

Introduction to Neuroimaging: Basics of Study Interpretation

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Lecture Overview

- CT vs. MRI
- Brain imaging basics
 - Indications and basic interpretation
- Head and neck basics
 - Indications and basic interpretation
- Spine imaging basics
 - Indications and basic interpretation

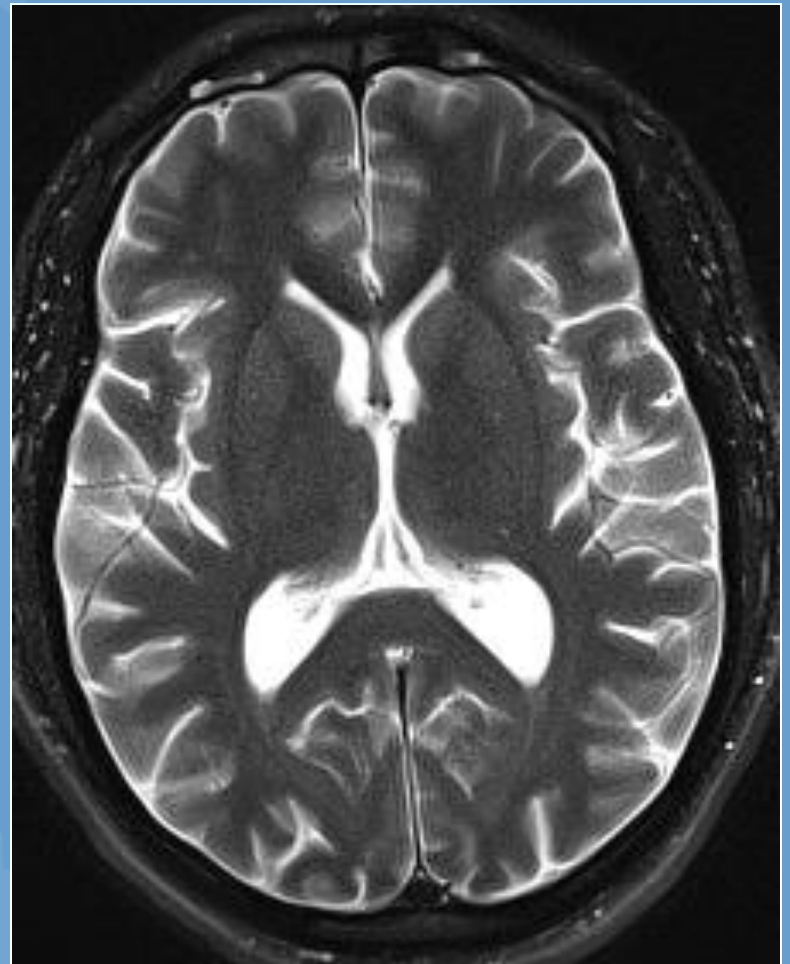
CT

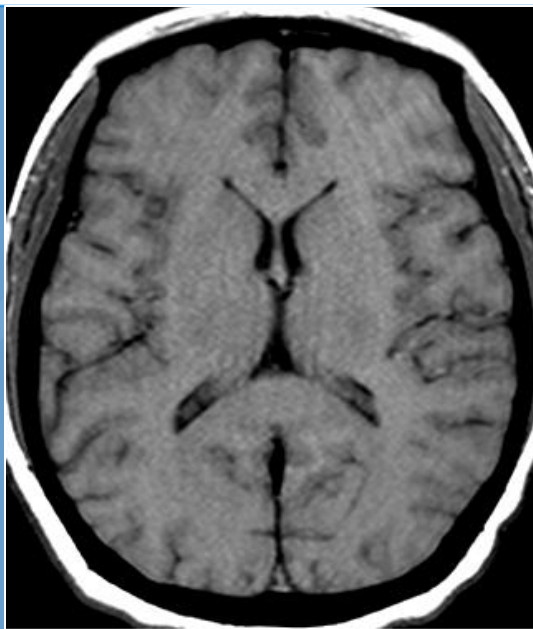
- Pros
 - Fast
 - Excellent screening tool
 - Clinician comfort
- Cons
 - Poorer soft tissue contrast
 - Ionizing radiation



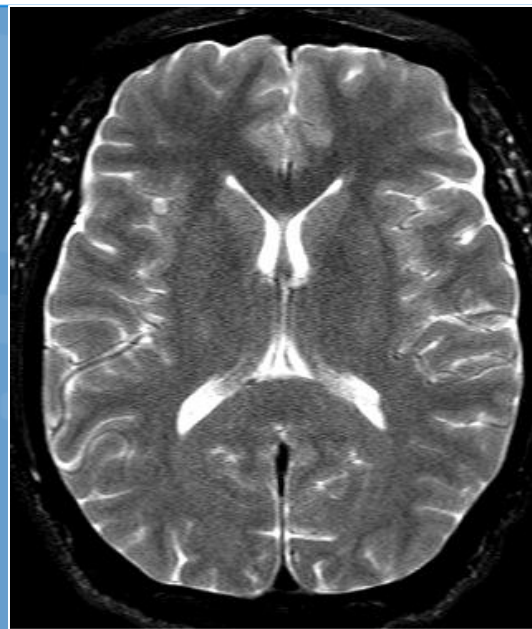
MRI

- 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

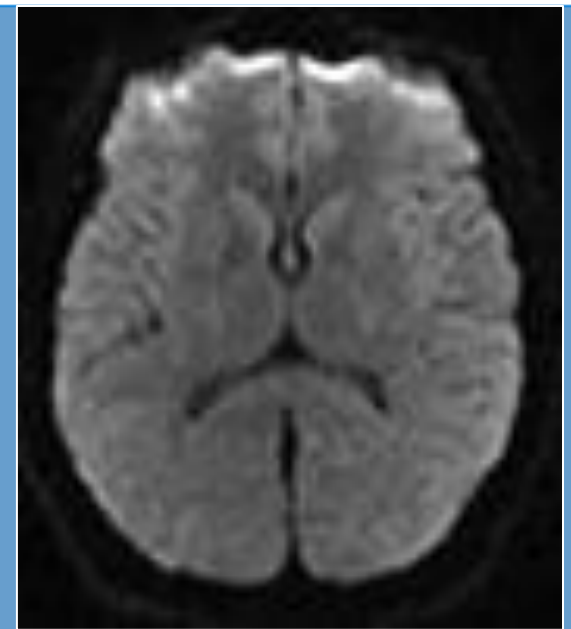




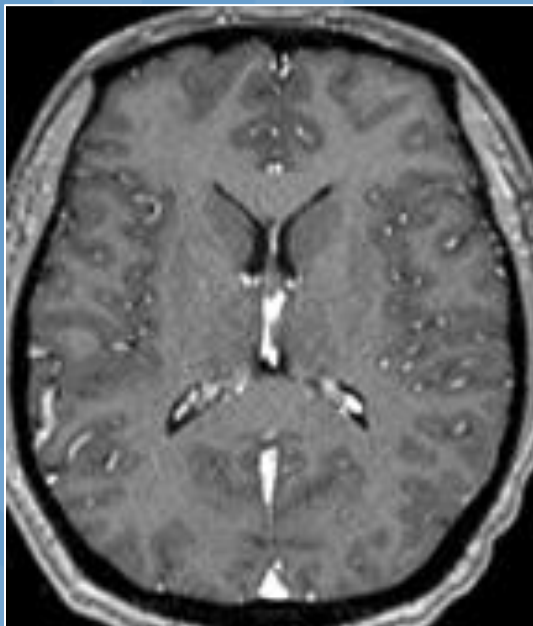
T1-weighted



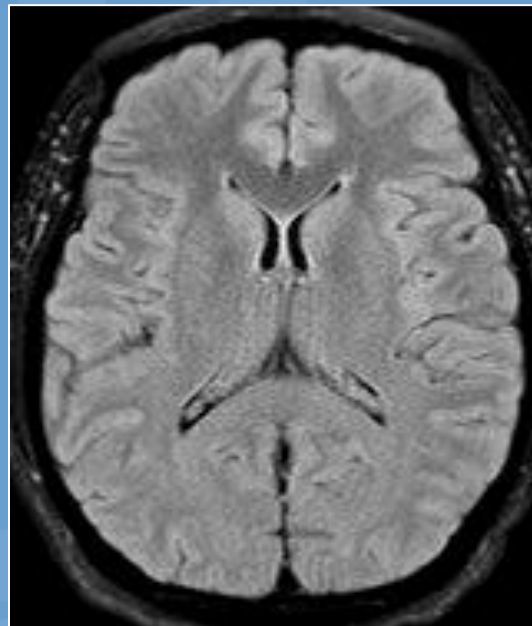
T2-weighted



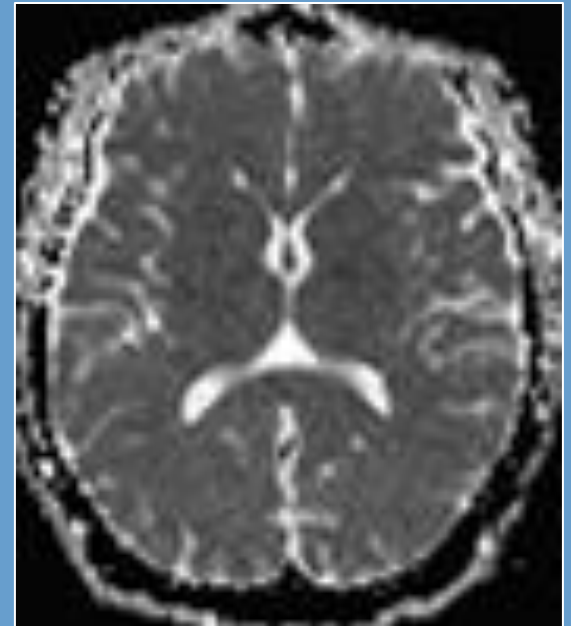
Diffusion Weighted



T1-weighted + Gd



FLAIR



Diffusion Weighted (ADC)



Brain Imaging Basics

Indications for Brain Imaging

What's the Question?

CT

- Acute head trauma
- Headache
- Acute neurologic deficits (suspected stroke)
- Suspected acute ICH
- Vascular occlusive disease
- Increased ICP
- Suspected hydrocephalus
- Mental status change
- Evaluation of IC vessels (CTA)

MR

- Evaluation of known or brain tumors
- Suspected metastatic disease
- Suspected stroke with negative CT
- Suspected dural sinus thrombosis
- Suspicious or equivocal CT findings
- Cranial neuropathies
- Suspicion for IC pathology with negative head CT

What to look at on a head CT

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



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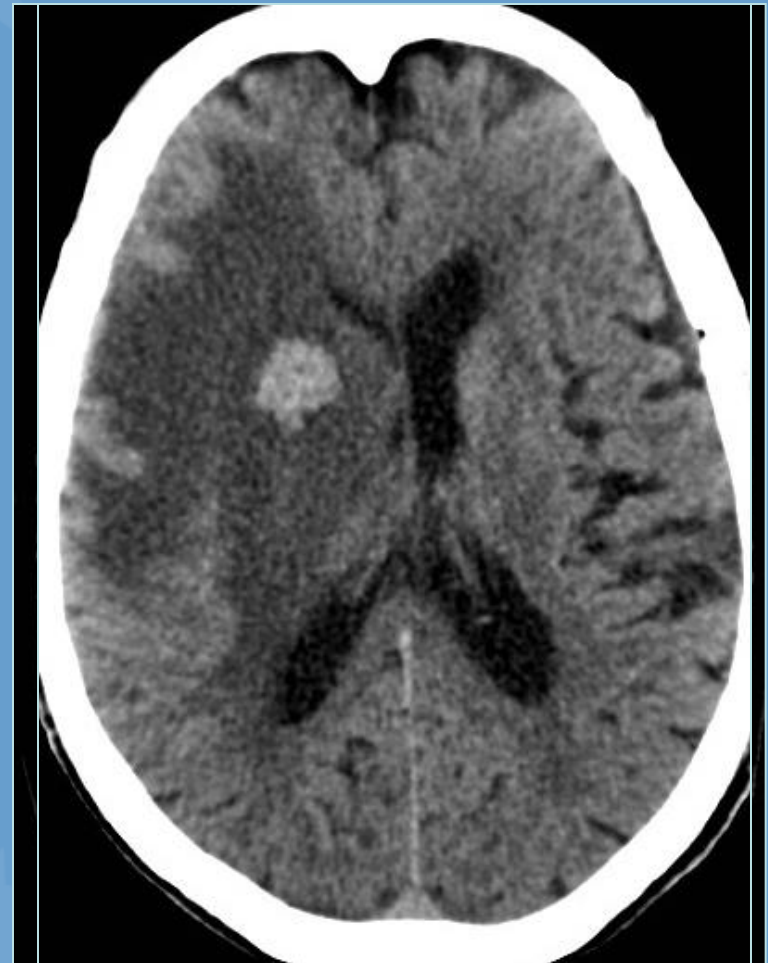


W=30 L=30

“Stroke” window

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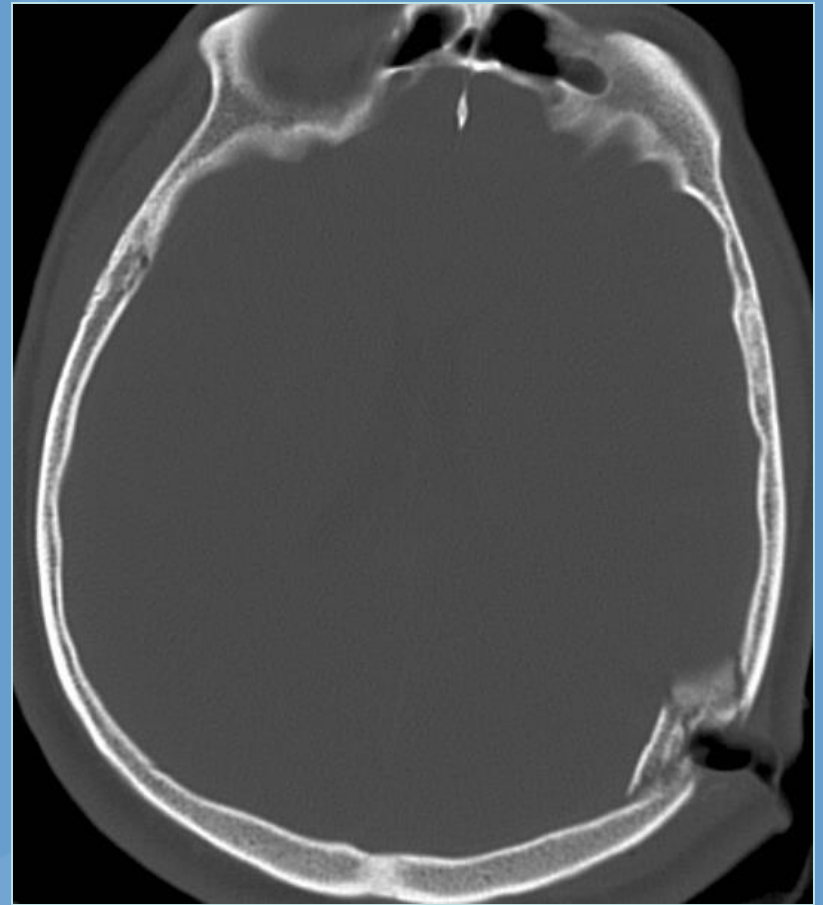
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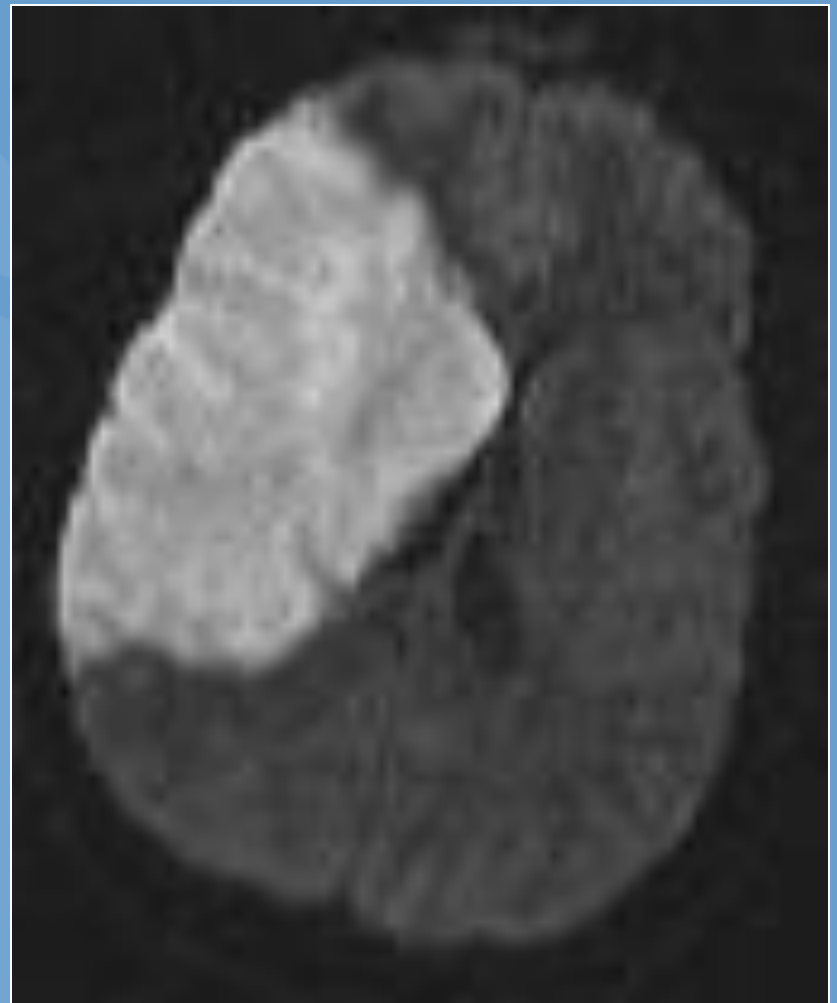
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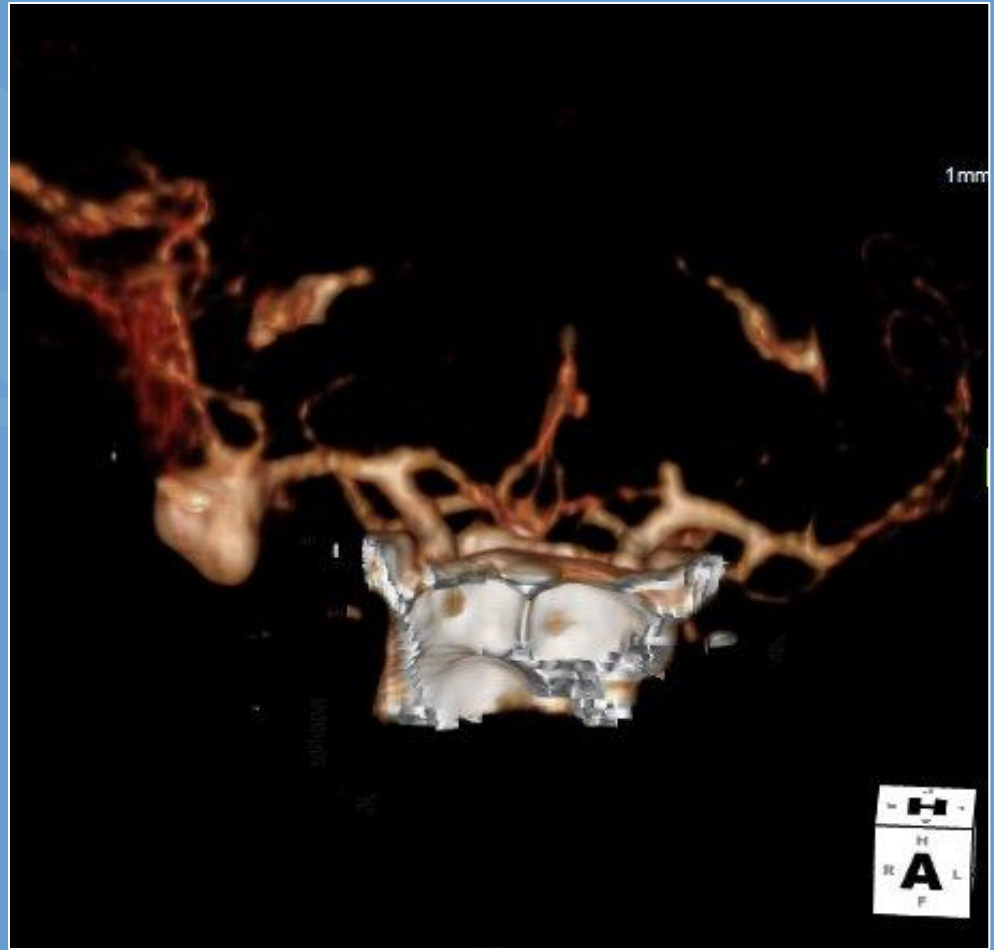
1. What's the abnormality on CT?
2. What MR sequence is being shown?
3. What's the diagnosis?



- 1) Where is the abnormality?
- 2) How can you evaluate this finding further?



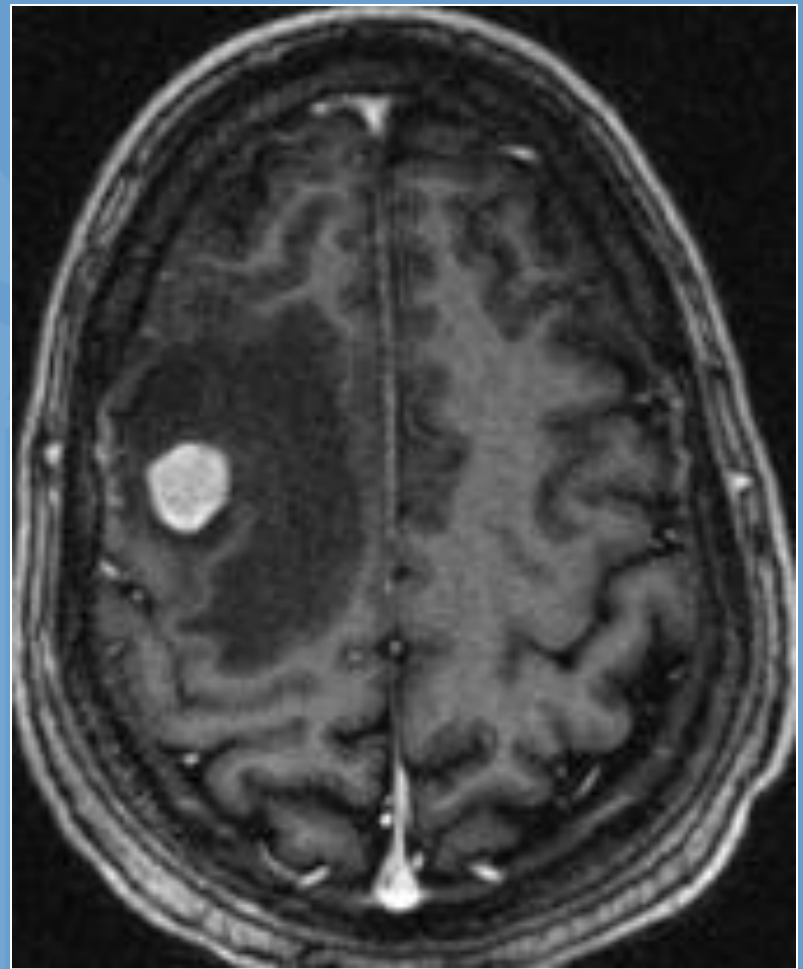
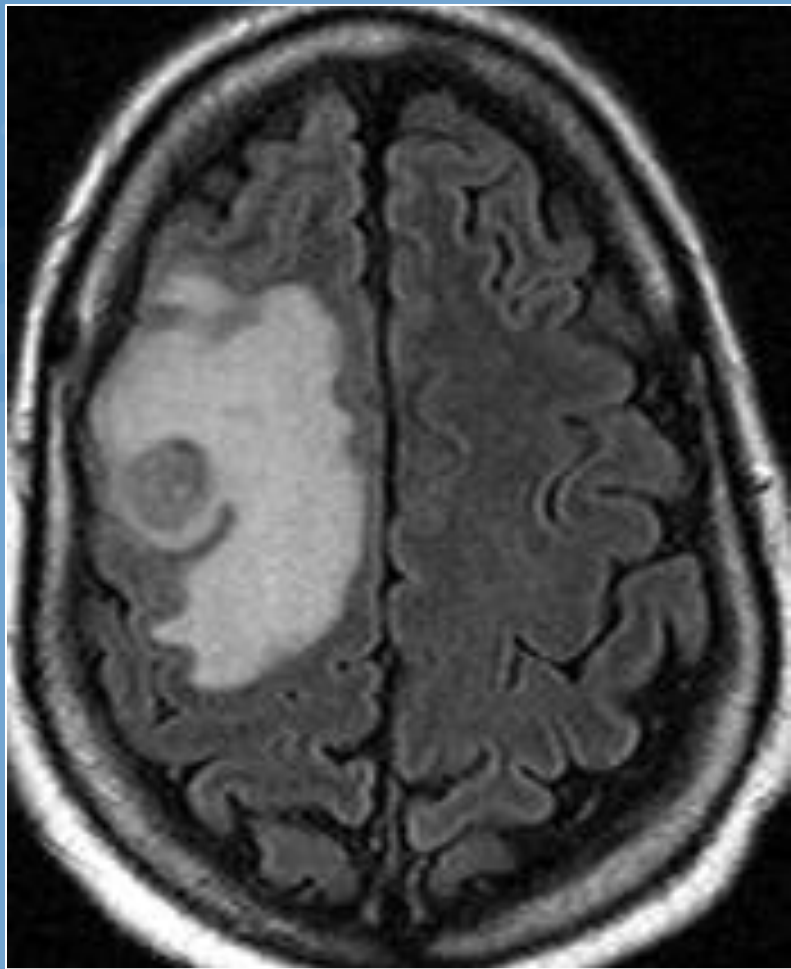
- 1) What type of study is this?
- 2) What's the diagnosis?



1. Where is the blood?
2. What is the most likely etiology of this hemorrhage?



1. What do you think is the cause of the edema?
2. What would you do next?



1. What type of study is this?
2. What are your two leading differentials?



Extracranial Head and Neck Basics

Indications for H&N Imaging

- Diagnosis and staging of squamous cell Ca and other H&N malignancies
- Evaluation of masses/lymphadenopathy
- Head and neck infections
 - Suspected tonsillar or RP abscess
 - Orbital cellulitis
- Evaluation of refractory chronic sinusitis
- Evaluation of hearing loss
- Chronic OM & cholesteatoma

Types of H&N studies

The type of study you order depends on the area of interest and the question you are trying to answer:

- General neck
- Orbits
- Maxillofacial and paranasal sinus
- Temporal bone
- Brachial plexus
- CTA of the neck

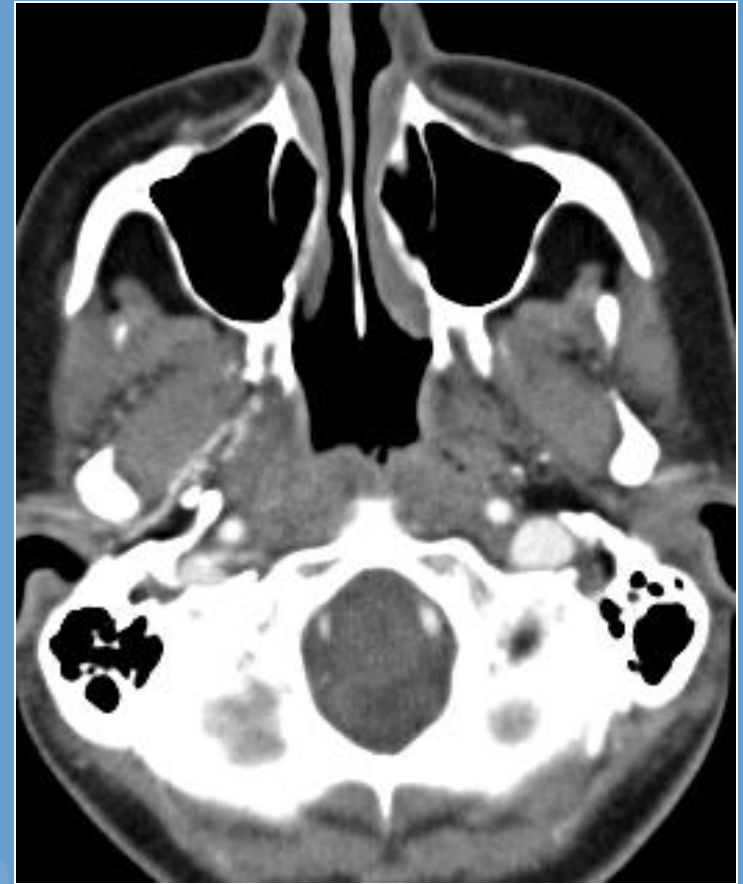
What to look at on a H&N study

- **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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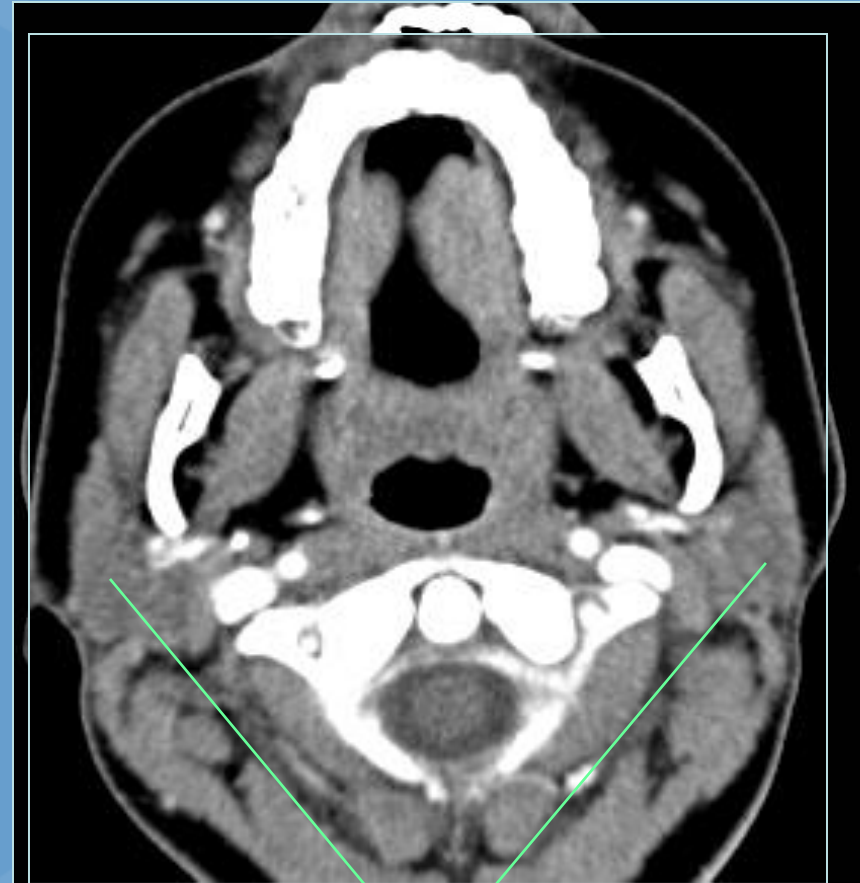
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Parotid glands

What to look at on a H&N study

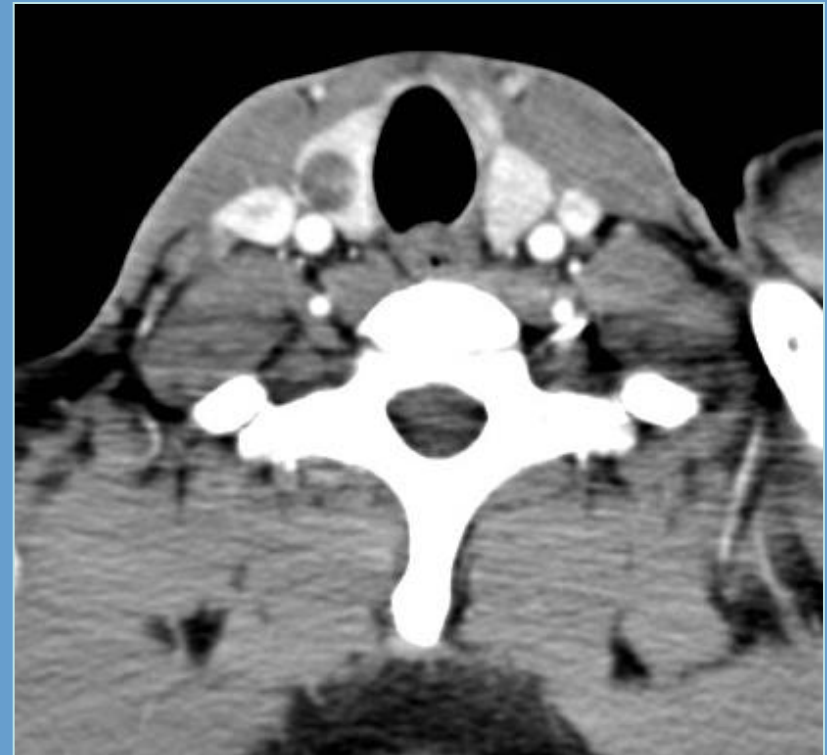
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Submandibular glands

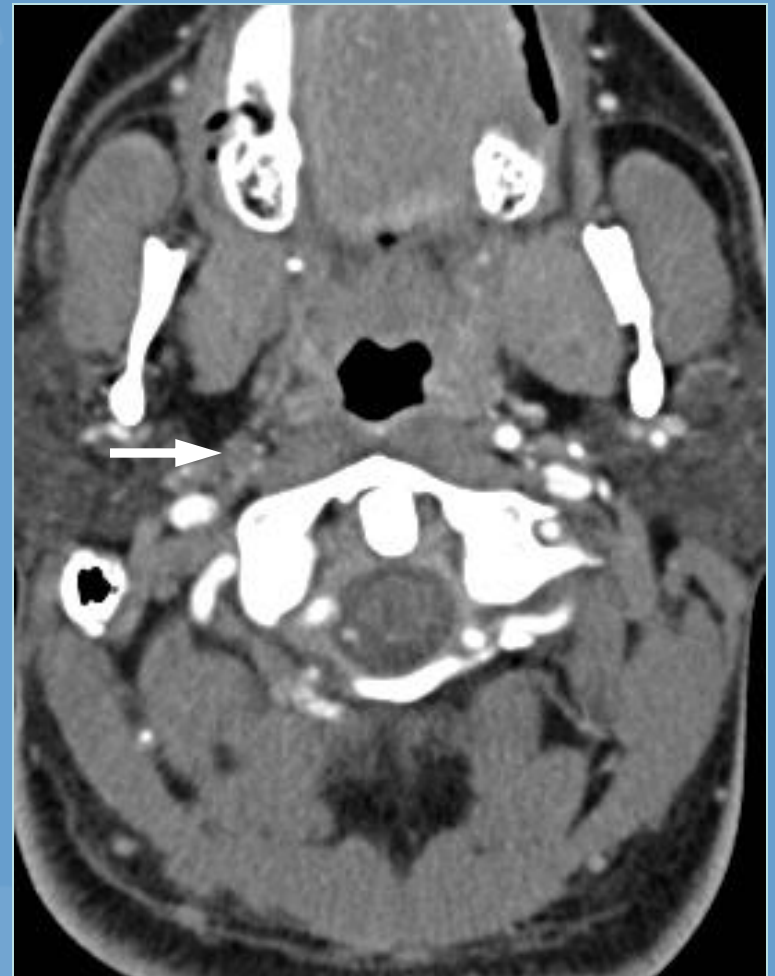
What to look at on a neck CT

- Orbits/globes
- Aerodigestive tract
 - Nasal cavities & sinuses
 - Oral cavity, pharynx, esophagus
 - Larynx & trachea
- Lymph Nodes
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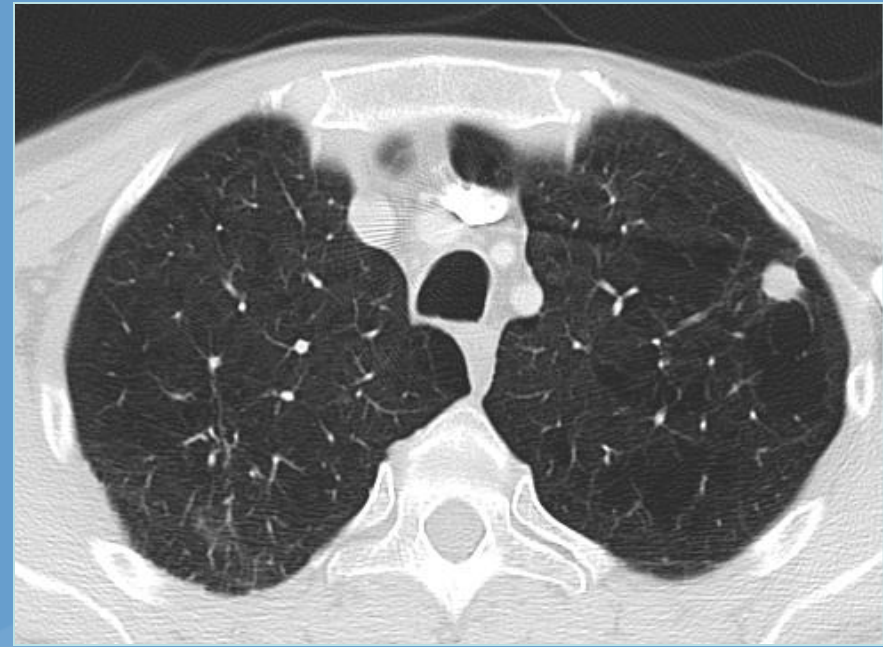
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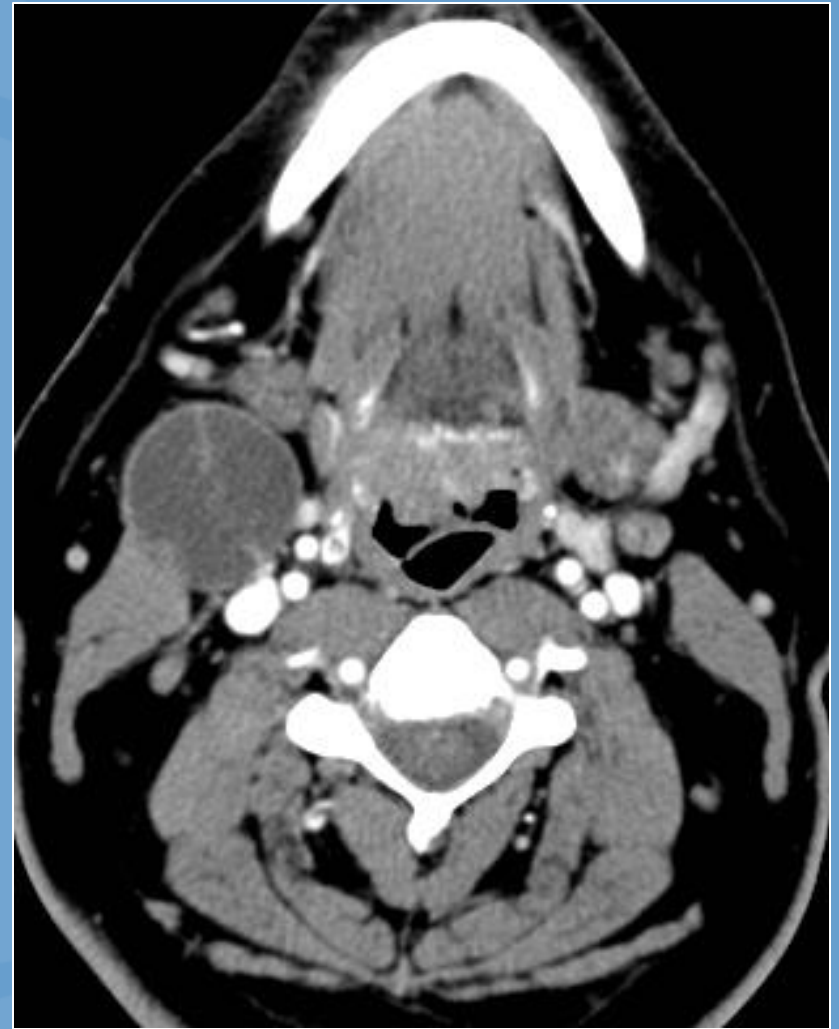


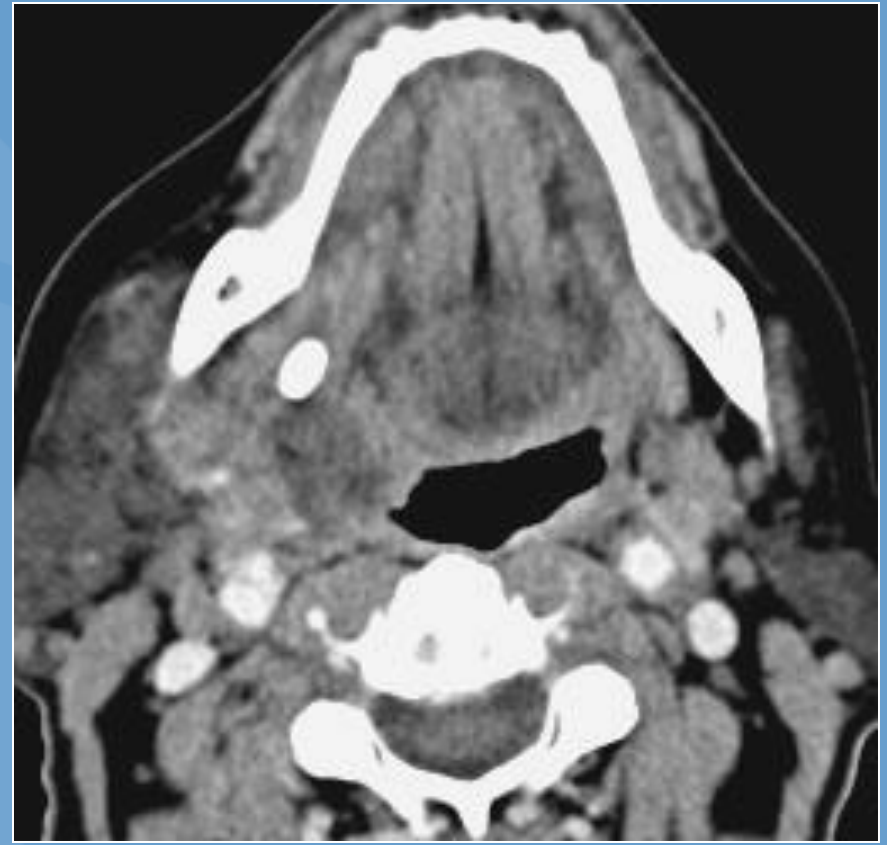
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1. What's the abnormality?
2. What's the most likely diagnosis?





1. Where is the abnormality centered?
2. What's the most likely cause of this process?



Spine Imaging Basics

Indications for Spine Cross-sectional Imaging

CT

- Trauma
- Infections
- Post-operative evaluation
- Evaluation of congenital spine anomalies

MR

- Trauma
 - Soft tissue and ligament injury
- Myelopathy or radiculopathy
- Demyelinating disease
- Tumor evaluation
- Search for and evaluate metastases
- Infections
- Back pain

Red Flags in Patients with Back Pain

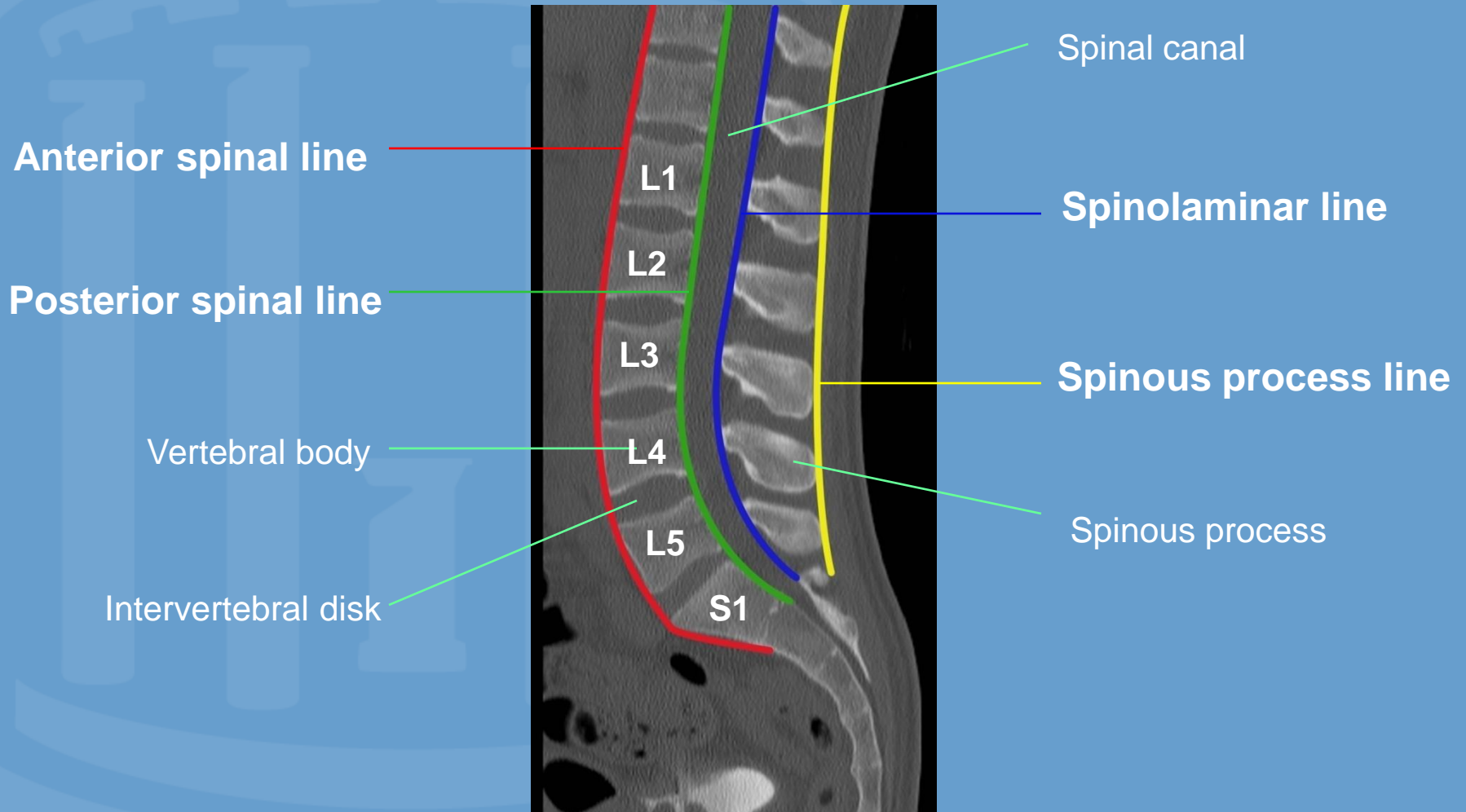
- Trauma
- Fever
- Sudden back pain with spinal tenderness (especially with history of osteoporosis, cancer, steroid use)
- Severe or progressive neurologic deficits (e.g. bowel or bladder function, saddle parasthesia)
- Serious underlying medical condition (e.g., cancer)

What to look at on a spine CT

- Vertebral body & disc height
- Alignment
- Lysis/Sclerosis
- Extraspinal tissues



Midsagittal Image Spinal Lines



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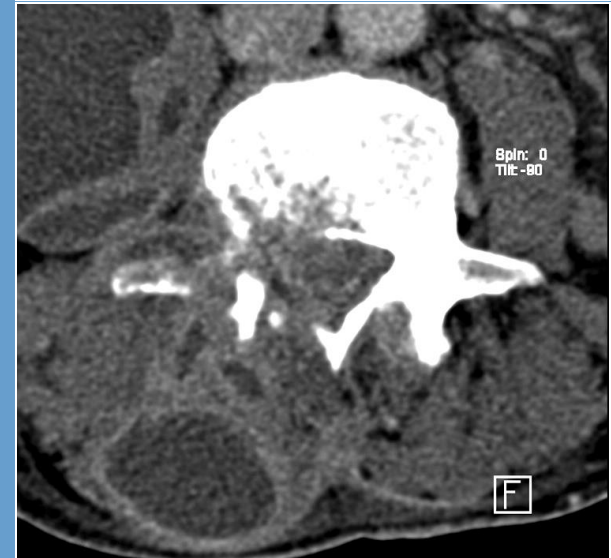
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What to look at on a spine CT

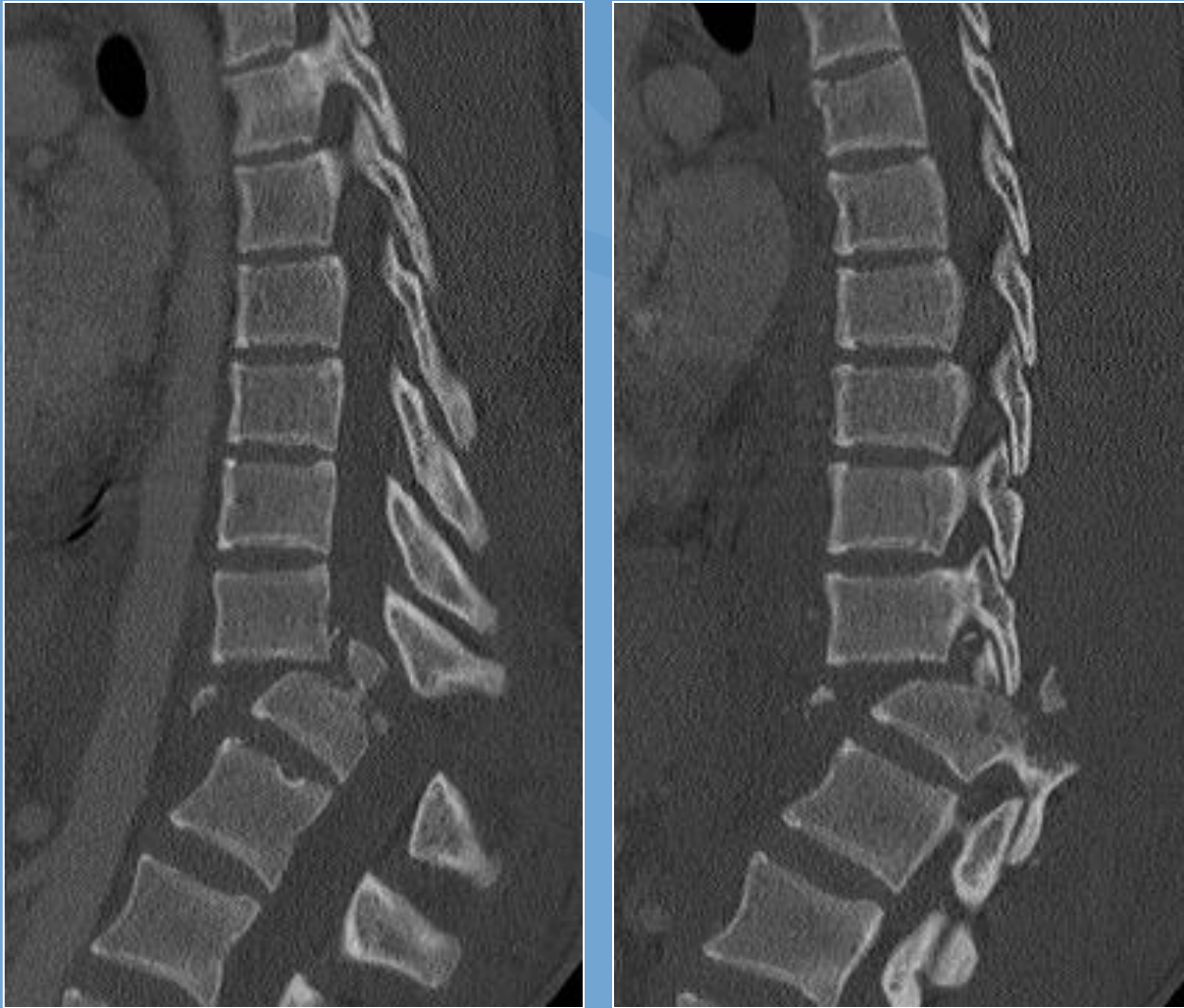
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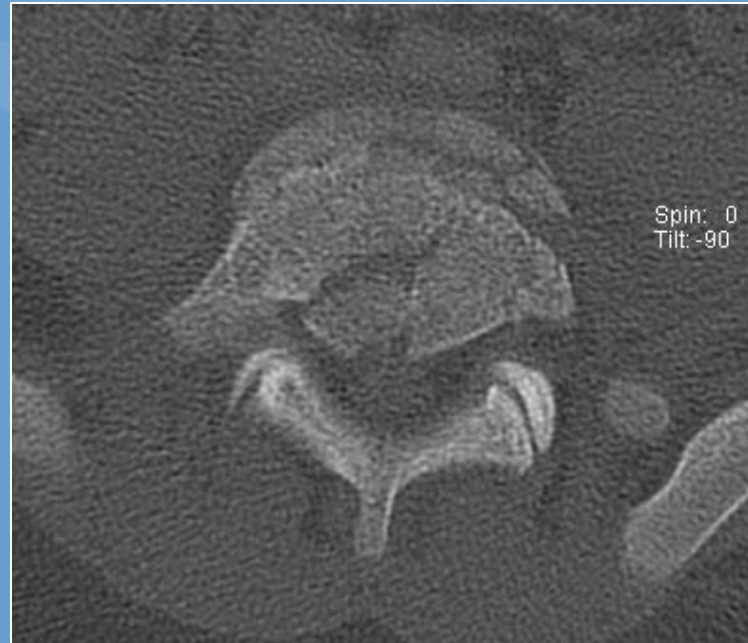
What to look at on a spine MR

- Vertebral body & disc height
- Alignment
- Masses
- Extraspinal tissues
- Disc bulges/herniations
- Spinal canal stenosis & cord compression
- Marrow and cord signal

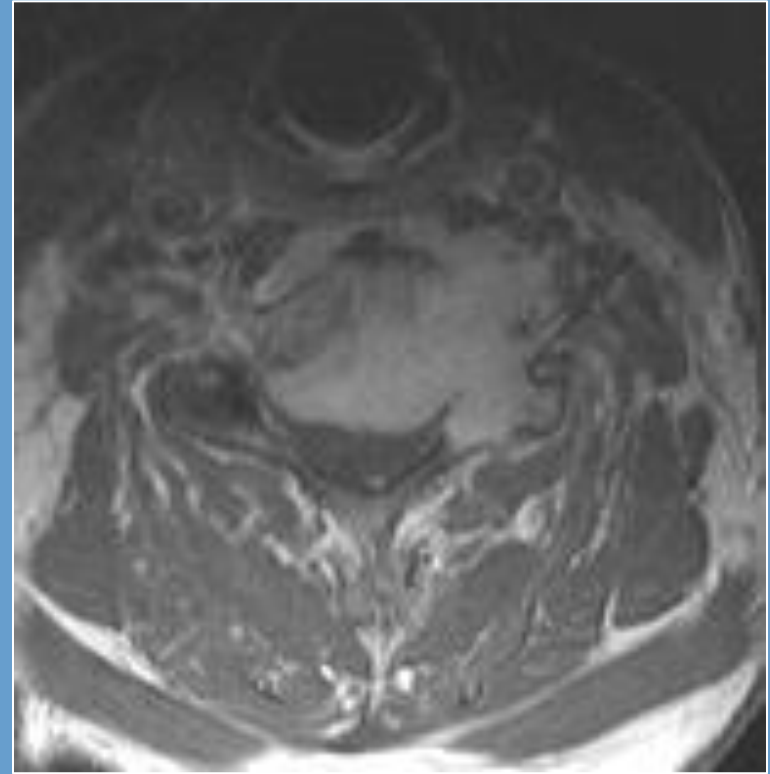




1. What's the abnormality?
2. What's the likely mechanism of injury?



1. What's the abnormality?
2. What's the likely mechanism of injury?



1. Why is this patient complaining of lower extremity weakness?
2. What's the likely diagnosis?



That's all Folks!