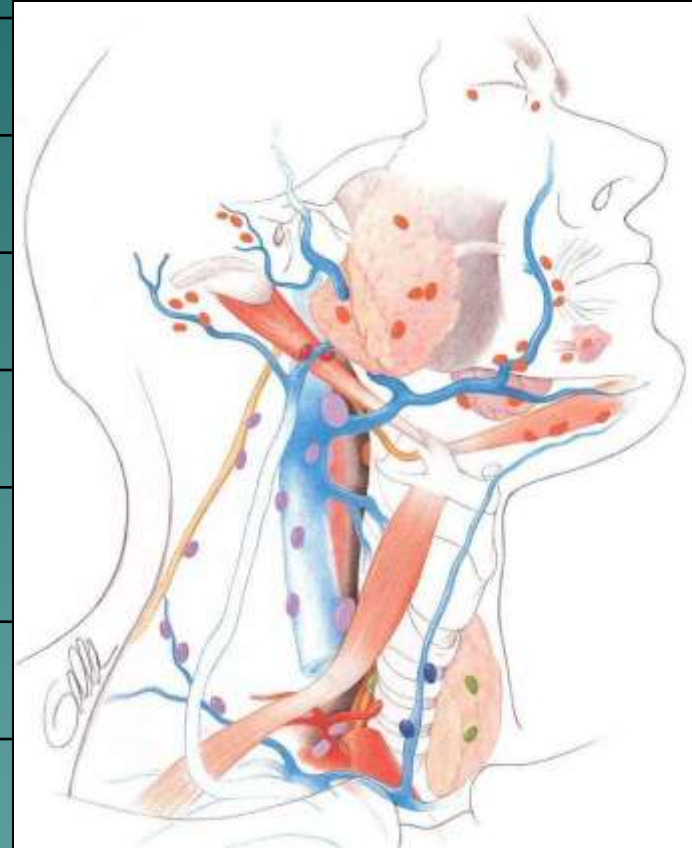
Common Nodal Drainage Patterns

Face and Scalp	Anterior	Facial, Ib
	Lateral	Parotid
	Posterior	Occipital, V
Eyelids	Medial	Ib
	Lateral	Parotid, II
Chin		Ia, Ib, II
External Ear	Anterior	Parotid, II
	Posterior	Post auricular, II, V
Middle Ear		Parotid, II
Floor of mouth	Anterior	Ia, Ib, IIa > IIb
	Lower incisors	Ia, Ib, IIa > IIb
	Lateral	Ib, IIa > IIb, III
	Teeth except incisors	Ib, IIa > IIb, III
Nasal Cavity	Anterior	Ib
	Posterior	Retropharyngeal, II, V



Common Nodal Drainage Patterns

Nasal Cavity	Posterior	Retropharyngeal, II, V
Nasopharynx		Retropharyngeal, II, III, V
Oropharynx		IIb > IIa, III, IV, V
Larynx	Supraglottic	IIa > IIb, III, IV
	Subglottic	VI, IV
Cervical esophagus		IV, VI
Thyroid		VI, IV, V, Mediastinal
Tongue	Tip	Ia, Ib, IIa > IIb, III, IV
	Lateral	Ib, IIa > IIb, III, IV

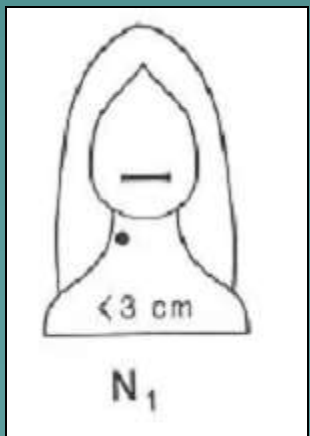


Staging

- ◆ Nx: Regional lymph nodes cannot be assessed.

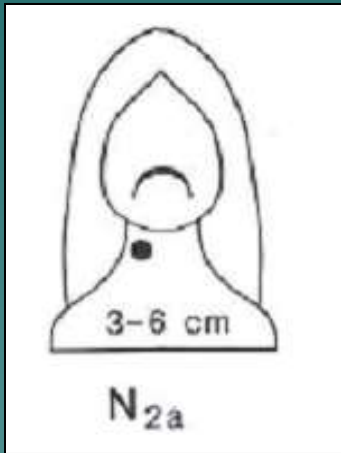


- ◆ N₀: No regional lymph node metastases.

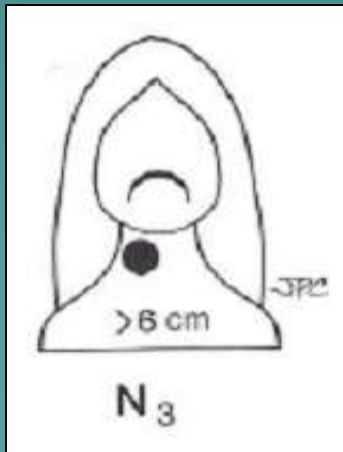


- ◆ N₁: Single ipsilateral lymph node, ≤ 3 cm

Staging



- ◆ N2a: Single ipsilateral lymph node 3 to 6 cm
- ◆ N2b: Multiple ipsilateral lymph nodes \leq 6 cm
- ◆ N2c: Bilateral or contralateral nodes \leq 6cm



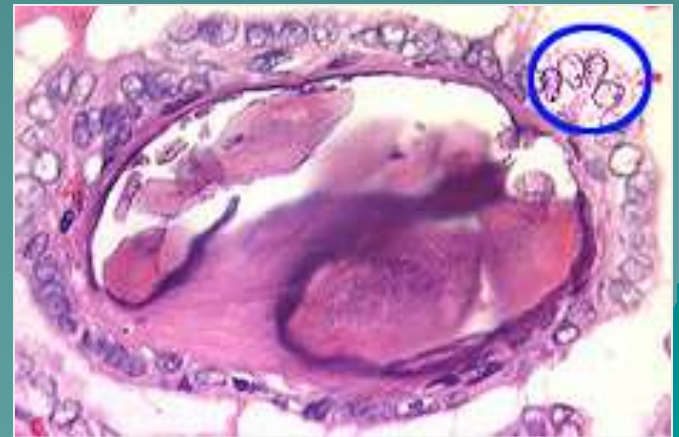
- ◆ N3: Metastases $>$ 6 cm

Staging

- ◆ Nasopharyngeal Carcinoma
 - N1 – Unilateral < 6cm
 - N2 – Bilateral < 6 cm
 - N3a > 6 cm
 - N3b – Extension to supraclavicular fossa



- ◆ Thyroid
 - N1 – Regional node mets
 - ◆ N1a - Ipsilateral
 - ◆ N1b - Bilateral, midline, contralateral cervical or mediastinal LN

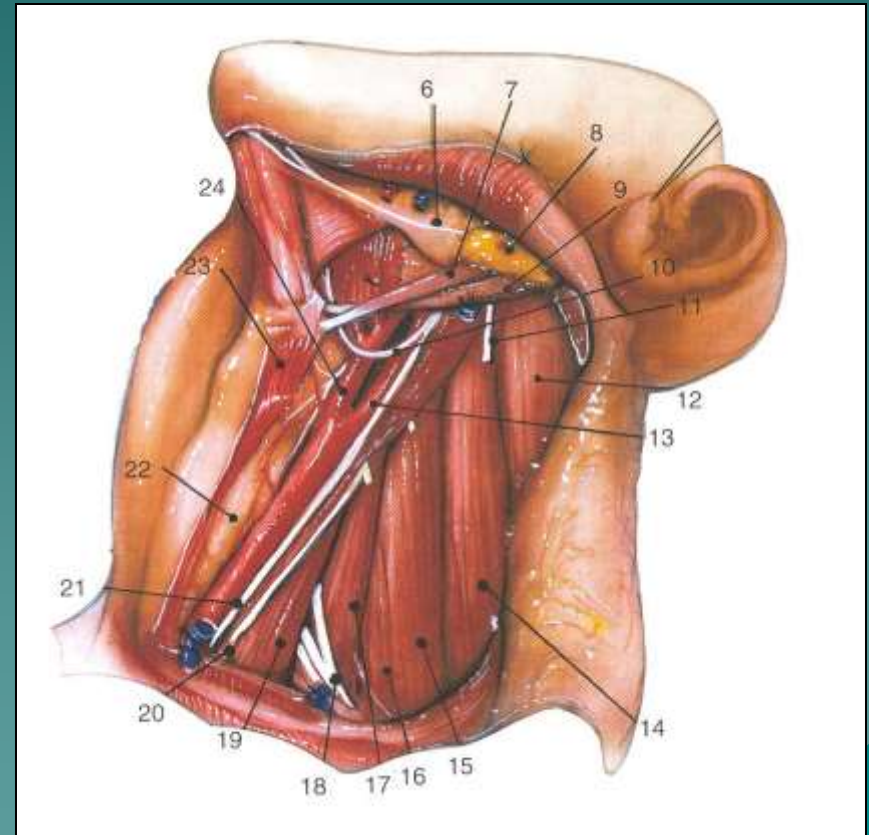


Classification

- ◆ Radical
 - Gold standard operation
- ◆ Modified radical
 - Preservation of non lymphatic structures
- ◆ Selective
 - Preservation of lymph node groups
- ◆ Extended
 - Removal of additional lymph node groups or non lymphatic structures

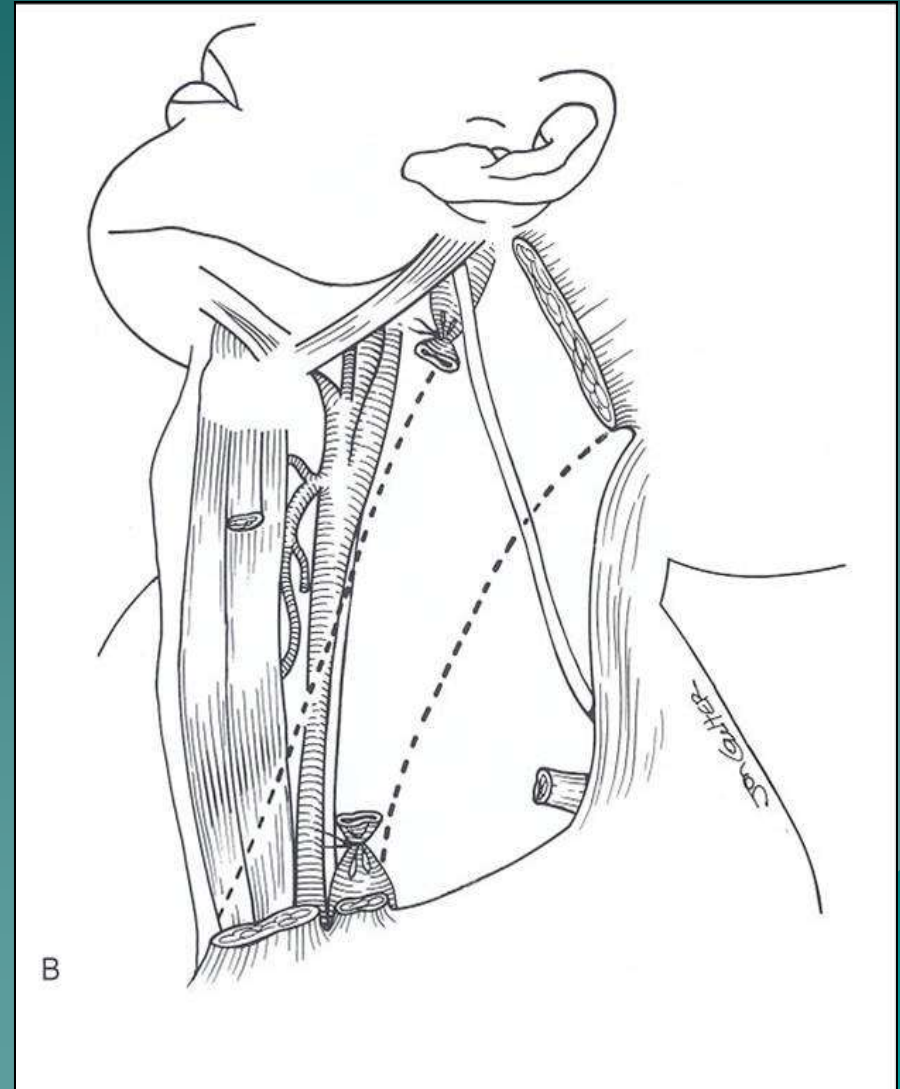
Radical Neck Dissection

- ◆ Removes
 - Nodal groups I-V
 - SCM, IJV, XI
 - Submandibular gland, tail of parotid
- ◆ Preserves
 - Posterior auricular
 - Suboccipital
 - Retropharyngeal
 - Periparotid
 - Perifacial
 - Paratracheal nodes



Modified Radical Neck Dissection

- ◆ Removes
 - Nodal groups I-V
- ◆ Preserves
 - SCM, IJV, XI (any combination)
- ◆ Notate according to which structures are preserved



Selective Neck Dissection

- ◆ Remove high risk lymph node groups based on tumor site.
- ◆ Supraomohyoid
 - Levels I-III
- ◆ Lateral
 - Levels II-IV

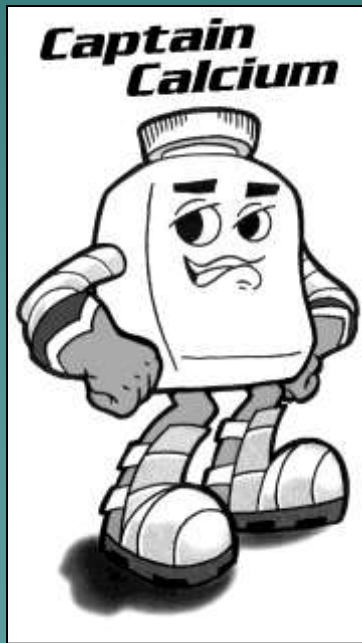
Selective Neck Dissection

- ◆ Posterolateral
 - Levels II-V
 - Postauricular nodes
 - Suboccipital nodes



Selective Neck Dissection

- ◆ Anterior
 - Level VI
 - RLN injury
 - Hyperparathyroidism



Extended Neck Dissection

- ◆ Removal of any structures that are routinely preserved in a neck dissection.
- ◆ Notated by naming the structure(s) removed.

Sentinel Lymph Node



- ◆ Overview
- ◆ N_0 Neck
- ◆ Techniques
- ◆ Results

Sentinel Lymph Node History

- ◆ 1955 → First echelon node
- ◆ 1960 → “Sentinel node”
- ◆ 1977 → Demonstrated in penile cancer
- ◆ 1992 → Morton reintroduced concept in N0 melanoma
- ◆ Currently widely used in melanoma and breast cancer therapy.

Sentinel lymph node concept

- ◆ Tumor spreads via lymphatics to a primary node.
- ◆ Examination of primary echelon nodes for tumor direct the need for surgical management of the nodal basins.

Sentinel lymph node concept

- ◆ Difficulties of lymphatic mapping in head and neck (O'Brien).
 1. It is difficult to visualize lymphatic channels using lymphoscintigraphy because of proximity to the injection site.
 2. The radiotracer travels fast in the lymphatic vessels.
 3. If more than one node is visible, it can be difficult to distinguish first echelon nodes from second-echelon nodes.
 4. The SLN may be small and not easily accessible (eg, in the parotid gland).

N₀ Neck

- ◆ Occult neck disease
 - Head and neck cancer → 30%
 - Oral cavity CA → 20% to 45%
- ◆ Factors that indicate > 20% chance of subclinical metastases
 - Tumor thickness > 4mm
 - Size > 2 cm
 - Anatomic location

Accuracy of diagnostic methods in detecting occult cervical metastases.

	Sensitivity % (range)	Specificity % (range)
Palpation	35 (30-40)	35 (27-42)
CT	45 (17-86)	11 (3-21)
US	46 (42-50)	21 (11-33)
MRI	42 (20-70)	14 (5-26)
US FNAC	42 (27-50)	0

A new approach to pre-treatment assessment of the N0 neck in oral squamous cell carcinoma: the role of sentinel node biopsy and positron emission tomography

N₀ Neck Treatment

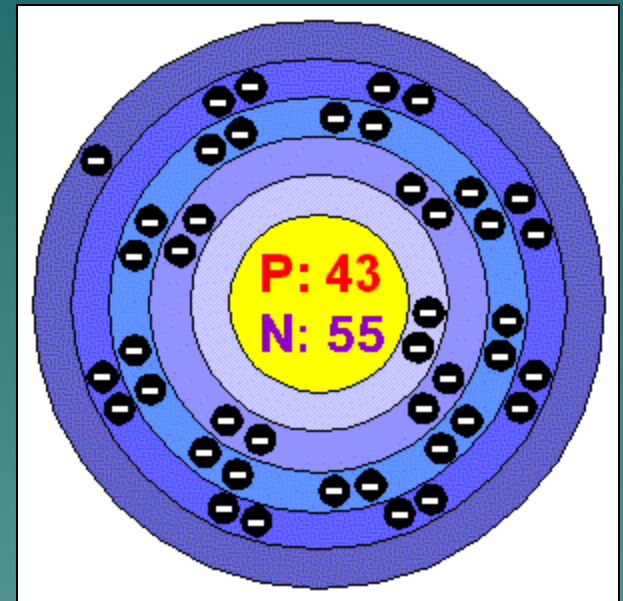
- ◆ T1/T2 N0 oral SCCA
 - Better 10-year survival in pts who had elective neck dissection.
- ◆ T1/T2 N0 tongue SCCA
 - 5-year actuarial benefit for elective neck management

Sentinel Lymph Node Biopsy and N₀ Oral Cavity SCCA

- ◆ Multiple small case series display the feasibility of SLNB in oral SCCA
- ◆ Majority of lesions T1/T2
- ◆ No standardized techniques
- ◆ All series compare
 - Pre op lymphoscintigraphy
 - Intra-op localization
 - Post op pathology

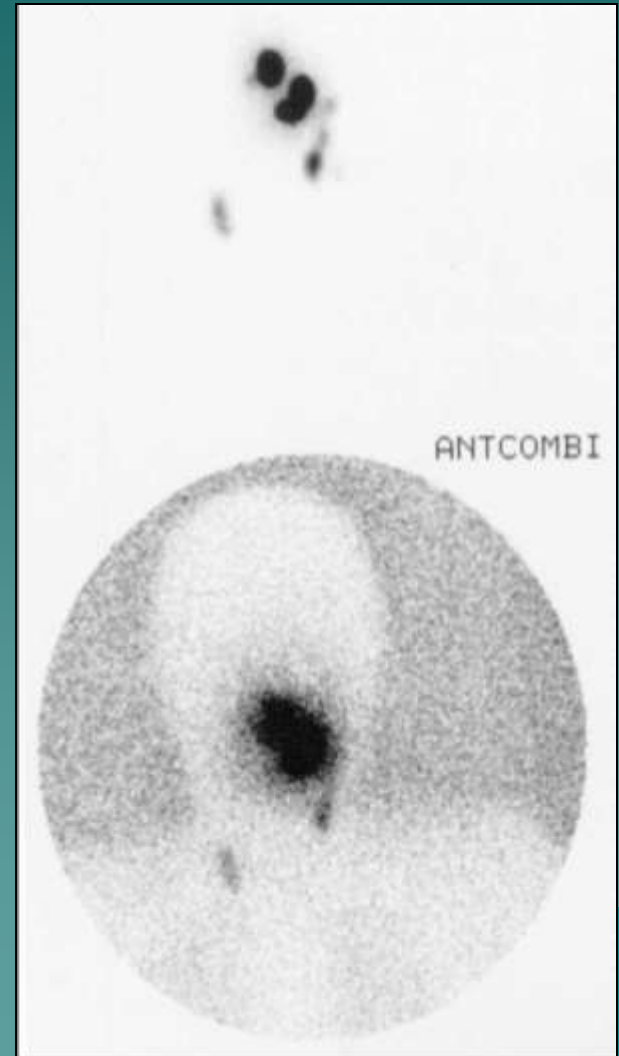
Pre op Technique

- ◆ Technetium
 - Day before surgery
 - Submucosal injections
 - 10-30 MBq Tc 99m per quadrant
 - +/- local anesthesia
 - Avoid spillage
 - Rinse mouth
- ◆ Dosage does not correlate with ability to identify nodes



Pre op Technique

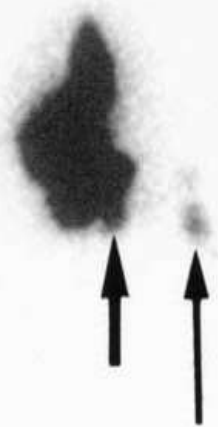
- ◆ Lymphoscintigraphy
 - Dynamic
 - ◆ 45 -60 minutes
 - ◆ Necessary to clearly identify sentinel nodes
 - ◆ SLNs seen within 15 minutes
 - Static
 - ◆ Confirms dynamic images
 - ◆ AP / Lateral / Oblique
 - ◆ Delayed images for non revealing dynamic studies
 - Cobalt pencil
 - ◆ Labels anatomical points
 - Left / right mandible
 - Chin
 - Cricoid cartilage
 - Sternal notch



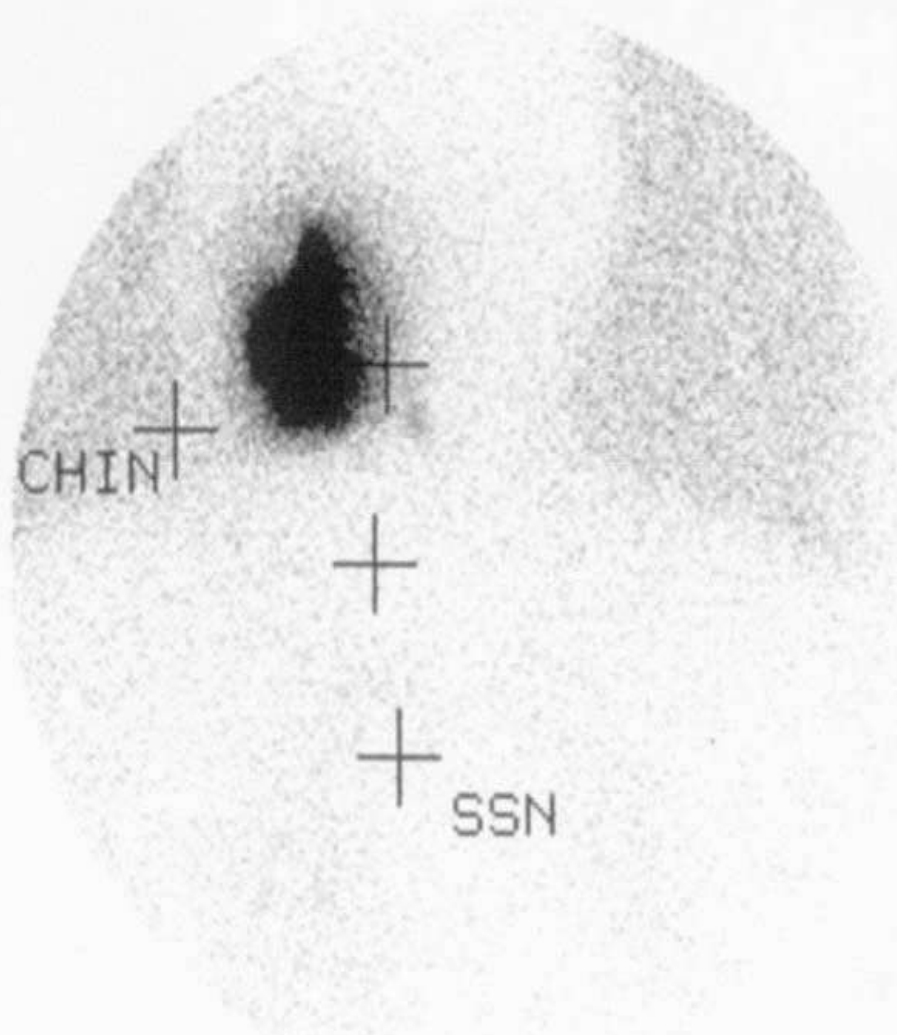
Right Lateral Trans + Emission

Right Lateral

MANDIBLE +
+ CHIN
+ CRICOID
+ SSN



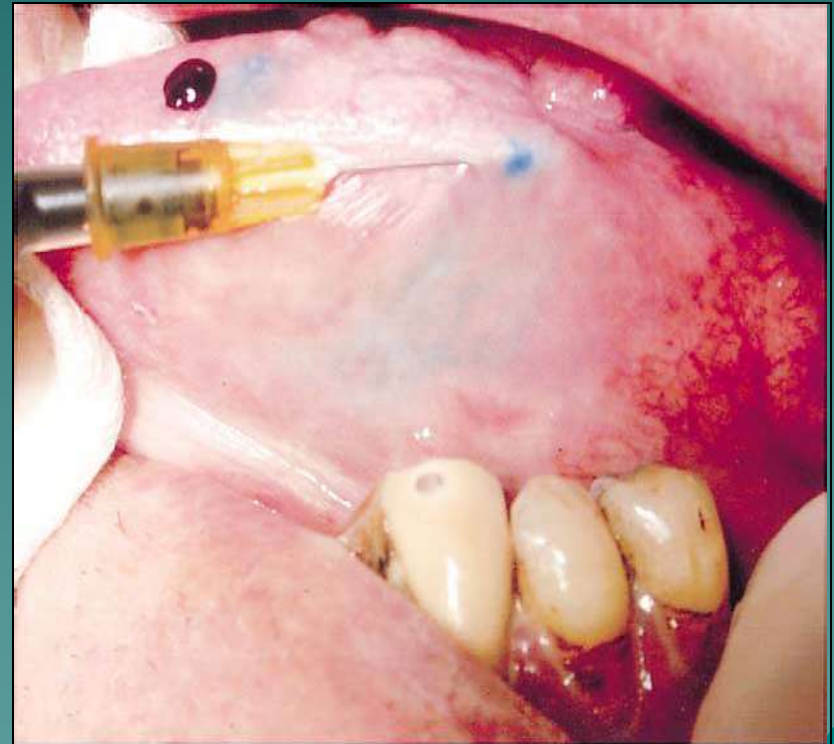
Left Lateral



Left Lateral Trans + Emission

Pre op Technique

- ◆ Blue Dye
 - Submucosal injection
 - 2.5% Patent Blue dye
 - No more than 20 min pre incision



Operative Technique

- ◆ Limited incision guided by lymphoscintigraphy and gamma probe
- ◆ Frozen section analysis

Operative Technique

- ◆ Gamma probe
 - Examine operative bed for increased signal
 - Tumor extirpation
 - Lead shield
 - Removal of high signal nodes
 - Examine removed node and compare to operative bed



Complications

- ◆ Reported complication rates < 1%
 - Cutaneous malignancy cases
- ◆ Injury of VII, XI due to limited exposure

Results

- ◆ Sentinel nodes found in $> 90\%$ of cases.
 - Experience matters
 - Surgeons with less than 10 cases \rightarrow 56% success in SLNB
- ◆ Lymphoscintigraphy revealed unexpected bilateral or contralateral disease in about 14% of pts
- ◆ About 2-3 SLN per patient

Results

- ◆ Up to 46% of SLN harbor metastases
 - Fine section frozen analysis
 - ◆ Increases sensitivity to about 95%
 - Immunohistochemical staining
- ◆ False negative rates
 - 10%
 - Grossly involved nodes less likely to take up tracer
- ◆ Better sensitivity for T1/T2 lesions
 - Most false negative results associated with larger T3 lesions

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