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 acquisition
  – 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
Centrum Semiovale Level

- Precentral sulcus
- Central sulcus
- Postcentral sulcus
- Superior frontal gyrus
- Middle frontal gyrus
- Precentral gyrus (Frontal lobe)
- Postcentral gyrus (Parietal lobe)
- Intraparietal sulcus
- Centrum semiovale
- Parieto-occipital fissure
Lateral Ventricle Level

- Caudate body
- Central sulcus
- Lateral (Sylvian) fissure, posterior segment
- Superior temporal sulcus
- Superior temporal gyrus
- Intra-occipital sulcus
- Corona radiata
- Lateral ventricle
- Superior sagittal sinus
- Parieto-occipital fissure
3rd Ventricle Level

- Lateral ventricle, frontal horn
- Internal capsule, anterior limb
- Lateral (Sylvian) fissure
- Internal capsule, posterior limb
- Thalamus
- Lateral ventricle, occipital horn
- Caudate, head
- Basal ganglia, lentiform nuclei (GP & putamen)
- Insula
- 3rd ventricle
- Superior temporal sulcus
- Parieto-occipital fissure
- Calcarine sulcus
Midbrain Level

- Superior temporal gyrus
- Cerebral aqueduct (of Sylvius)
- Lateral (Sylvian) fissure
- Midbrain
- Quadrigeminal cistern
Suprasellar Cistern Level

- Olfactory sulcus
- Suprasellar cistern
- Interpeduncular cistern
- Ambient cistern
- Gyrus rectus
- Amygdala
- Cerebral peduncle
- Hippocampus
- Cerebellum
Foramen Magnum Level

- Nasopharynx
- Mandibular condyle
- Mastoids
- Medulla
- Cerebellar tonsil
- Foramen magnum
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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“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” = Ventrices – 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
• Lung apices/mediastinum
• Bones, muscles and mastoids
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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 – Coronal CT

Superior Rectus
Superior Ophthalmic v.
Lateral Rectus
Optic n.
Superior Oblique
Medial Rectus
Inferior Rectus
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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
- Inferior orbital fissure
- Ethmoid sinuses
- 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
Oropharynx Level

- Mandibular 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

- Genioglossus m.
- Sublingual space
- Vallecula
- ECA
- Pharyngeal airway
- Hyoid
- Epiglottis
- ICA
- IJ vein
Supraglottic Larynx Level

- Preepiglottic space
- Piriform sinus
- Posterior pharyngeal wall
- Laryngeal airway
- Aryepiglottic fold
- Sternocleidomastoid
Supraglottis

Arrows = Preepiglottic space

Hypopharynx

Larynx
Supraglottis

Arrowheads = False vocal folds
Glottis

* = True vocal cords

Postcricoid hypopharynx
Subglottis

Postcricoid hypopharynx
Larynx/Hypopharynx – Coronal CT

- Thyroid Cartilage
- False Vocal Cord
- True Vocal Cord
- Trachea
- Hyoid
- Piriform Sinus
- Laryngeal Ventricle
- Cricoid
Tracheal Level

- Tracheal airway
- Common carotid a.
- Thyroid gland
- IJ vein
- Esophagus
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Submandibular glands
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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

- Axial Images
- Lumbar Spine
- Pedicle
- Lamina
- Inferior facet (level above)
- Transverse processes
- Vertebral body
- Intervertebral disk
- Superior facet
- Neural foramen
- Spinous process
- Superior facet (level below)
- Inferior facet
Parasagittal Image

- Intervertebral disk
- Vertebral body
- Neural foramen
- Pedicle
- Superior facet
- Pars intraarticularis
- Inferior facet
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

- Anterior spinal line
- Posterior spinal line
- Spinolaminar line
- Spinous process line
- Spinal canal
- Vertebral body
- Intervertebral disk
- L1
- L2
- L3
- L4
- L5
- S1
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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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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!