Neuroradiology Primer: Basic Anatomy and Study Interpretation

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Lecture Overview

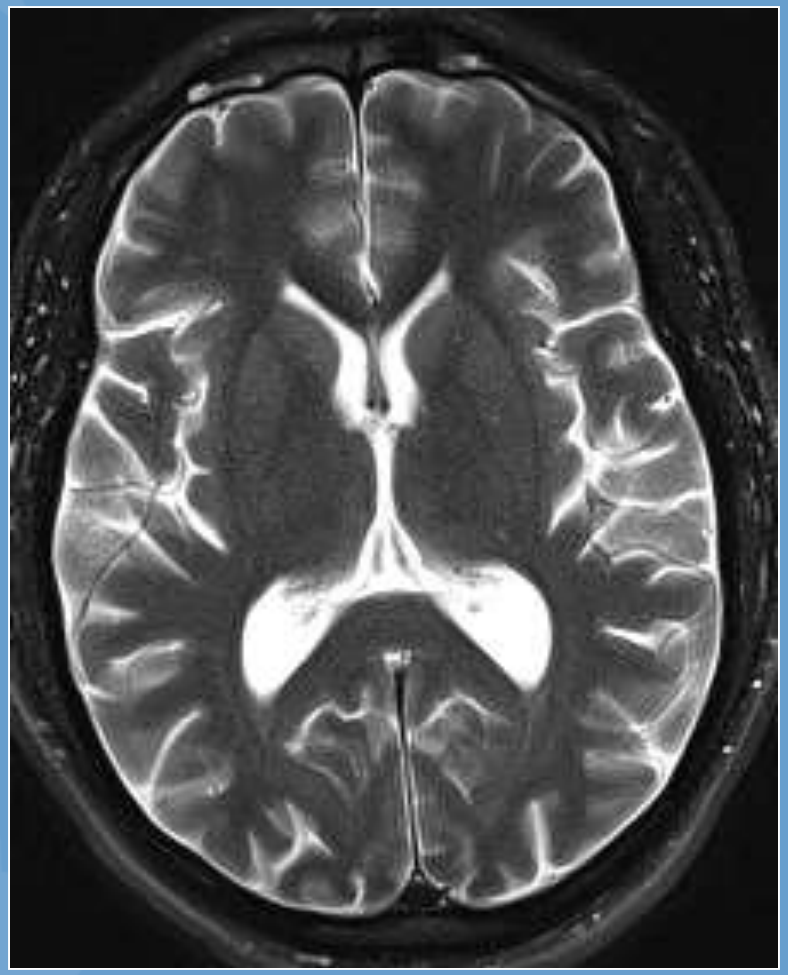
- Types of studies
- Basics of x-sectional imaging
- Imaging anatomy
  - Brain
  - Head & Neck
  - Spine

CT

- Pros
  - Fast
  - Excellent screening tool
  - Clinician comfort
- Cons
  - Poorer soft tissue contrast
  - Ionizing radiation
  - Acute contrast nephropathy

MRI

- Pros
  - Better soft tissue contrast
  - Multiplanar aquisition
  - Gives more information
  - No ionizing radiation
- Cons
  - Takes a long time
    - ↑ susceptibility to motion
  - More difficult to interpret
  - Certain implants/FB contraindicated
  - NSF



What can we see?

- Air
- Fat
- Soft tissue (GM, WM, muscle, glands)
- Bone
- Blood vessels (IV contrast)

Plane of Orientation

Axial

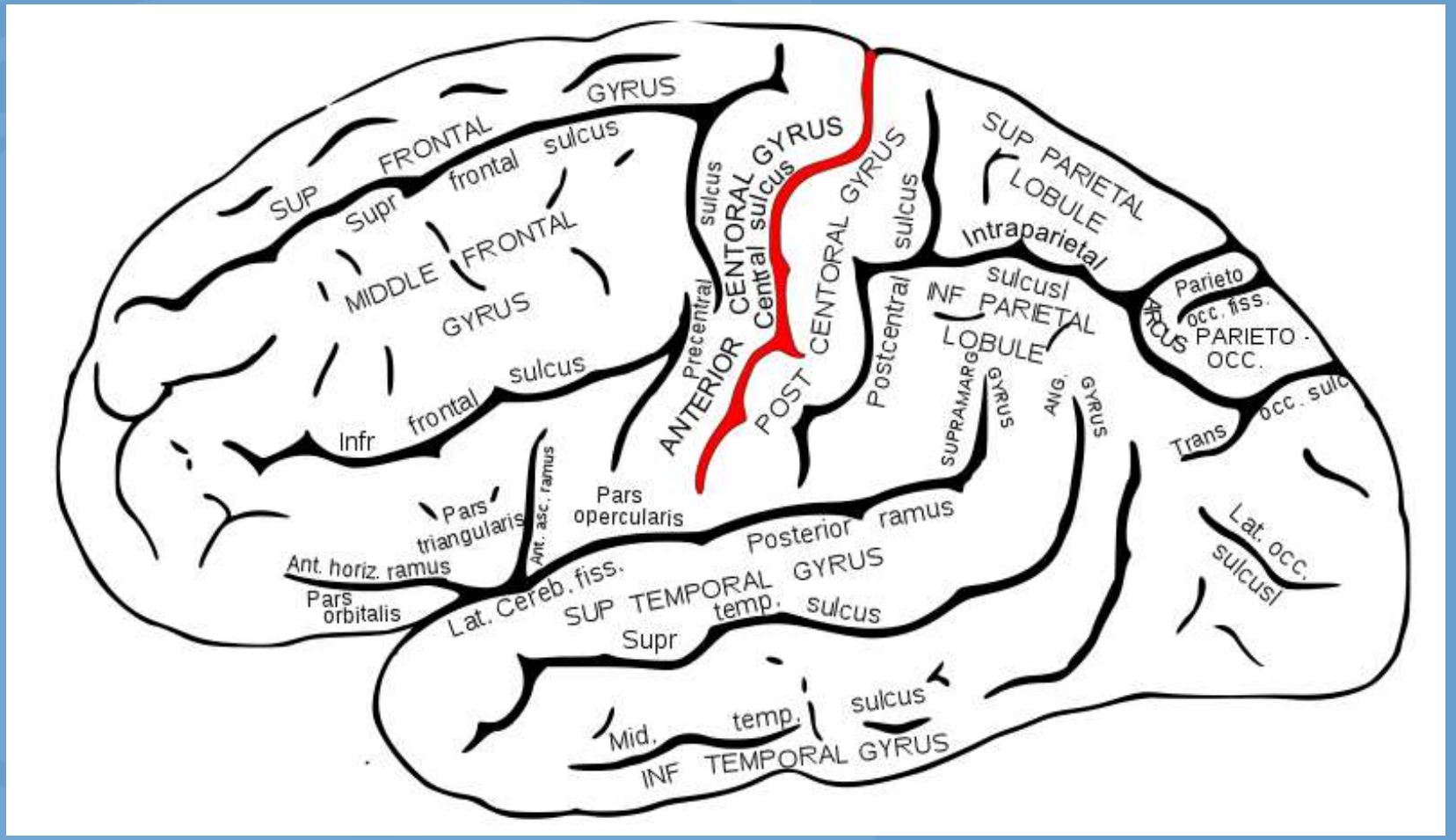
Coronal

Sagittal

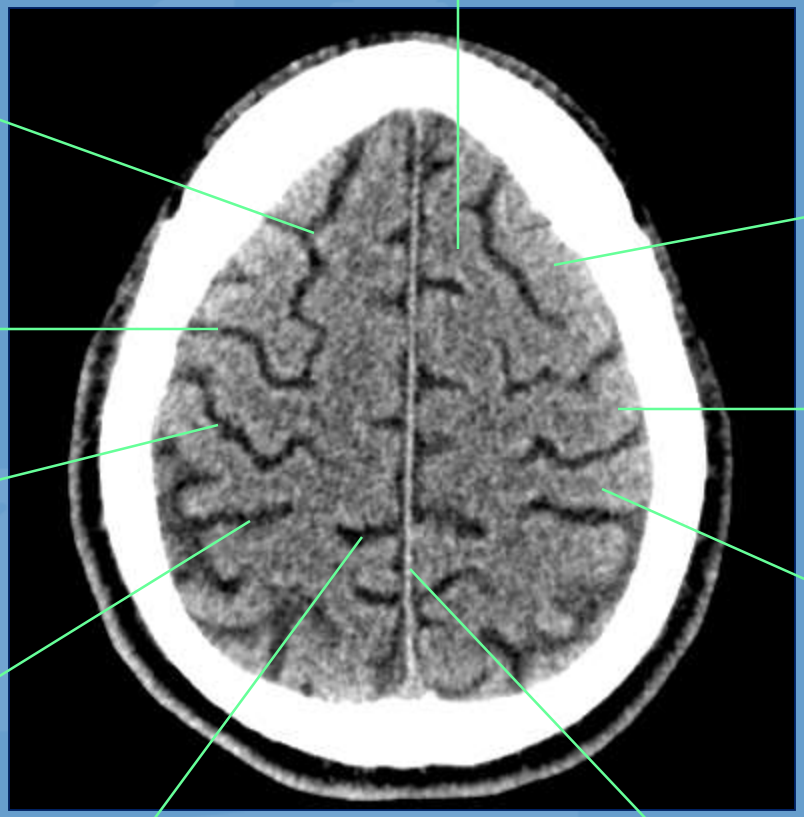
*On axial & coronal images, the RIGHT side of the patient is on the LEFT side of the image

Head CT
Anatomy and Basic Interpretation

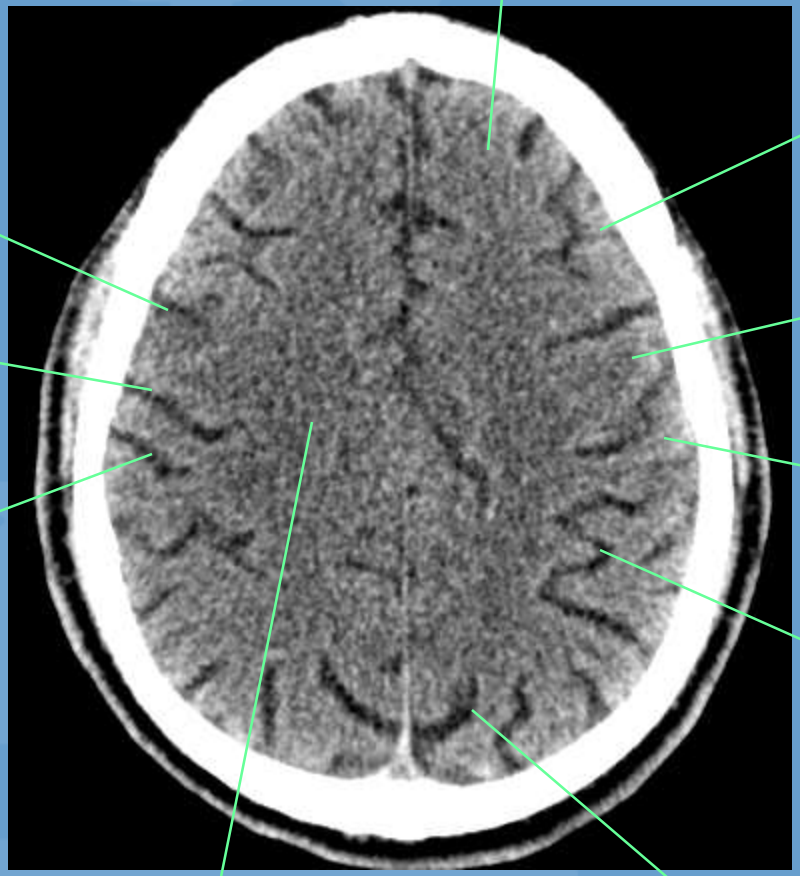
Surface Anatomy of the Brain



Vertex Level



Centrum Semiovale Level



Lateral Ventricle Level

Caudate body

Central sulcus

Lateral (Sylvian) fissure, posterior segment

Superior temporal sulcus

Parieto-occipital fissure

Corona radiata

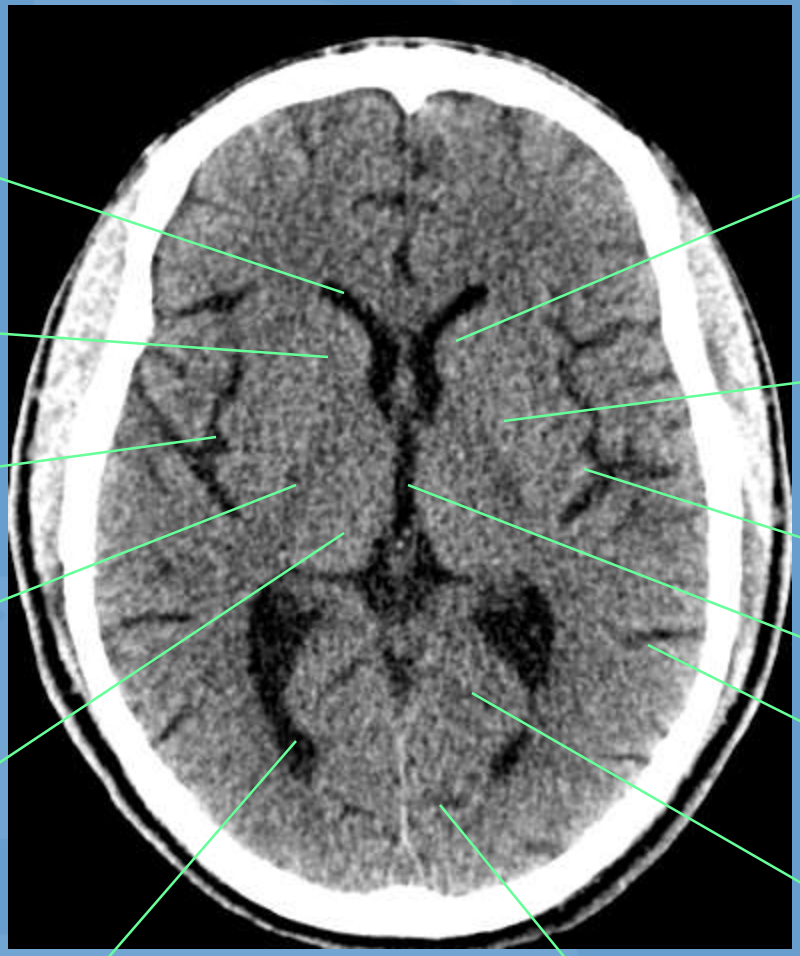
Lateral ventricle

Superior temporal gyrus

Intra-occipital sulcus

Superior sagittal sinus

3rd Ventricle Level



Lateral ventricle, frontal horn

Internal capsule, anterior limb

Lateral (Sylvian) fissure

Internal capsule, posterior limb

Thalamus

Lateral ventricle, occipital horn

Calcarine sulcus

Parieto-occipital fissure

Superior temporal sulcus

3rd ventricle

Insula

Basal ganglia, lentiform nuclei (GP & putamen)

Caudate, head

Midbrain Level

Superior temporal gyrus

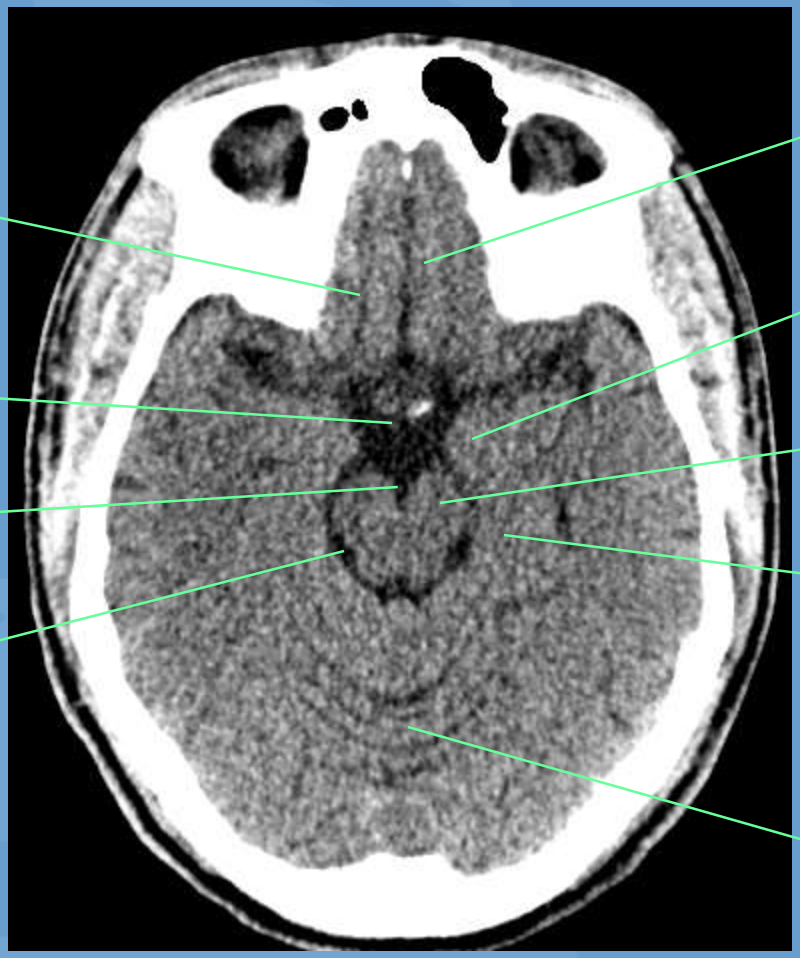
Cerebral aqueduct (of Sylvius)

Lateral (Sylvian) fissure

Midbrain

Quadrigeminal cistern

Suprasellar Cistern Level



Brachium Pontis Level

Temporal lobe

Cerebellopontine angle cistern

Middle cerebellar peduncle (Brachium pontis)

Cerebellar hemisphere

Vermis

Sella turcica

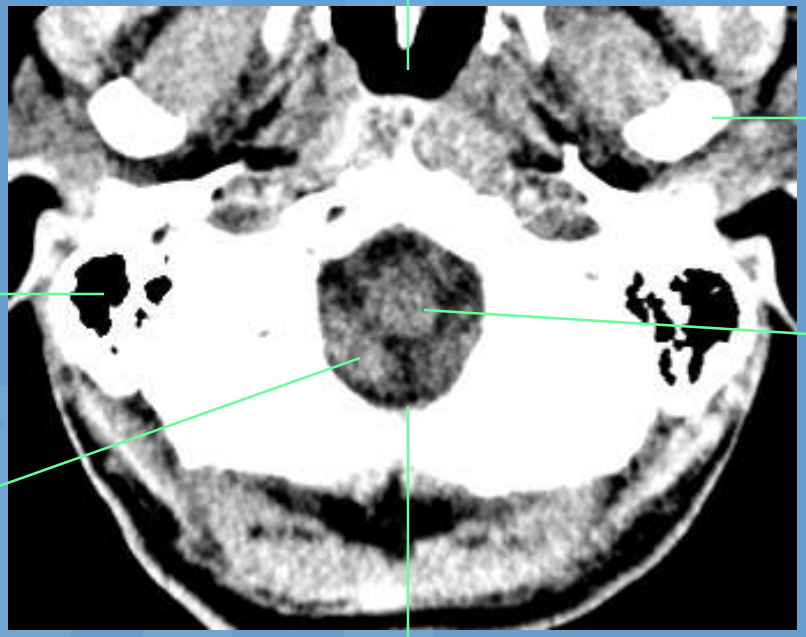
Prepontine cistern

Pons

Sigmoid sinus

4th ventricle

Foramen Magnum Level



What to look at on a head CT

- Blood (Intra- vs. extraaxial)
- Gray/white differentiation
- Edema
- Masses/Mass effect
  - Midline shift
  - Cisterns (effacement → herniation)
- Ventricles (hydro)
- Bones (fxs, lysis, sclerosis)
- Paranasal sinuses/mastoids
- Extracranial soft tissue

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W=30 L=30

“Stroke” window

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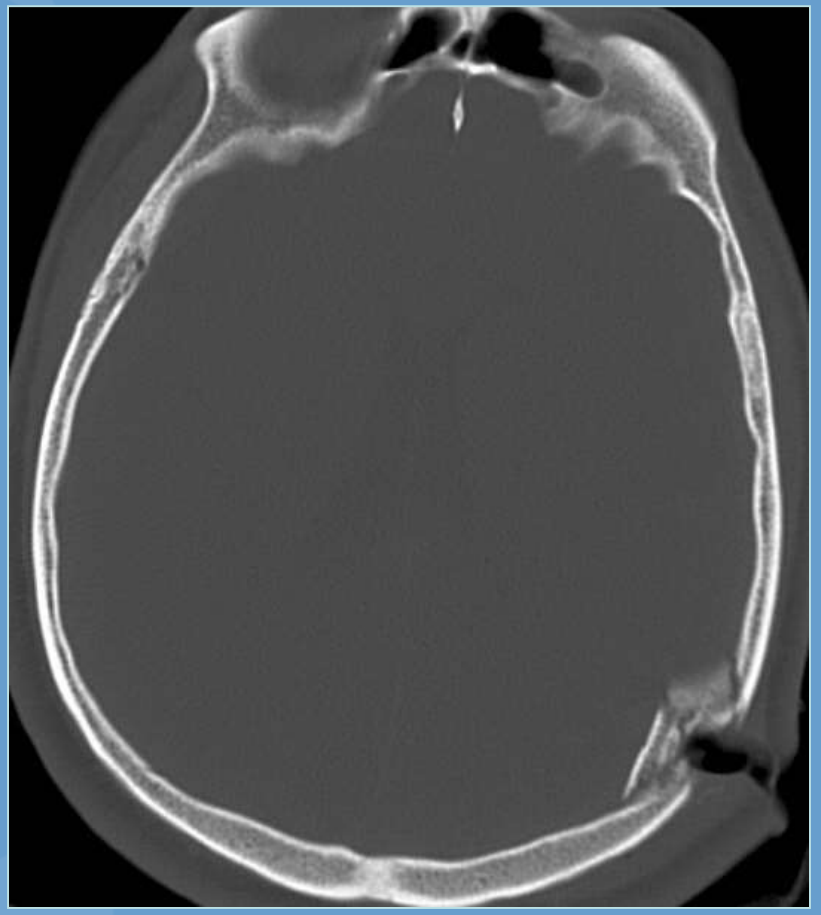

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“Blood Can Be Very Bad”

1) “Blood” – intra- or extraaxial
2) “Can” = Cisterns & extra-axial CSF – effacement or asymmetry
3) “Be” = Brain
   - Gray/white differentiation
   - Symmetry
   - Shift
   - Hyper- or hypodensity
4) “Very” = Ventricles – too big or too small
5) “Bad” = Bones, sinuses, & extracranial tissues

What's wrong with this picture?

Neck CT
Anatomy and Basic Interpretation

What to look at on a neck CT

- Brain
- Orbits/globes
- Aerodigestive tract
  - Nasal cavities & sinuses
  - Oral cavity, pharynx, esophagus
  - Larynx & trachea
- Lymph Nodes
- Salivary glands – parotid, SM, SL
- Thyroid
- Vessels – carotids, verts, IJs
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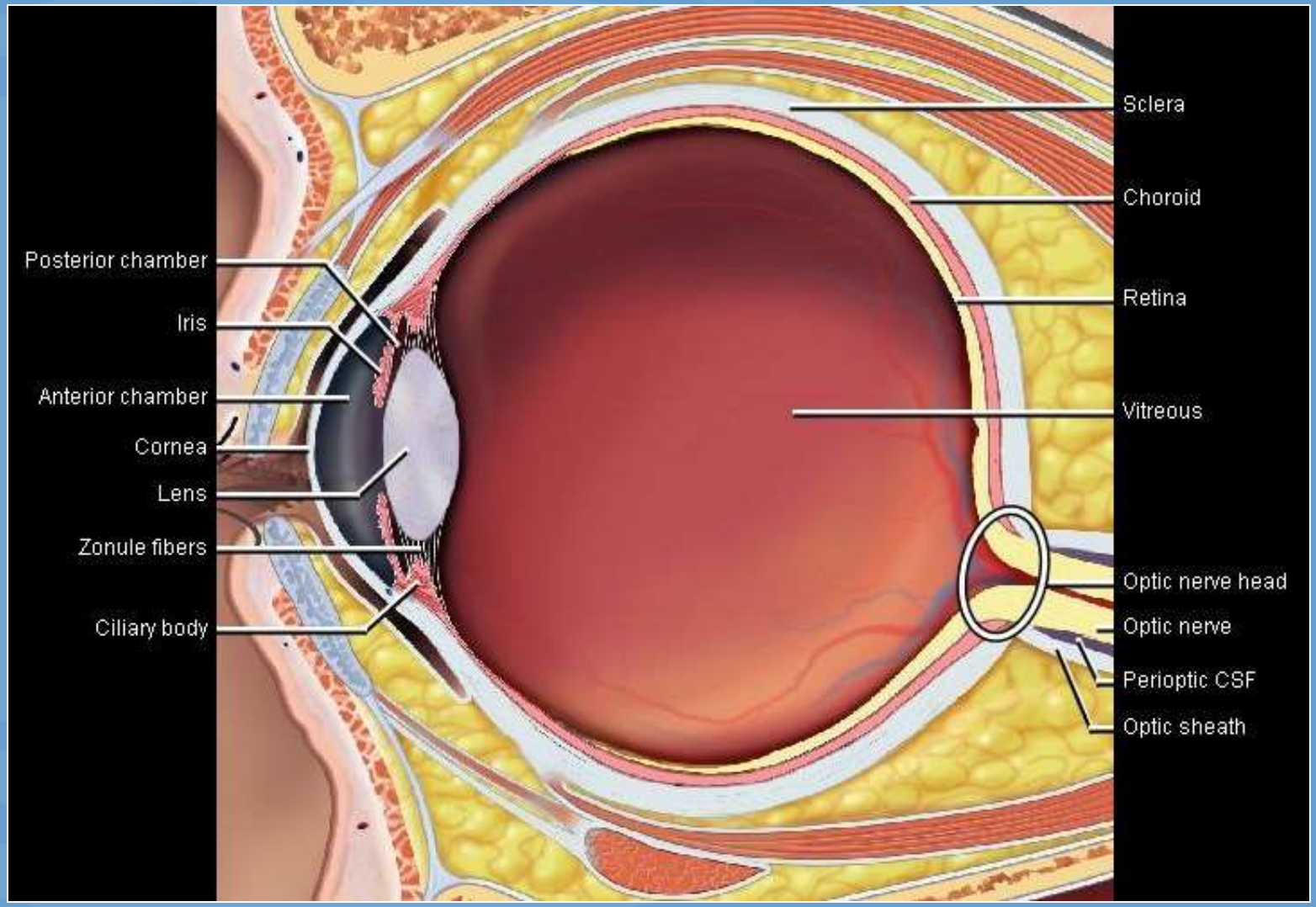
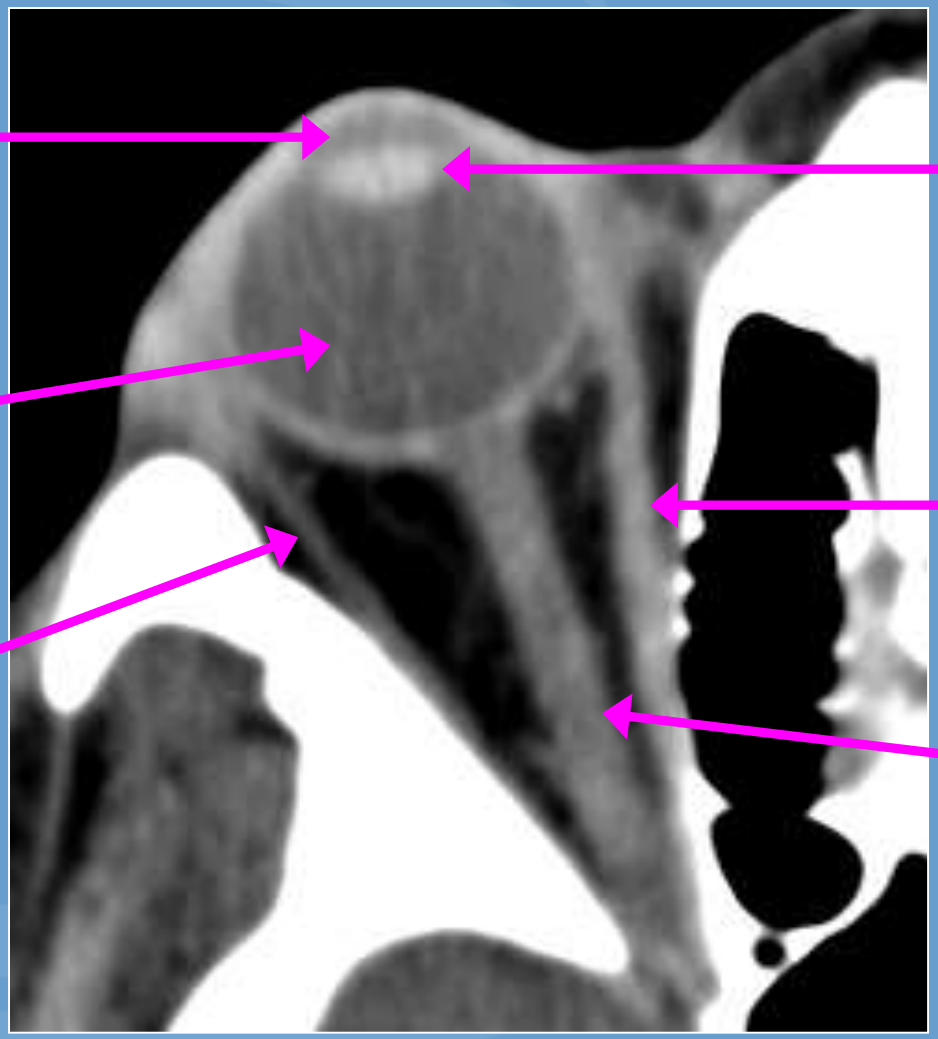
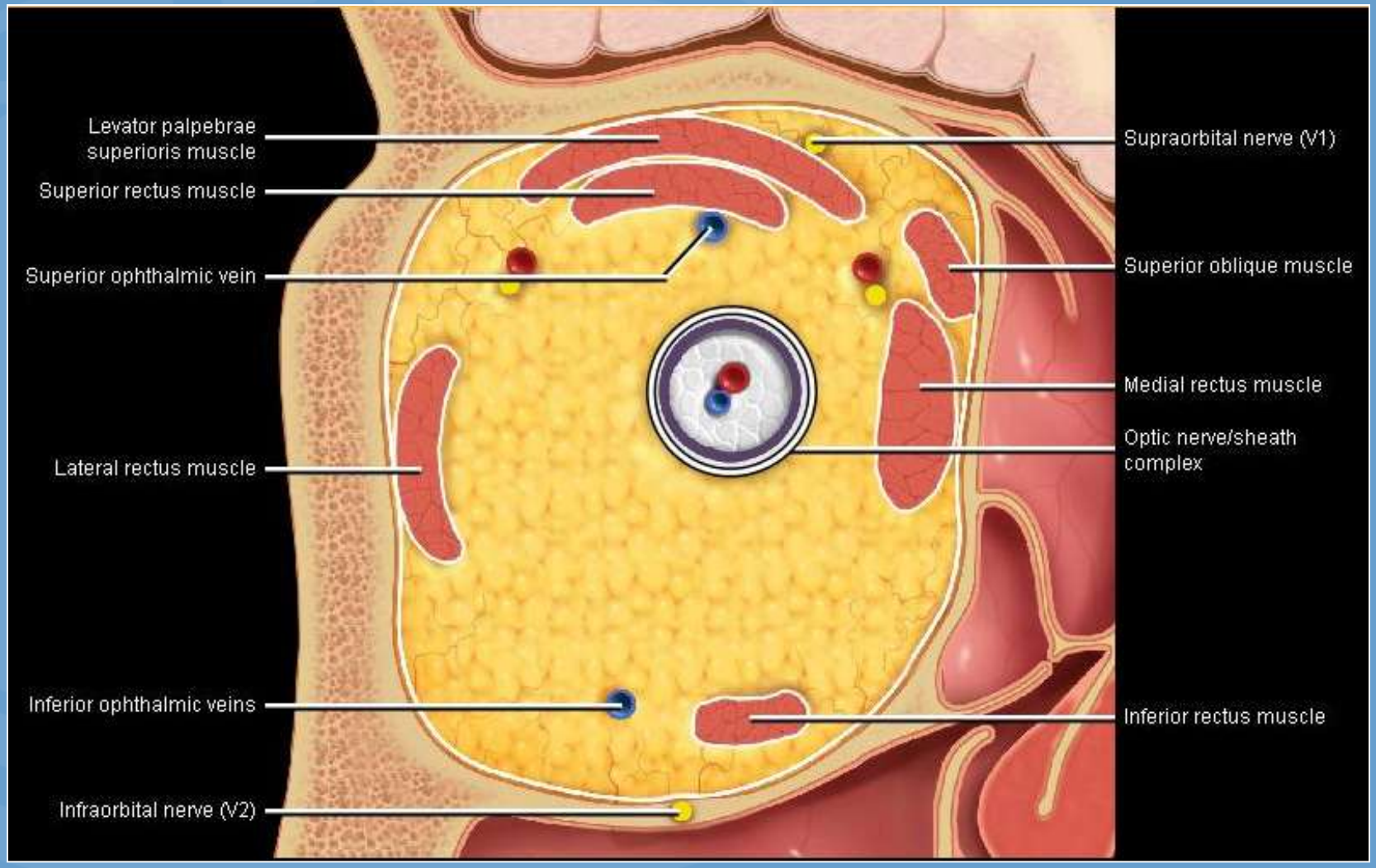
The Globe


Posterior chamber
Iris
Anterior chamber
Cornea
Lens
Zonule fibers
Ciliary body
Sclera
Choroid
Retina
Vitreous
Optic nerve head
Optic nerve
Perioptic CSF
Optic sheath

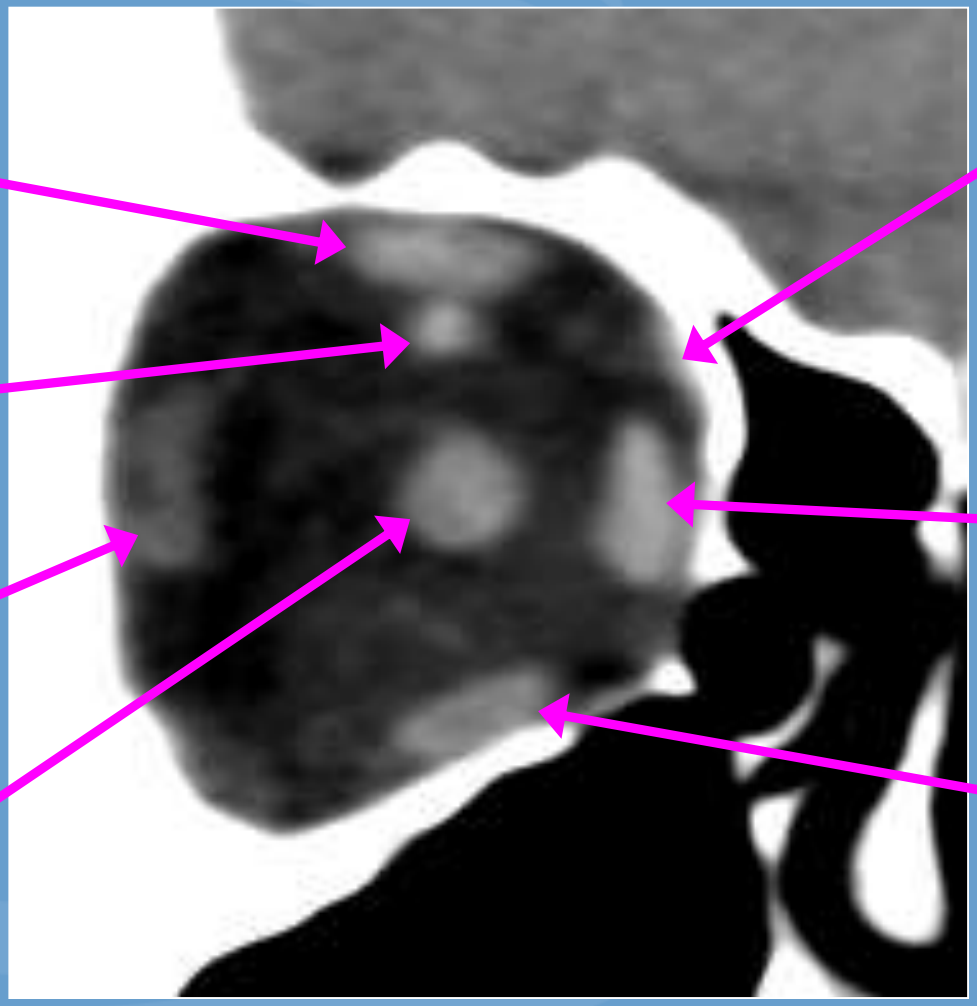
Orbit – Axial CT



Orbit – Coronal Section



Orbit – Coronal CT



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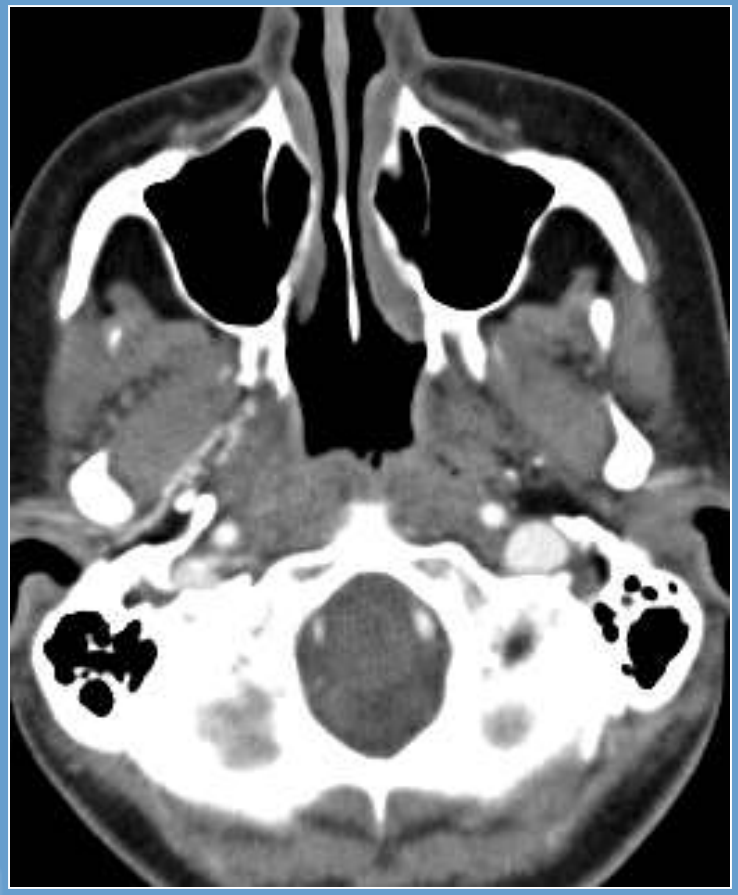
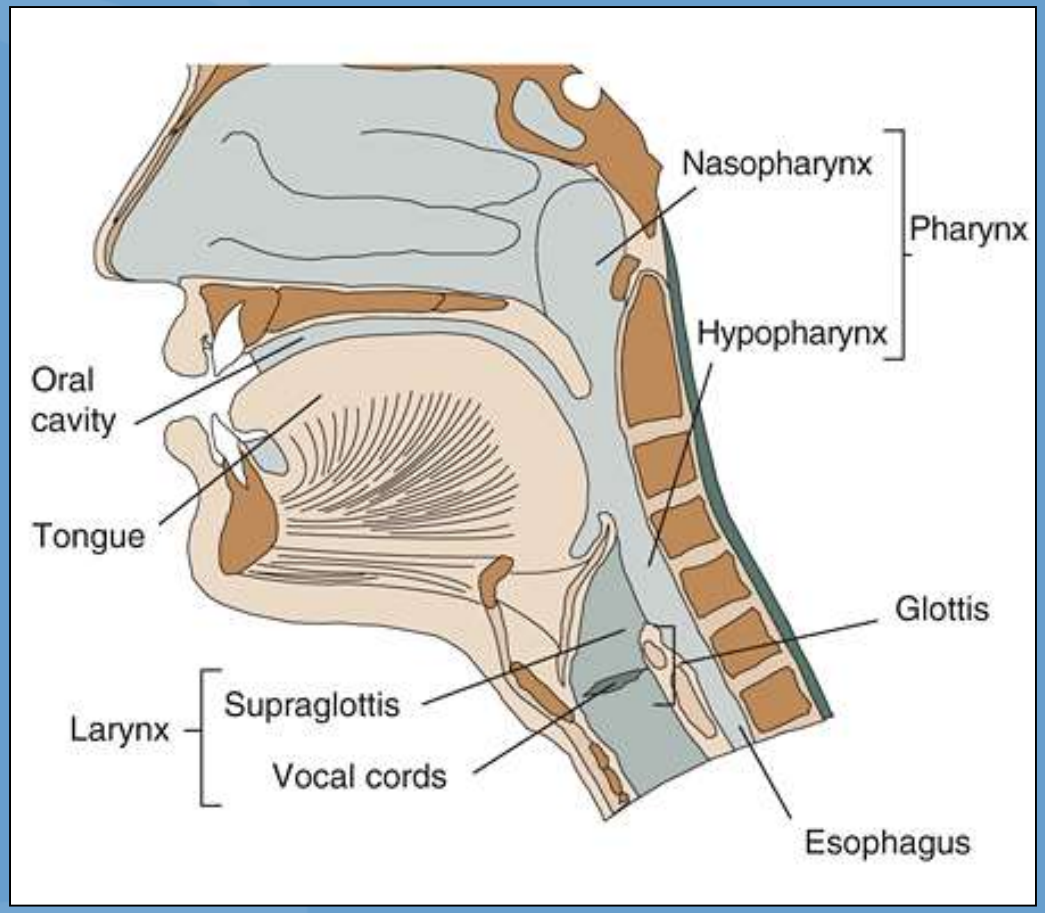


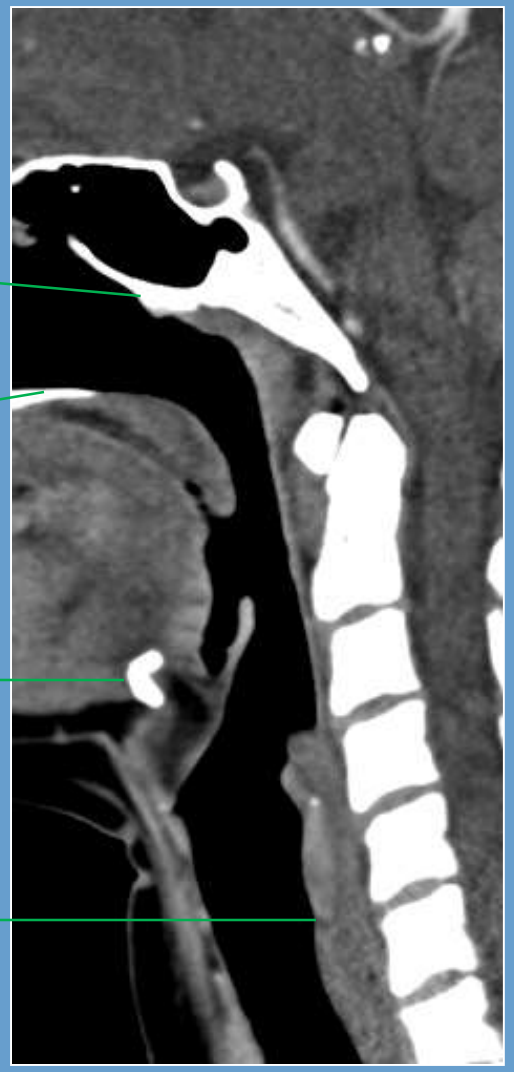
The Upper Aerodigestive Tract

- Nasal cavity and paranasal sinuses
- Oral cavity
- Pharynx
  - Nasopharynx
  - Oropharynx
  - Hypopharynx
- Larynx



Pharynx

- Nasopharynx
  - Skull base to hard palate
- Oropharynx
  - Hard palate to hyoid
- Hypopharynx
  - Hyoid to cricopharyngeus (caudal margin of cricoid cartilage)



Orbital Level

Nasal cavity

Nasal septum

Ethmoid sinuses

Inferior orbital fissure

Sphenoid sinus

Mastoid air cells

Nasopharynx Level

Nasal cavity

Nasal septum

Medial pterygoid plate

Mandibular condyle

Mastoid air cells

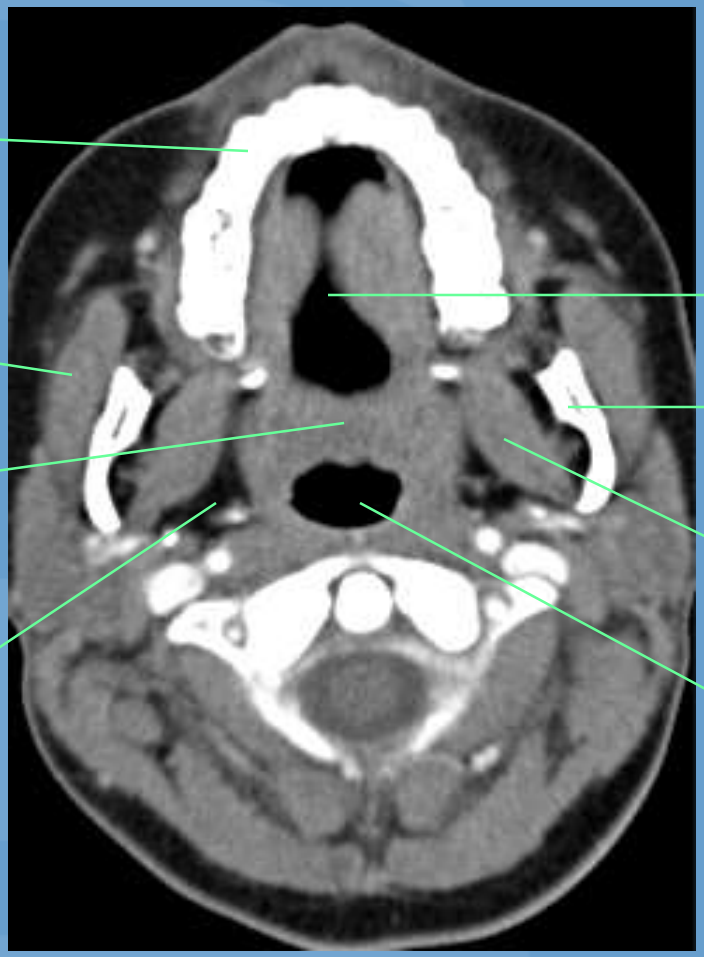
Maxillary sinus

Lateral pterygoid plate

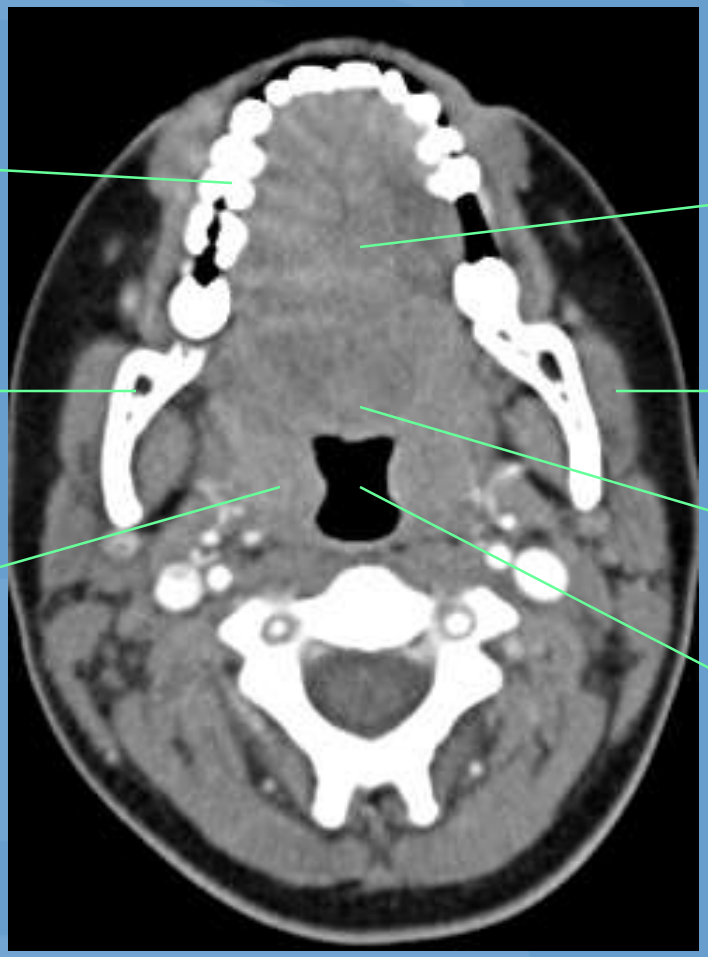
Lateral pterygoid m.

Nasopharyngeal airway

Soft Palate Level



Oropharynx Level



Mandiblular alveolus

Mandibular ramus

Palatine (faucial) tonsil

Oral tongue (oral cavity)

Masseter

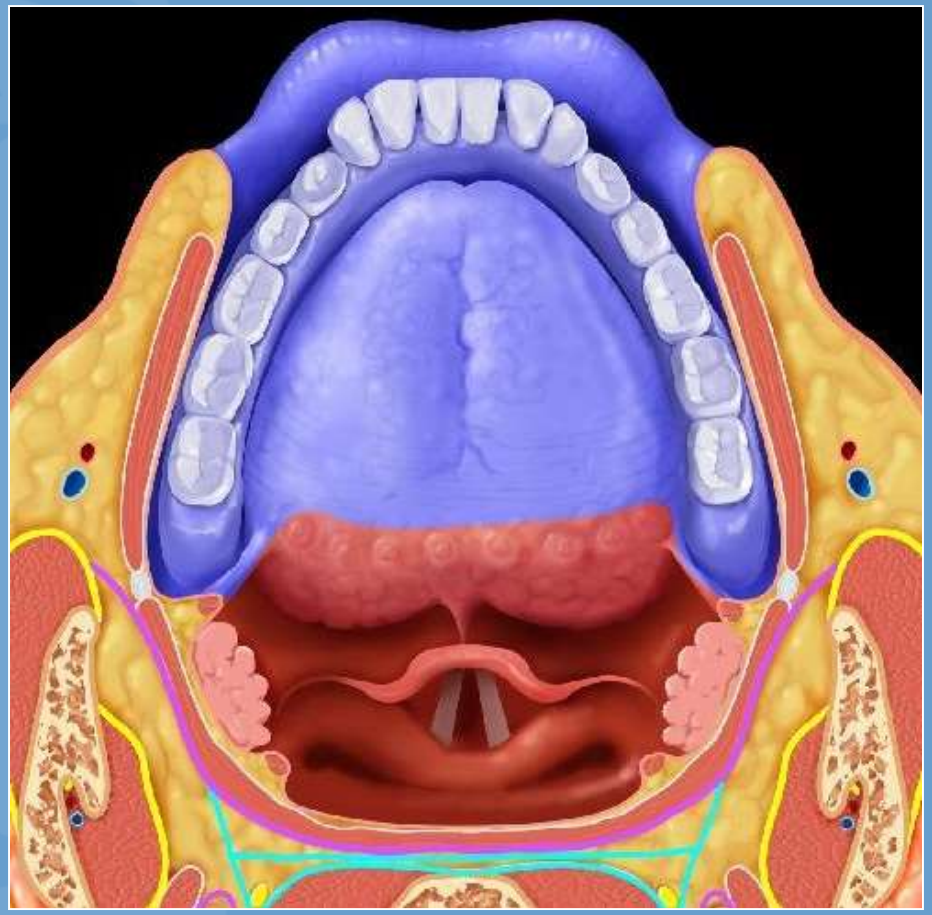
Base of tongue (oropharynx)

Oropharyngeal airway

Oral Cavity

Key Contents

- Oral tongue
- Mandible
- Oral mucosa
- Myelohyoid m.
- Sublingual space

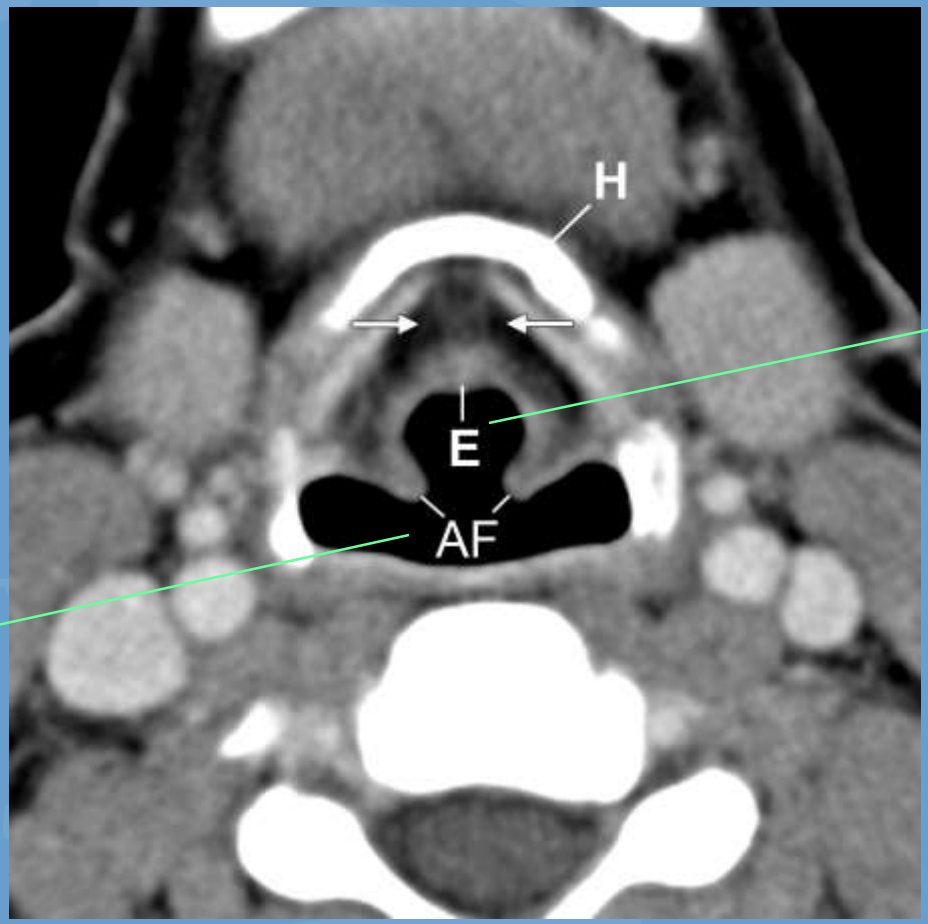


Hyoid Level


Sublingual space
Genioglossus m.
Vallecula
Hyoid
ECA
Epiglottis
Pharyngeal airway
ICA
IJ vein

Supraglottic Larynx Level

Supraglottis

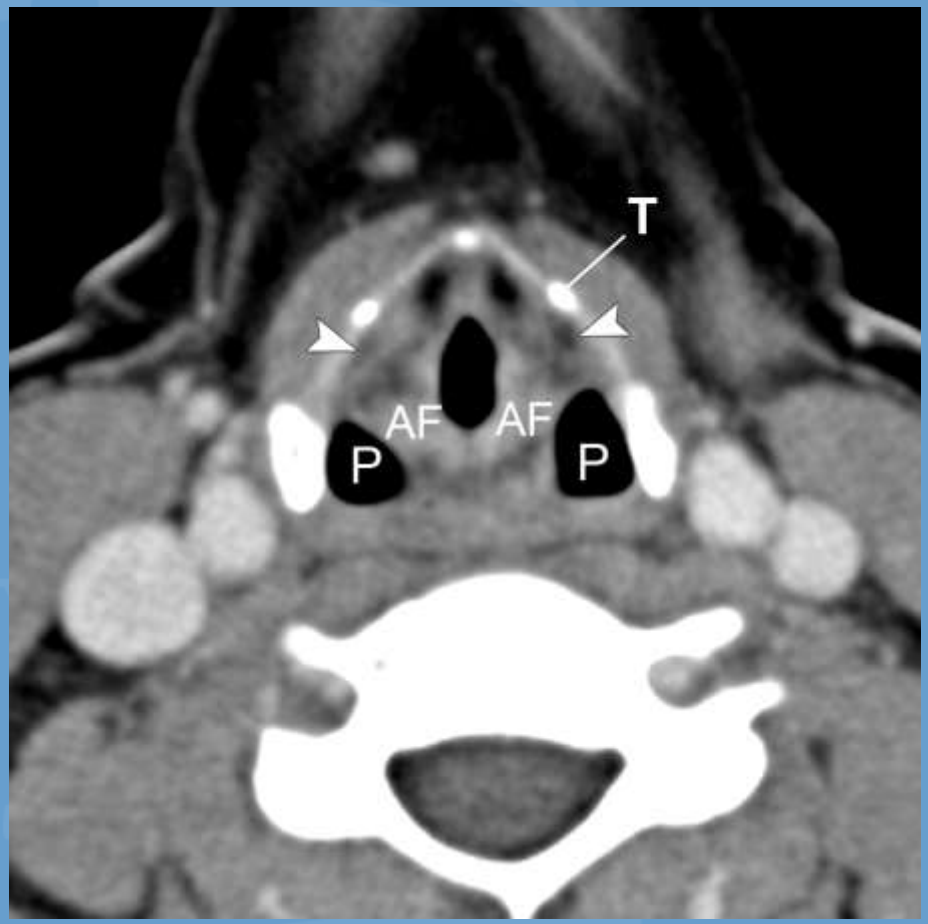


Larynx

Hypopharynx

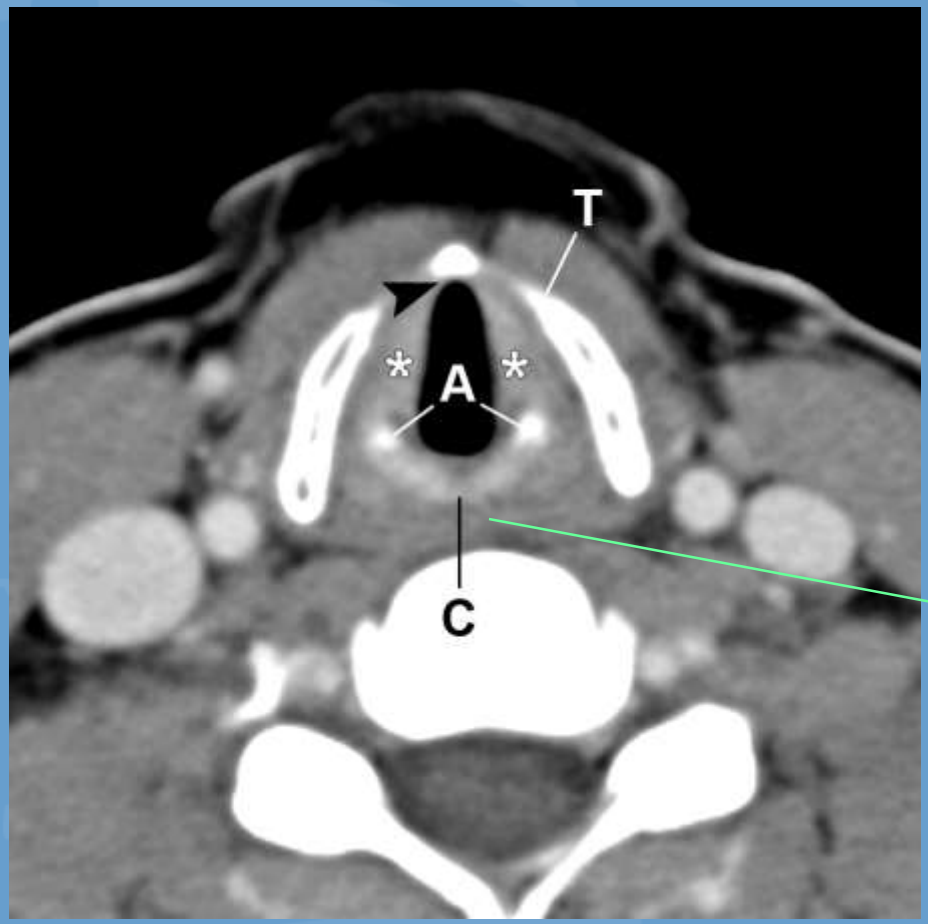
Arrows = Preepiglottic space

Supraglottis



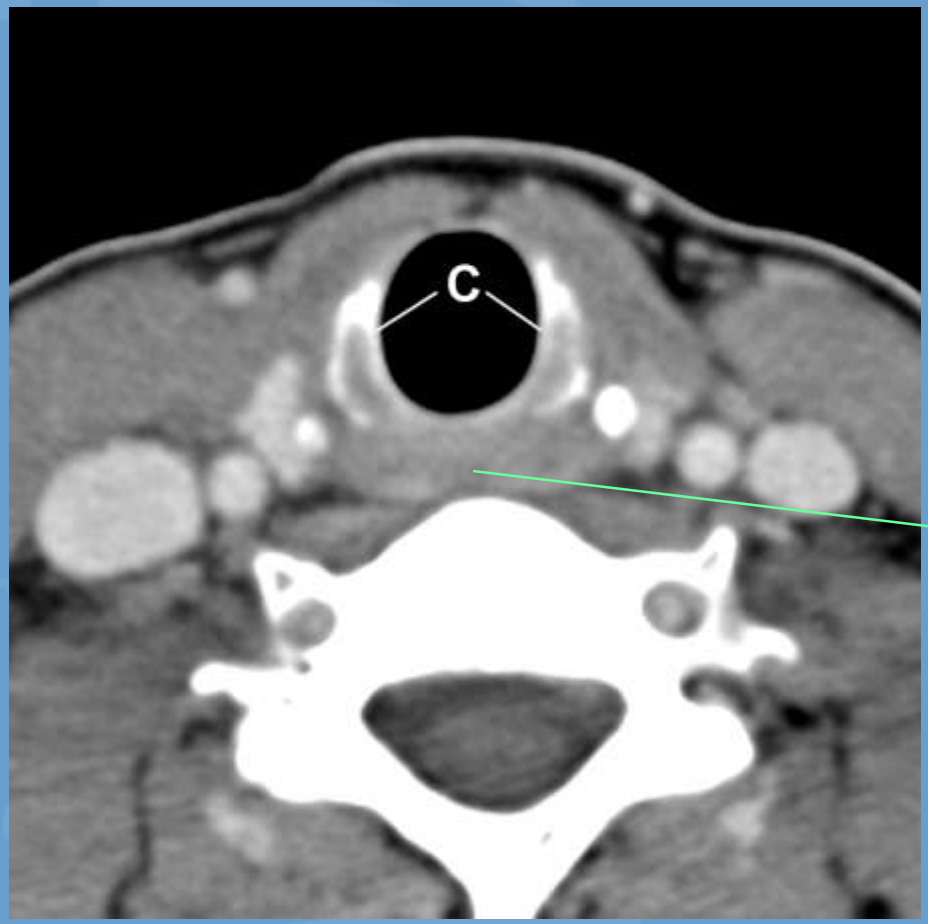
Arrowheads = False vocal folds

Glottis

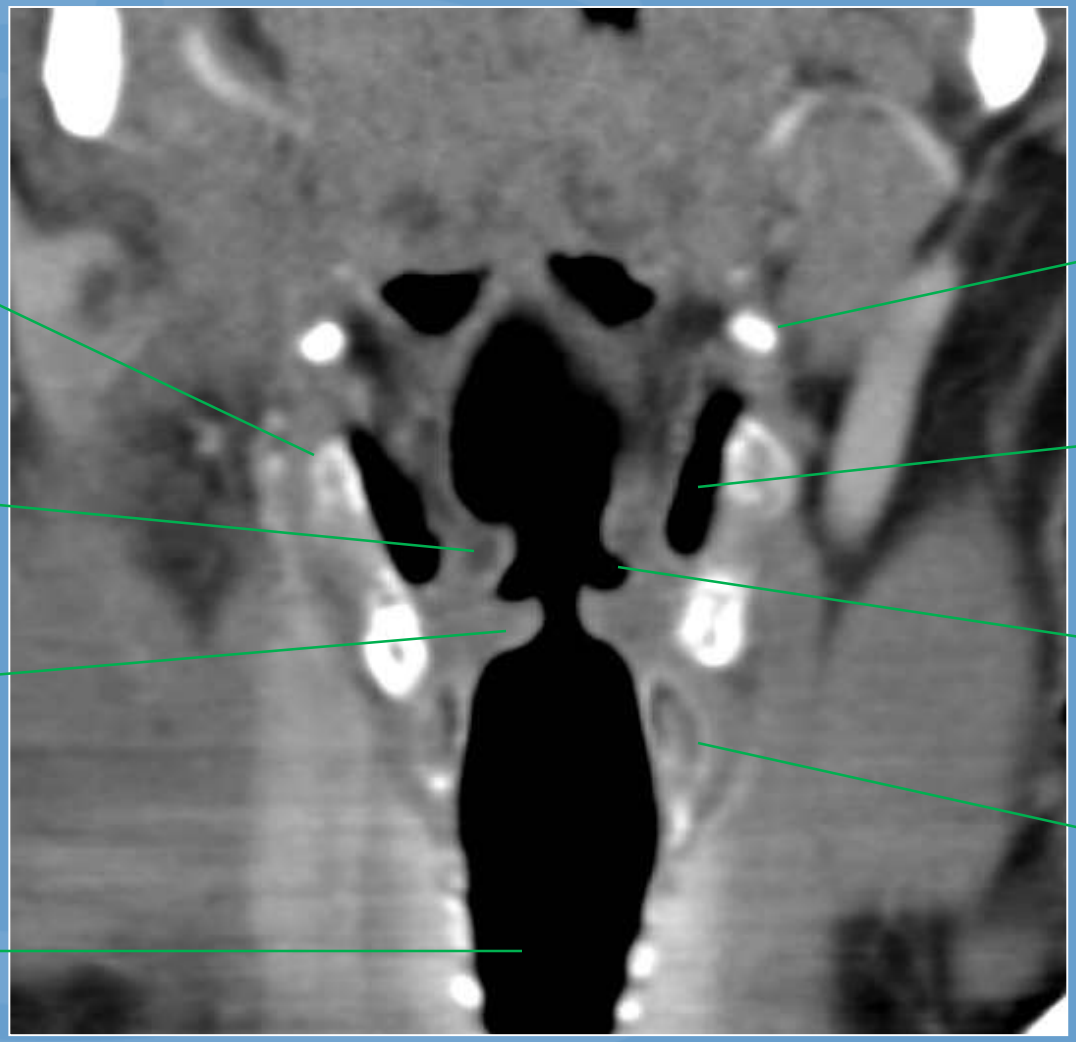


* = True vocal cords

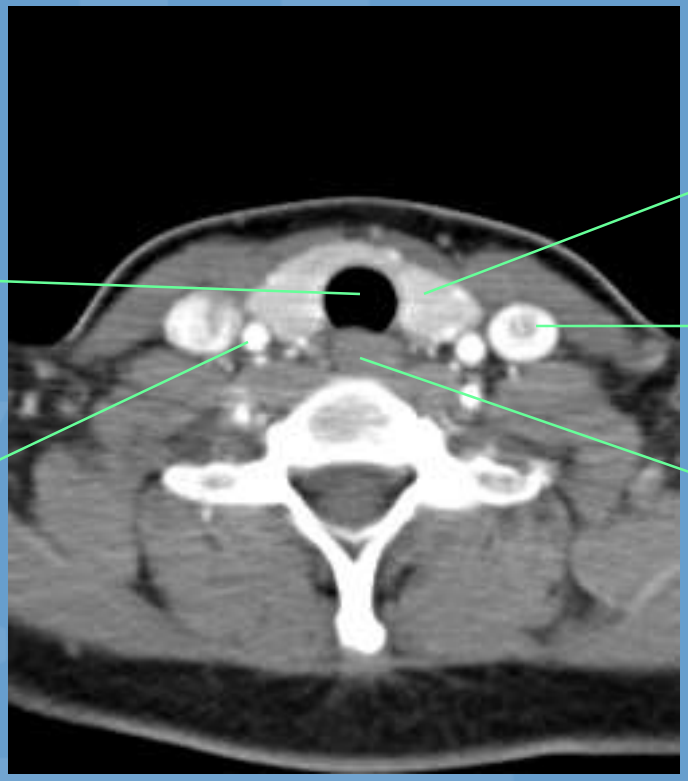
Subglottis



Larynx/Hypopharynx – Coronal CT



Tracheal Level



What to look at on a neck CT

- Brain
- Orbits/globes
- Aerodigestive tract
  - Nasal cavities & sinuses
  - Oral cavity, pharynx, esophagus
  - Larynx & trachea
- Lymph Nodes
- Salivary glands – parotid, SM, SL
- Thyroid
- Vessels – carotids, verts, IJs
- Lung apices/mediastinum
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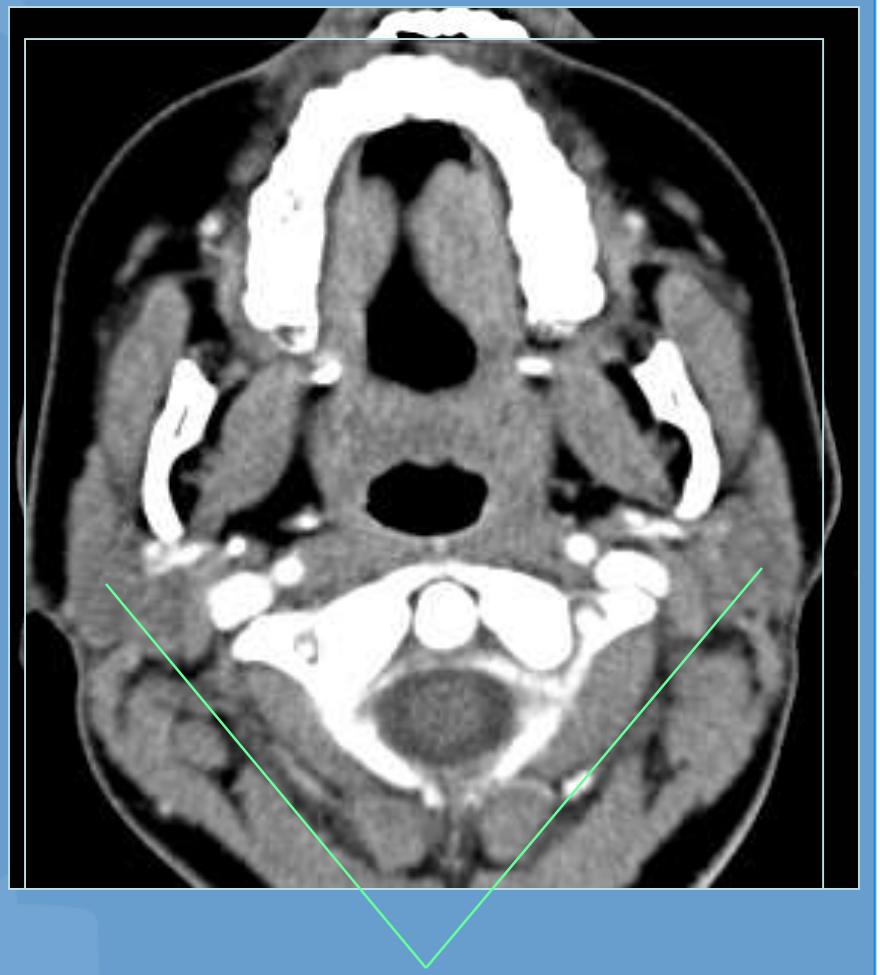

Parotid glands

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Submandibular glands

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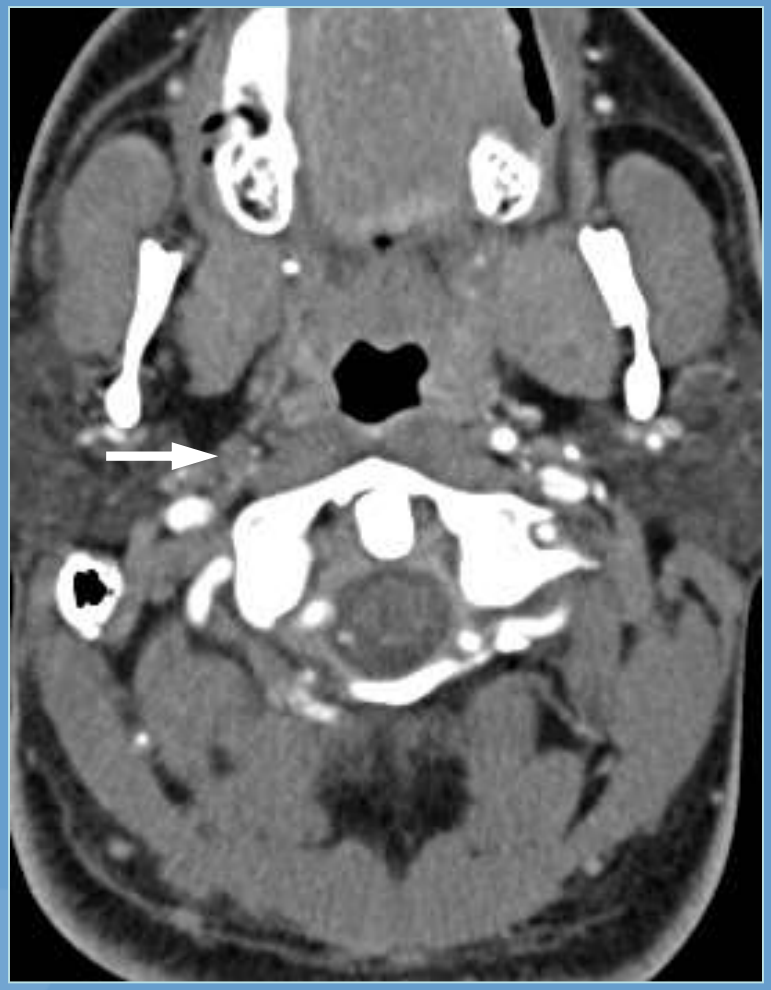

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Bones, muscles and mastoids

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“Evaluating A Neck Scan Takes Very Little Effort”

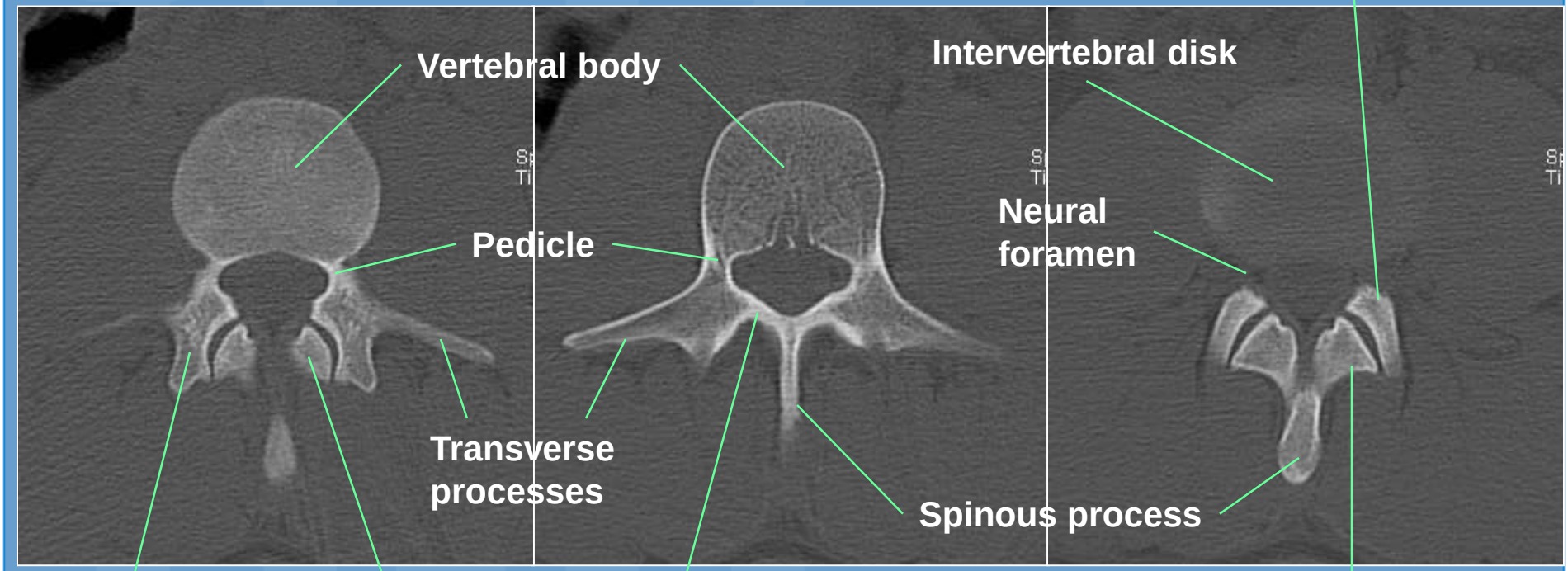
1) “E” = Eyes & orbits
2) “A” = Aerodigestive tract
3) “N” = Nodes
4) “S” = Salivary glands
5) “T” = Thyroid
6) “V” = Vessels
7) “L” = Lung apices/mediastinum
8) “E” = Everything else (brain, bones, mastoids & soft tissues)

What's the diagnosis?

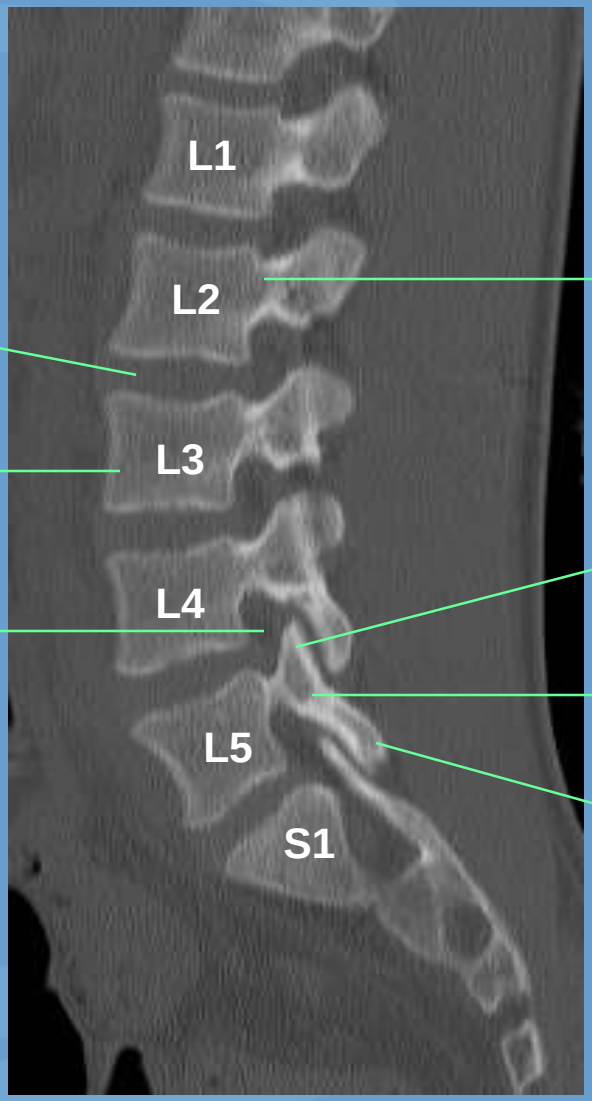
What's the diagnosis?

Spine CT
Anatomy and Basic Interpretation

Axial Images
Lumbar Spine



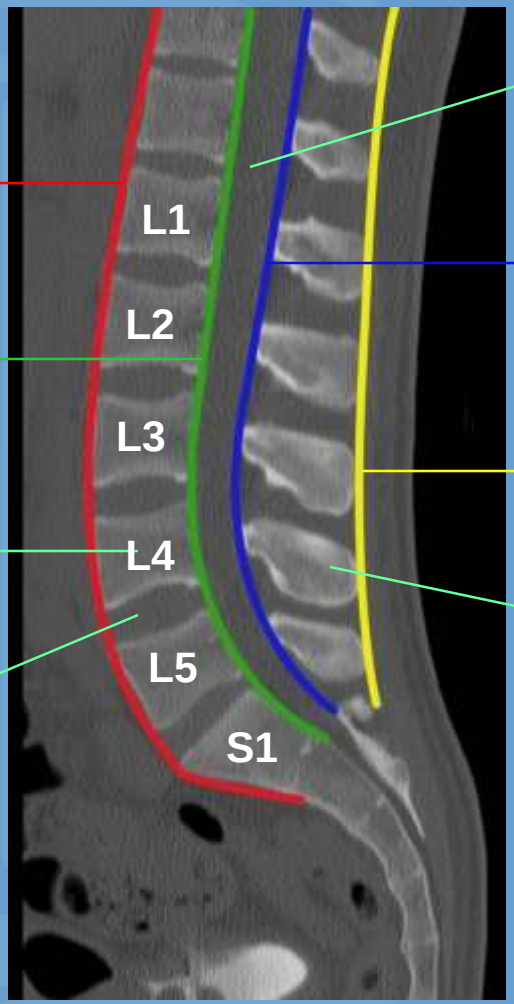
Parasagittal Image



What to look at on a spine CT

- Alignment
- Vertebral body & disc height
- Facet alignment
- Transverse & spinous processes
- Lysis/Sclerosis
- Congenital anomalies
- Extraspinal tissues
- Sacrum/SI joints, pars defects (L-Spine)
- Craniocervical junction (C-spine)
- Transverse foramen involvement (C-spine)

Midsagittal Image
Spinal Lines



Spinal canal

Anterior spinal line

Spinolaminar line

Posterior spinal line

Spinous process line

Vertebral body

Spinous process

Intervertebral disk

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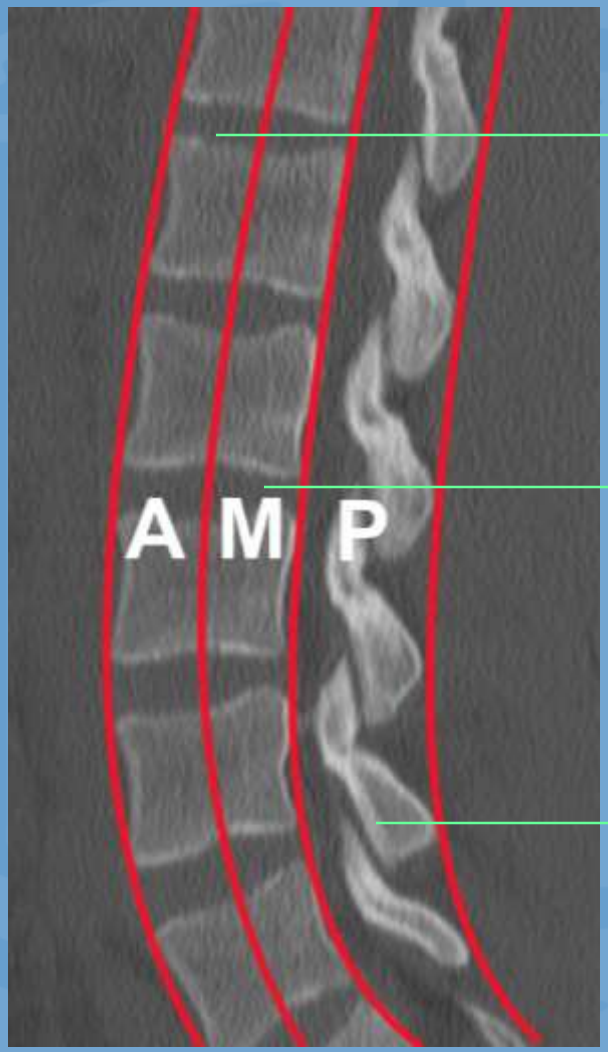
Spinal Stability
3 Column Model (Denis)



Anterior column

- Anterior ½ of vertebral body
- ALL
- Anterior annulus

Middle column

- Posterior ½ of vertebral body
- PLL
- Posterior annulus

Posterior column

- Posterior bony arch
- Posterior ligamentous complex

What's wrong with this picture?

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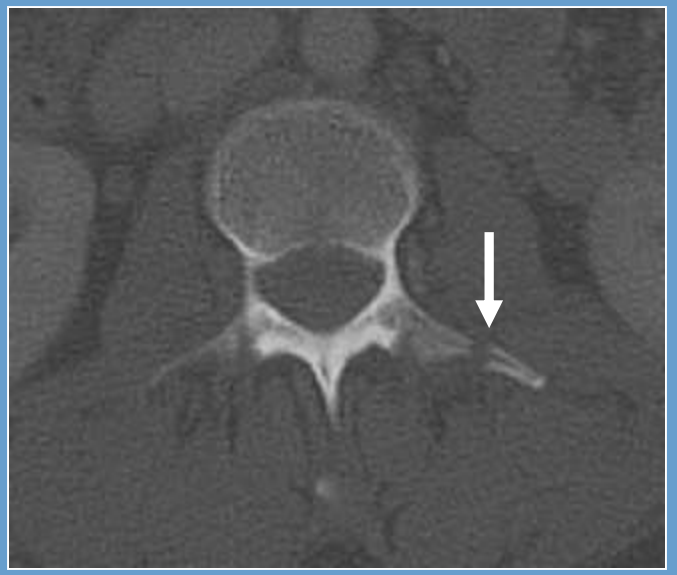

What to look at on a spine CT

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- Vertebral body & disc height
- Facet alignment
- Transverse & spinous processes
- Lysis/Sclerosis
- Congenital anomalies
- Extraspinal tissues
- Sacrum/SI joints, pars defects (L-Spine)
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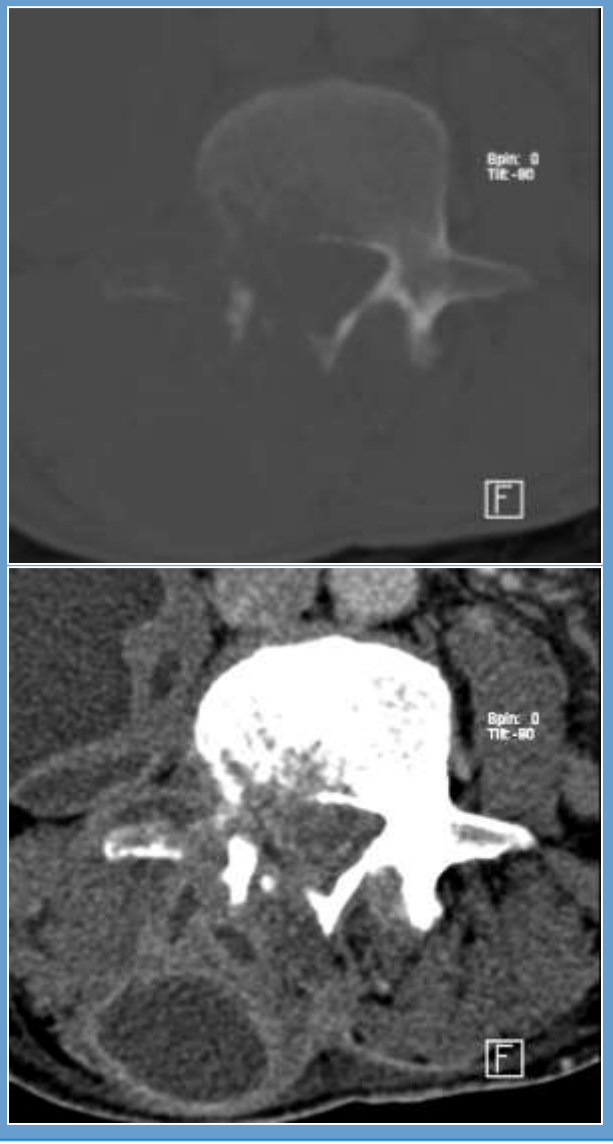

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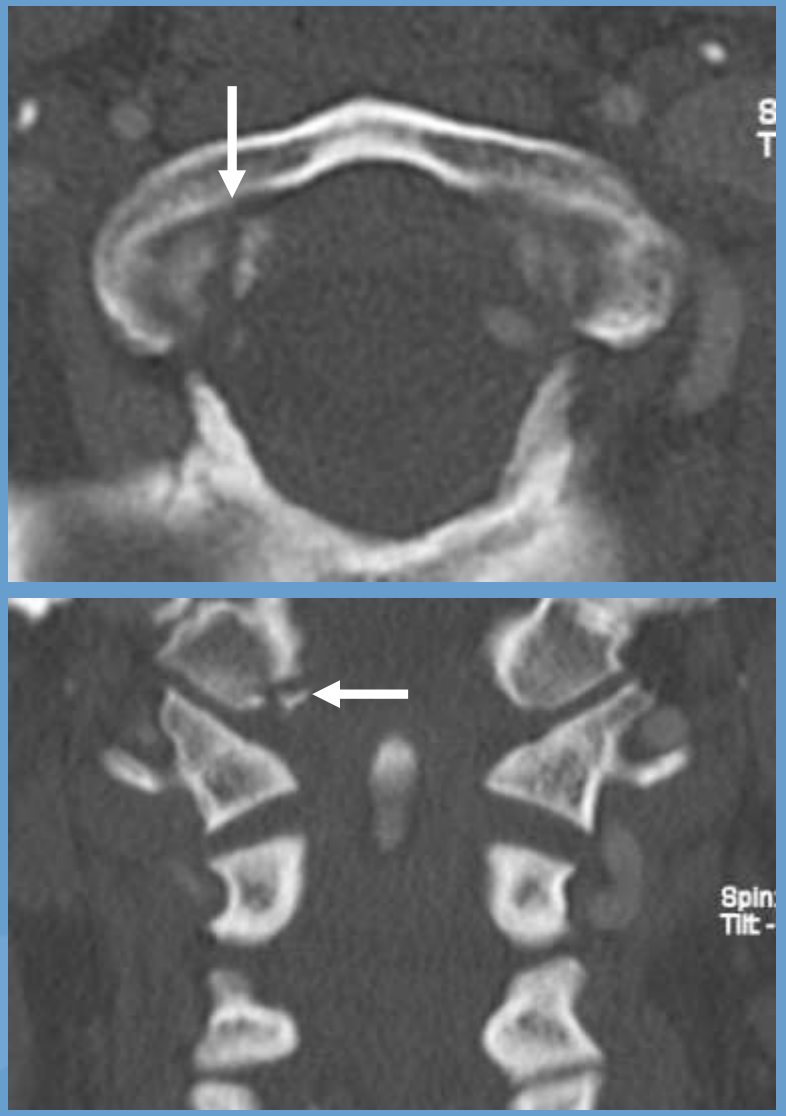

Take Home Points

- Knowledge of normal anatomy is your friend
- Develop and stick to a search pattern when looking at studies
  - "Blood Can Be Very Bad"
  - "Evaluating A Neck Scan Takes Very Little Effort"
- Don't be afraid to ask questions!