

RADIOLOGY

NEUROPSYCHIATRY BLOCK

TEAM 438

Editing File

Color index:

Black: main text

Gray: Extra info

Pink : girls slides

Blue: boys slides

Red: important



Spinal Cord



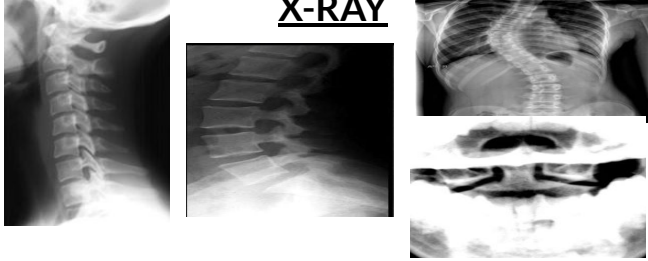
Objectives

By the end of this lecture you should know:

1. Anatomy of spinal cord.
2. Anatomy of vertebral column.
3. Identify, and distinguish between, common types of Radiographic Images.
4. You should also be able to recognize some RADIOLOGICAL presentation of spinal cord **diseases**.

Imaging Modalities

X-RAY

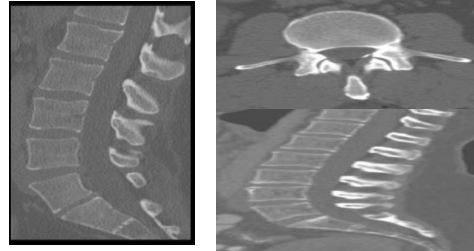


1. **Often the first diagnostic imaging.**
 2. **Small dose** of radiation to visualize the bony parts
 3. Can detect:
 - 3.1. Spinal alignment and curvature
 - 3.2. Spinal instability- with flexion and extension views
 - 3.3. Congenital (birth) defects of spinal column
 - 3.4. Fractures caused by trauma
 - 3.5. Moderate osteoporosis (loss of calcium from the bone)
 - 3.6. Infections
 - 3.7. Tumors
- May be taken in different positions (flexion and extension) to assess for instability

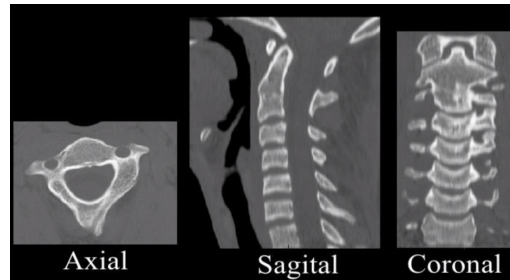
ULTRASOUND

- More in children

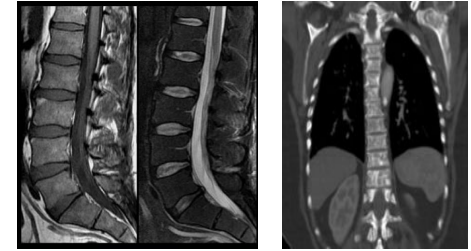
CT



1. Uses radiation
2. Obtain 2-D images > can be processed to 3-D images
3. Entire spine can be imaged within a few minutes
4. **Detailed information regarding bony structures, better than X Ray**
5. Limited information about spinal cord & soft tissues



MRI



1. **Gold standard** of imaging for spinal cord disorders
 2. No radiation
 3. Can identify abnormalities of bone, **Soft tissues** and spinal cord
 4. Claustrophobic patients, uncooperative and children may need sedation or general anesthesia
 5. **Contraindications: implanted devices e.g. cardiac pacemakers and electromagnetic devices**
- ★ Intravenous contrast is sometimes administered to better visualize certain structures or abnormalities
- ★ Patient lies still in a tunnel like structure for about 25 minutes

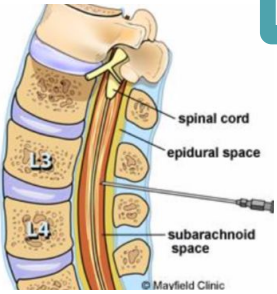
Modalities	Indication	Advantages	Disadvantages
X-ray	<ol style="list-style-type: none"> 1. Trauma 2. Intraoperative localization 	<ol style="list-style-type: none"> 1. Inexpensive 2. widely available 3. quick 4. portable 	<ol style="list-style-type: none"> 1. Radiation exposure 2. Difficulty in interpretation 3. High rate of false positive findings
CT	Trauma	<ol style="list-style-type: none"> 1. Better Visualization of: <ol style="list-style-type: none"> a. bony Structures (Fractures and fracture patterns) b. Degenerative or aging changes, c. Spinal alignment d. Herniated discs e. childhood anomalies 2. widely available 3. quick 	<ol style="list-style-type: none"> 1. Less useful at visualizing soft tissue structures 2. Radiation exposure 3. Cost\$
MRI	<ol style="list-style-type: none"> 1. “Red flags” patients⁴ 2. Radiculopathy ² 3. Tumor 4. Myelopathy³ 	<ol style="list-style-type: none"> 1. Visualization of soft tissue structures (e.g. relationship of disc to nerve) 2. No radiation exposure 	<ol style="list-style-type: none"> 1. Contraindications: ferromagnetic implants, cardiac pacemakers, intracranial clips, claustrophobia! 2. Not widely available 3. Cost\$\$\$\$ 4. Time consuming

1.extreme or irrational fear of confined places.

2.pinchd nerve, refers to a set of conditions in which one or more nerves are affected,This can result in pain (radicular pain), weakness, numbness, or difficulty controlling specific muscles.

3.Myelopathy is an injury to the spinal cord due to severe compression that may result from trauma.

4. Red flags are signs and symptoms found in the patient's history and clinical examination.



Myelogram

A contrast material is injected into **CSF** to better identify areas where spinal cord or spinal nerves may be compressed

Angiography

To evaluate arteries and veins

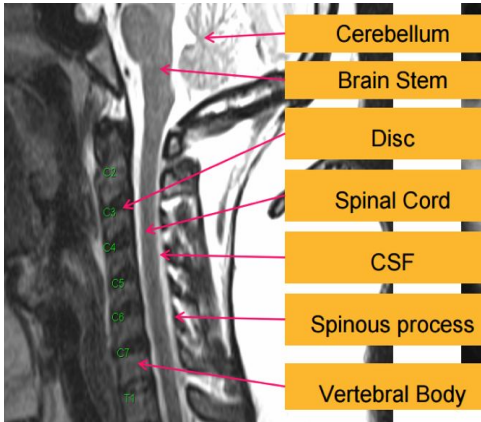
DEXA

radionuclide scan for bone density (osteoporosis)

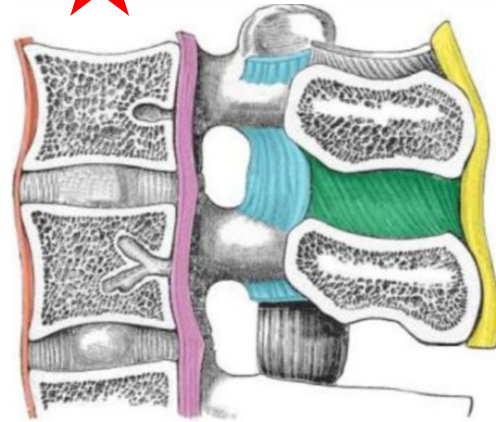
Radionuclide Bone Scan

Intravenous injection of radioactive material bound to phosphonates which deposit in bones, followed by images by gamma camera.

Radioanatomy



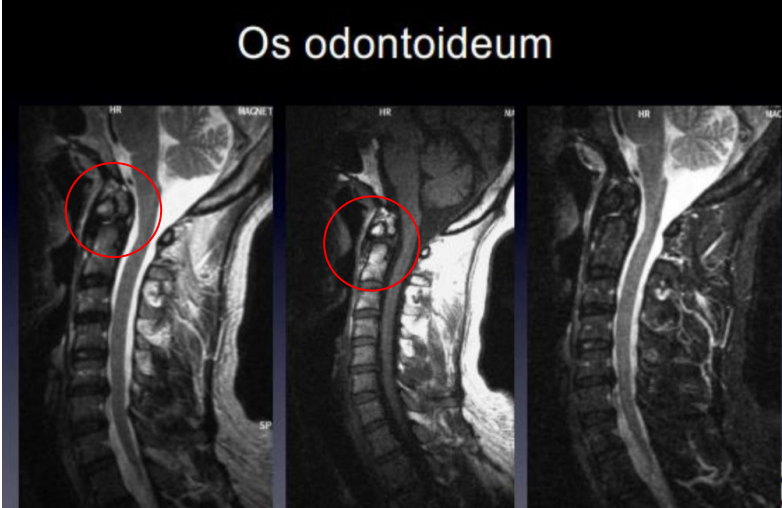
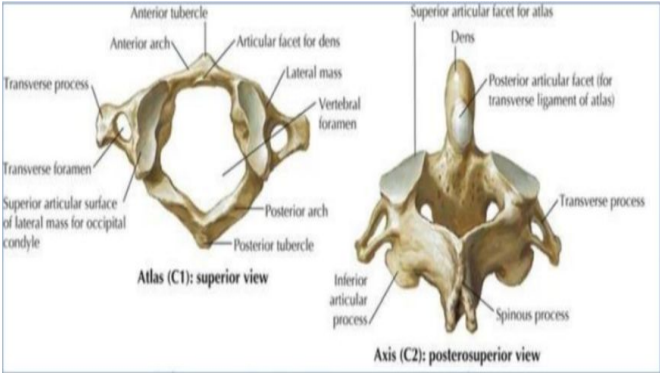
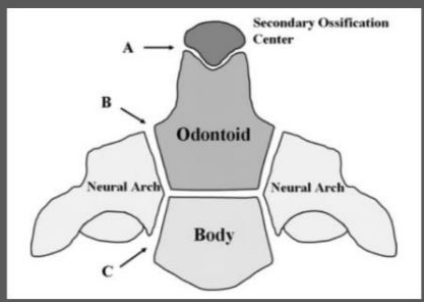
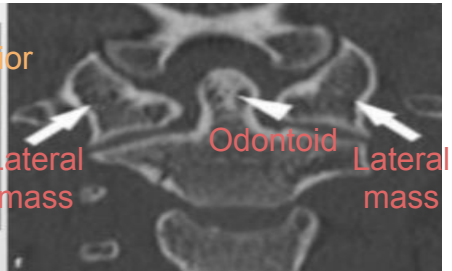
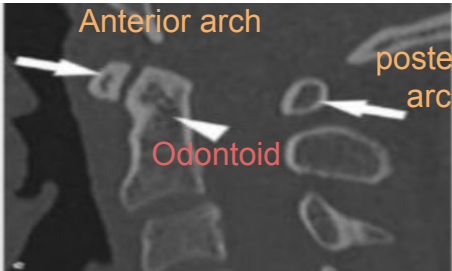
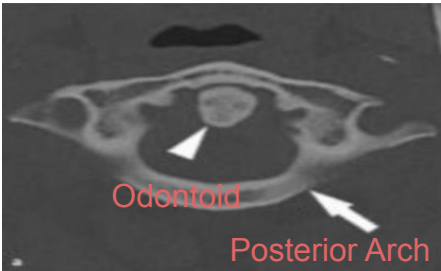
Spinal Ligaments



■	Anterior longit. ligament
■	Posterior longit. ligament
■	Ligamentum flavum
■	Interspinous ligament
■	Supraspinous ligament

Craniocervical junction

★ Craniocervical junction = C1 + C2



Normal not fracture:center of ossification of the dens not yet fused with the body of C2

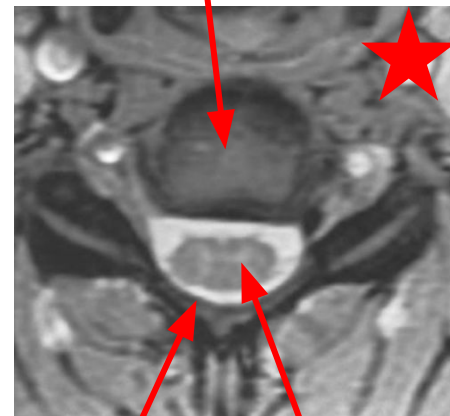
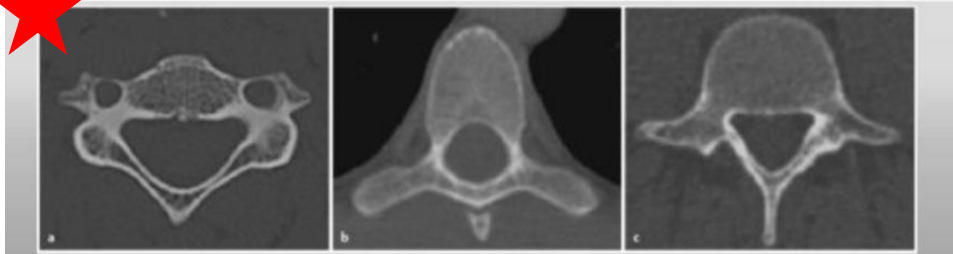
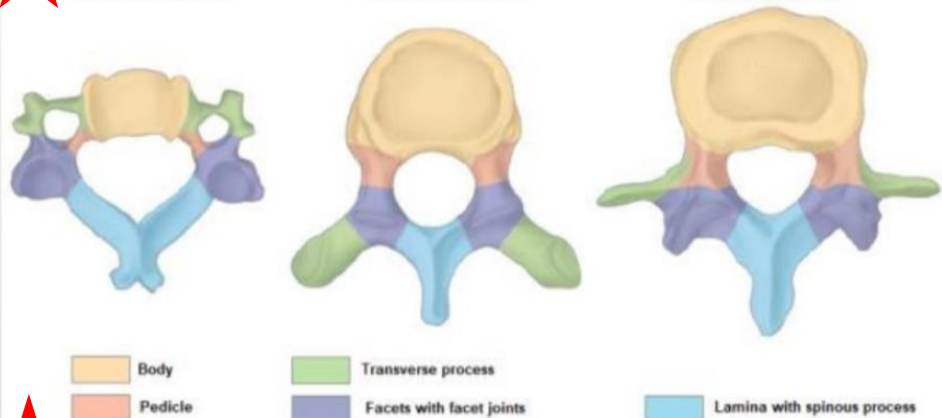
Vertebrae



Cervical spine

Thoracic spine

Lumbar spine



Body

Spinal canal

Spinal cord

Cervical spine:	6-7
Thoracic spine:	11-13
Lumbar spine:	4-6
Sacrum:	4-6
Coccyx:	2-8
TOTAL:	32-35

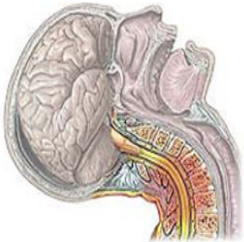
Abnormalities Of Spinal Cord

1) Trauma

- Plain film assessment of trauma > the first imaging method
- Plain Radiographs (x-rays) are usually the first series of images to be ordered by the physician.
- If fractures, or other bony defects, are suspected, CT images can provide very detailed information.
- When soft tissue injury is suspected, MRI is usually the imaging technology of choice.

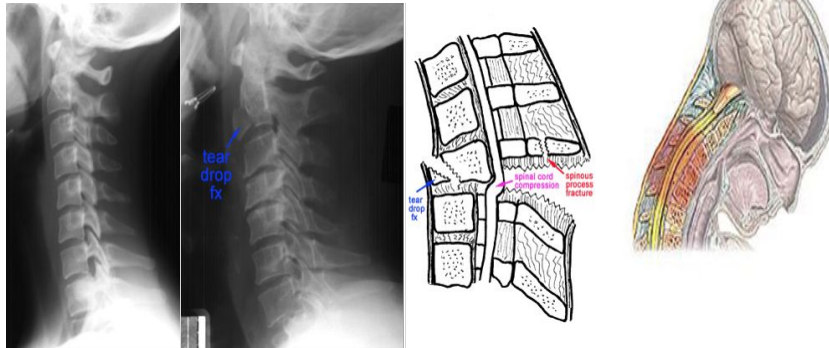
Injury:

Hyperextension



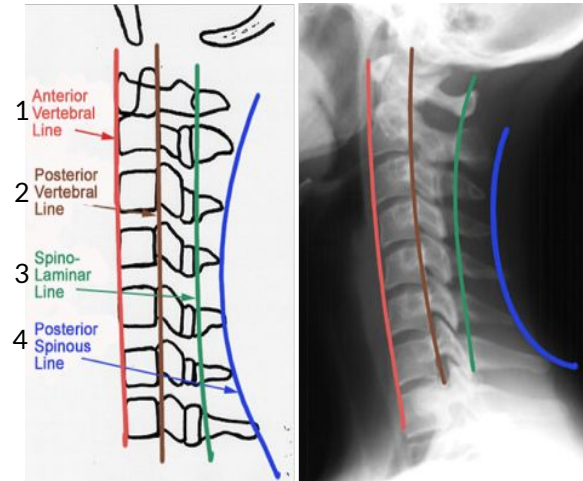
Sprain or strain of cervical tissues

Hyperflexion



Assess four parallel lines.

Alignment should be normal :
Check by drawing lines

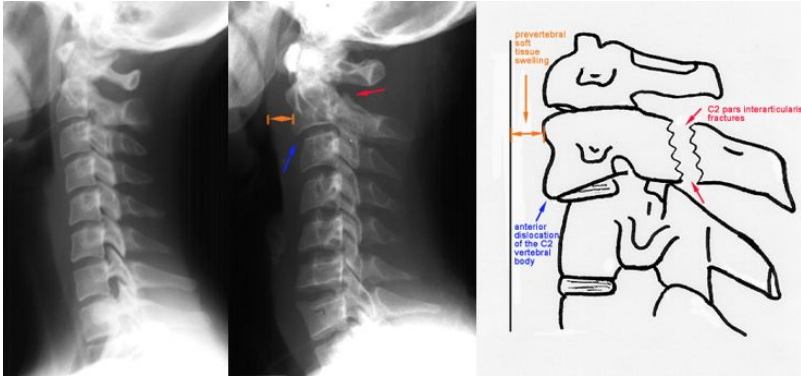


1. Anterior vertebral line
2. Posterior vertebral line
3. Spinolaminar line
4. Posterior spinous line

Abnormalities Of Spinal Cord

1) Trauma

Hangman's Fracture



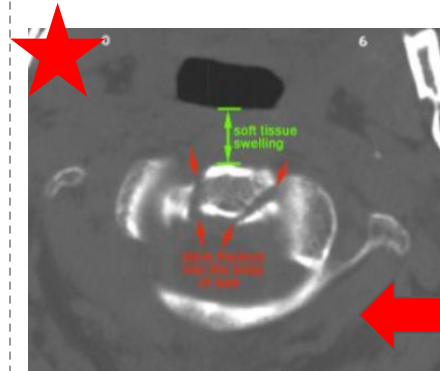
Fractures through the pars interarticularis of C2 resulting from hyperextension and distraction
Hyperextension (e.g. hanging, chin hits dashboard in road accident)

Radiographic features: (best seen on lateral view)

- Prevertebral soft tissue swelling
- Avulsion of anterior inferior corner of C2 associated with rupture of anterior longitudinal ligament.
 - Anterior dislocation of C2 vertebral body
 - Bilateral C2 pars interarticularis fractures



Soft tissue anterior to spine is very important, as it could be a secondary sign of presence of trauma injury.

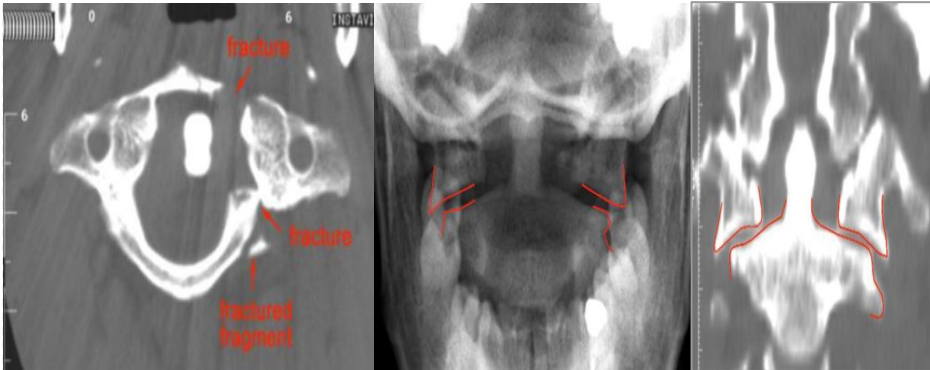


And after CT scan it will proof presence of fracture caused by trauma which caused the soft tissue swelling

Abnormalities Of Spinal Cord

1) Trauma

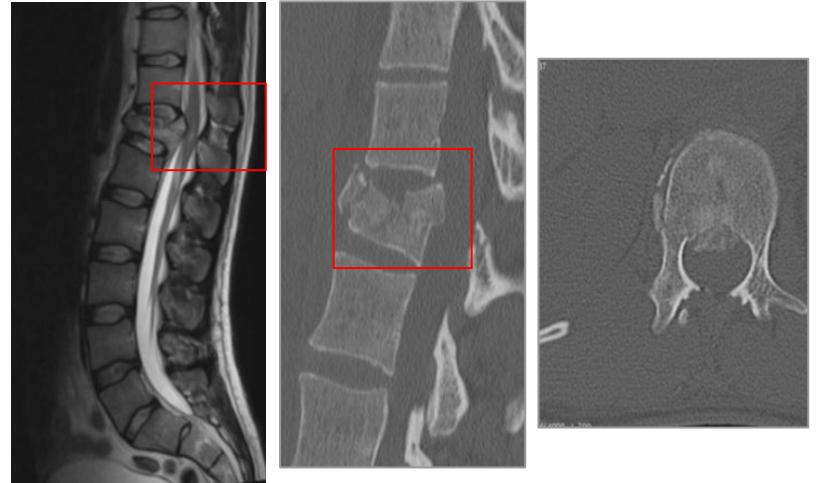
Jefferson Fracture



- Axial CT clearly shows the location of the fractures of C1
- Lateral displacement of C1 in plain film
- Coronal reconstruction from a CT confirms the findings from the odontoid view

A Jefferson fracture is a bone fracture of the anterior and posterior arches of the C1 vertebra,[1] though it may also appear as a three- or two-part fracture. The fracture may result from an axial load on the back of the head or hyperextension of the neck (e.g. caused by diving), causing a posterior break, and may be accompanied by a break in other parts of the cervical spine.

Burst Fractures



A type of compression fracture related to high-energy axial loading spinal trauma that results in disruption of the posterior vertebral body cortex with retropulsion into the spinal canal.

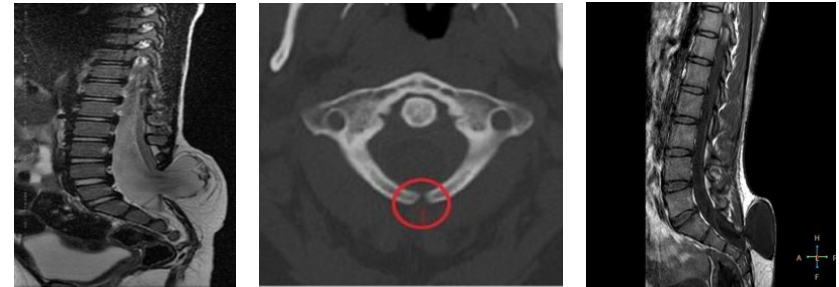
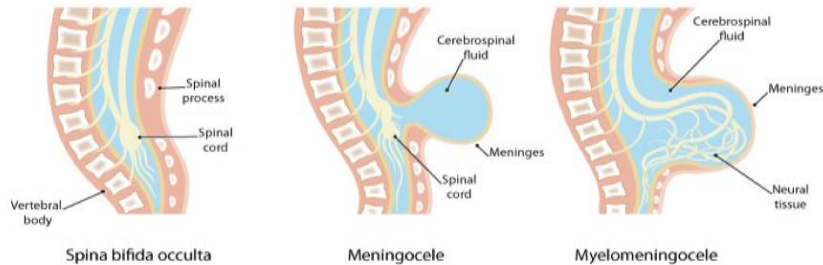
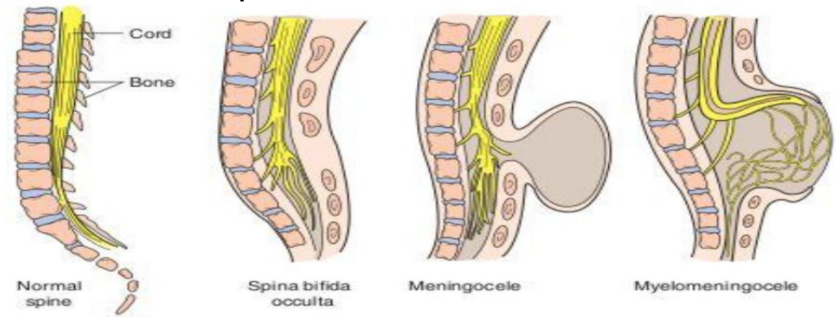
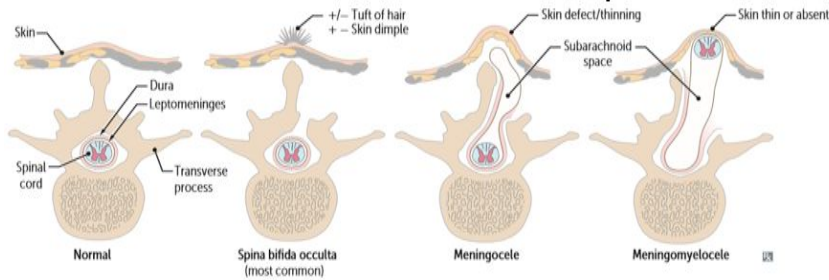
Abnormalities Of Spinal Cord

2) Congenital Defects

- **MRI** is the best to assess the contents of the cavity, extent of abnormalities, and spinal cord.
- **CT** shows bony structures the best and is often used before surgery

Spina Bifida

birth defect when portion of the neural tube fails to develop or close properly, causing defects in the spinal cord and in the bones of the spine.

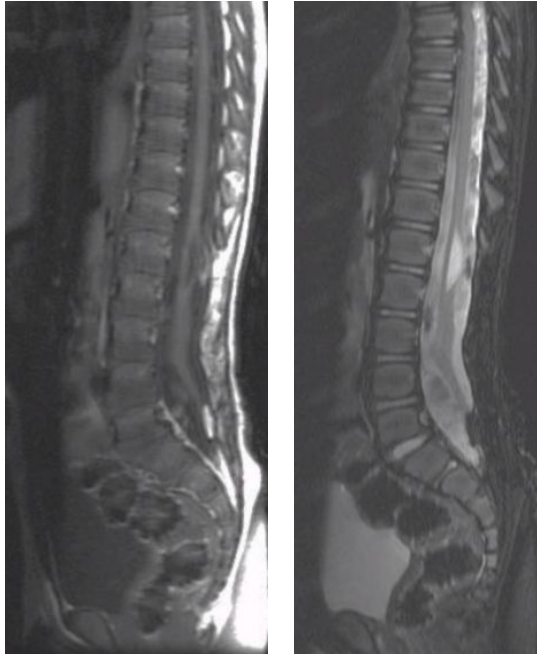


Abnormalities Of Spinal Cord

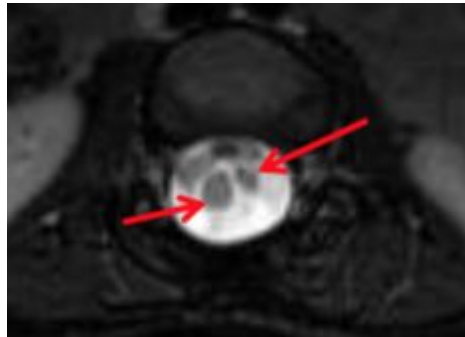
2) Congenital Defects



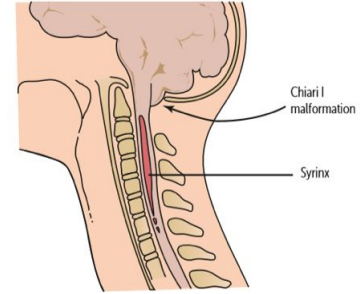
Split low lying cord (diastematomyelia)



Split cord malformations are a congenital abnormality, patient described as if he has to cords



Syringomyelia



a disorder in which a cyst or cavity forms within the spinal cord. This cyst, called a **syrinx**, can expand and elongate over time, destroying the spinal cord. The damage may result in loss of feeling, paralysis, weakness, and stiffness in the back, shoulders, and extremities.

Abnormalities Of Spinal Cord

3) INFLAMMATORY

Multiple Sclerosis

Multiple sclerosis (MS) is a immune-mediated inflammatory acquired chronic relapsing, most common **demyelinating disease** involving the central nervous system.

Characteristically disseminated not only in space but also in time.

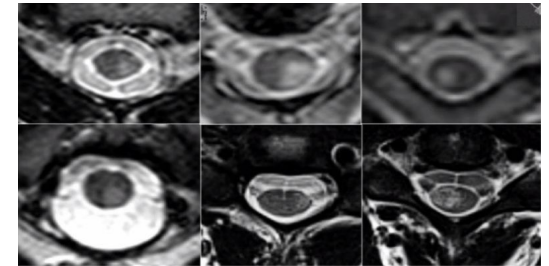
- ❖ Mostly in cervical cord (60%) and conus
- ❖ Less commonly in thoracic region
- ❖ More than 1 lesion in (55 %)
- ❖ < length (2 - 60 mm) in craniocaudal length
- ❖ Eccentric
- ❖ No or very little mass effect or cord swelling
- ❖ Lesions only in spinal cord in 5-24%
- ❖ May result in cord atrophy -> Disability

Ms and other demyelinating diseases overlap:

- ❑ Neuromyelitis optica was first thought to be a form of MS, but is now considered to be a distinct form.
- ❑ Acute Disseminated Encephalomyelitis can relapse and progress to MS.
- ❑ The partial form of transverse myelitis.

lesions:

- More likely multiple, focal and peripherally located
- don't cover the entire section on axial images
- often < 2 vertebral body heights on sagittal images
- are disseminated in time and space



On transverse images MS lesions typically have a round or triangular shape and are located posteriorly or laterally.

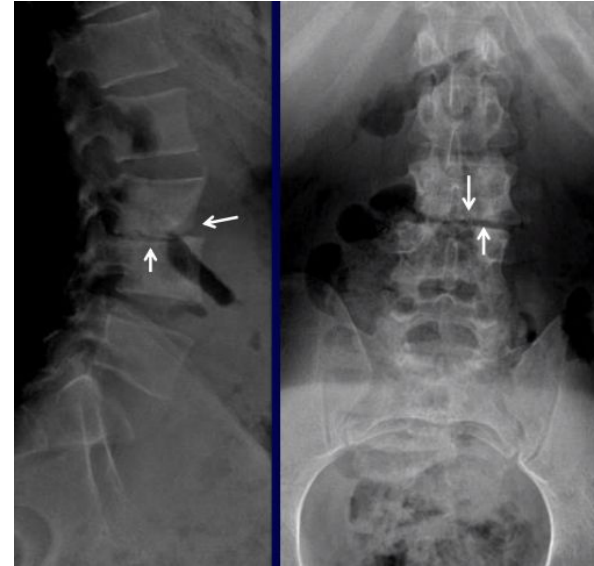
Abnormalities Of Spinal Cord

4) INFECTIONS

Discitis and Osteomyelitis

- Usually the result of blood-borne agents
 - Most common pathogen is staphylococcus, Streptococcus
 - less common Gram-negative rods in IV drug abusers or immunocompromised patients
 - E. Coli
 - Proteus
 - Non-pyogenic
 - Tuberculosis
 - Brucellosis
- May occur after invasive procedure like Surgery, Discography, Myelography
- In children, infection begins in vascularized disc
- In adults, in anterior inferior corner of vertebral body with spread across disk to adjacent vertebral endplate

Spondylodiscitis



Narrow and destruction of L3-L4 disc space with irregular erosions of opposing end-plates Spondylodiscitis

Abnormalities Of Spinal Cord

4) INFECTIONS

IMAGING FINDINGS

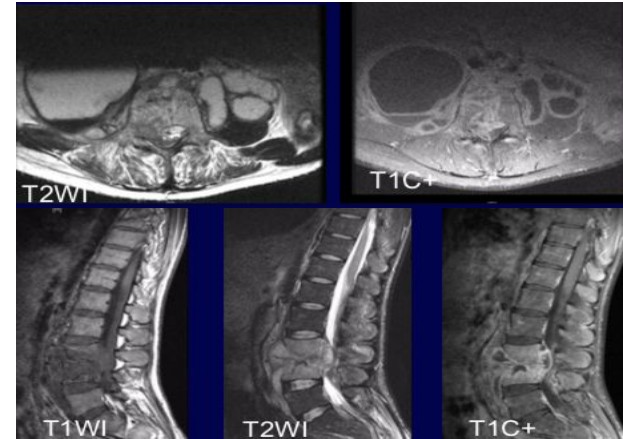
➤ PLAIN FILMS

- Narrowing and destruction of an intervertebral disk
- Indistinct adjacent endplates with destruction
- Often associated with bony sclerosis of the two contiguous vertebral bodies
- Paravertebral soft tissue mass
- Endplate sclerosis (during healing phase beginning anywhere from 8 weeks to 8 months after onset)
- Bone fusion after 6 months to 2 years

➤ MRI

- Bone marrow edema in infected vertebrae, discs and paraspinal soft tissues Dark on T1 and bright on T2 images
- Enhancement of inflamed tissues after contrast
- Fluid collections (abscesses) are common

Spondylodiscitis



- Sagittal T1WI shows decreased signal of vertebral bodies and disc with end plate destruction.
- Sagittal T2WI shows increased signal in corresponding areas with anterior subligamentous and intraspinal epidural abscess.
- Sagittal contrast-enhanced T1-fat sat shows intense enhancement the involved area
- T1WI T2WI T1C+ Axial T2WI and axial contrast-enhanced T1 fat sat show the paraspinal large abscesses

Abnormalities Of Spinal Cord

5) Tumors

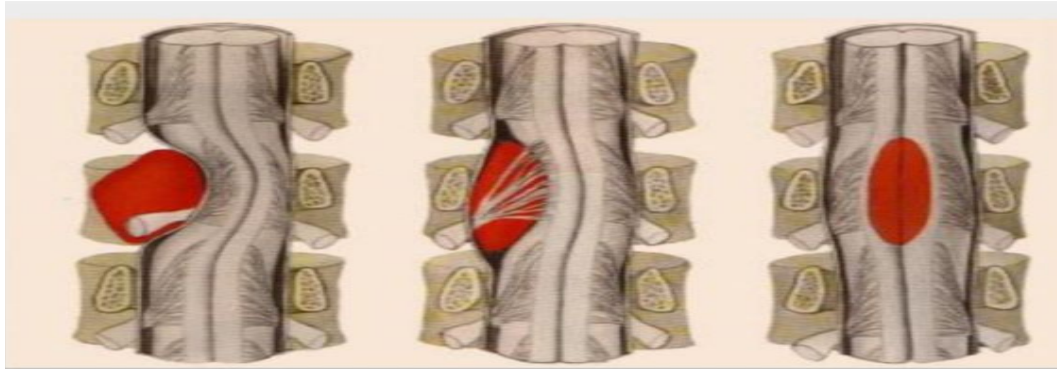
Classification



Extradural

Intradural
extramedullary

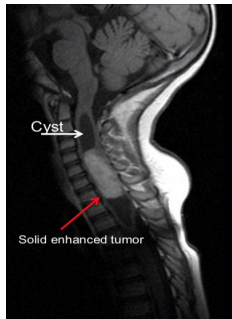
Intramedullary



EX: metastasis

EX: meningioma &
schwannoma

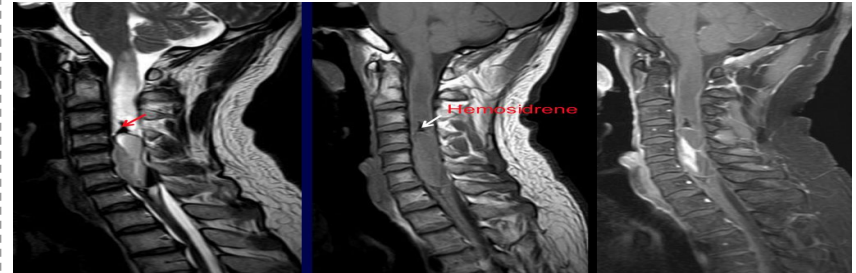
EX: Ependymoma &
Astrocytoma



Astrocytoma



Ependymoma

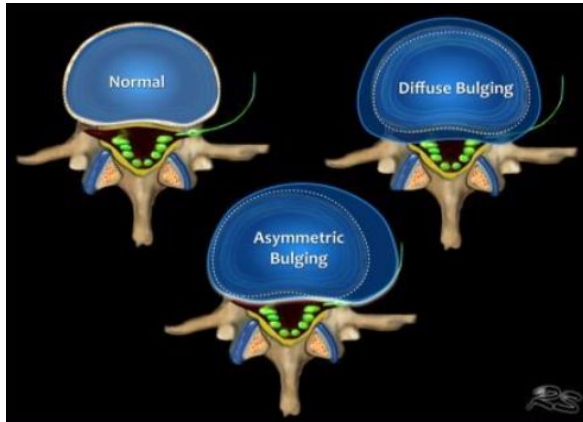


DISC DISEASE



The herniation is shown on the opposite side of what is shown on the image [Axial images]

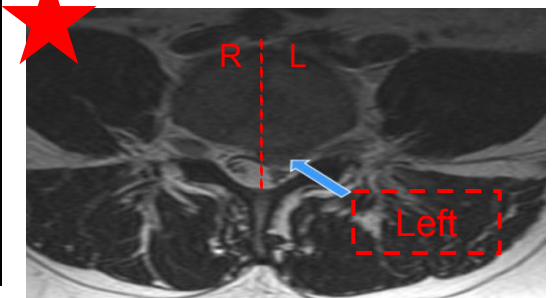
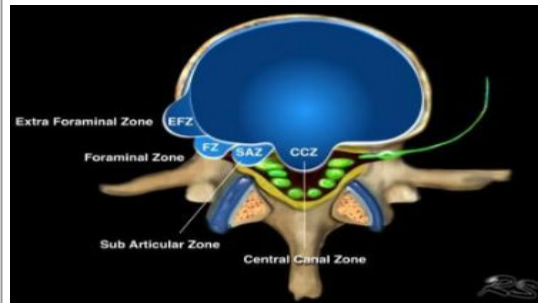
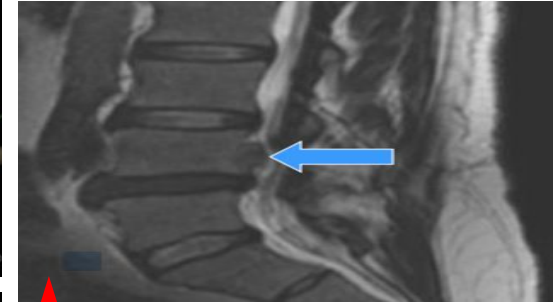
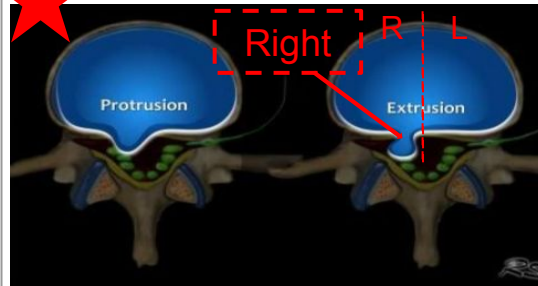
Bulging



A bulging disc can commonly be referred to as a slipped disc or a protruding disc.

However, when the disc bulge is significant enough for the disc nucleus to come out of the annulus, it is known as a herniated disc.

Herniation



Quiz :

1 - which of the following patients is Contraindicated to have MRI

- A - Patient with cardiac pacemaker.
- B - Patient with a tumor
- C - Patient with Myelopathy
- D - Patient with Radiculopathy

2 - which of the following Cervical spines represent Craniocervical junction?

- A - C1 + C2+C3
- B - C1 + C2
- C - C1 only
- D -C2 + C3

3 - which of the following is Intramedullary tumor of the spinal cord?

- A - Astrocytoma
- B - Meningioma
- C - Schwannoma
- D - Metastasis

4 -Baby boy born at term (40 weeks), delivered by C-section because of lack of progression of the labor but no medical problems were identified then. After birth a small meningocele is observed in the lumbar area, covered by a small patch of hair, the child was submitted to the Pediatric Surgical Dpt. for the repair of the meningocele. Two months after the surgery the child came for reevaluation and a spinal ultrasound scan was done, revealing that, the spinal cord was splitted in two, what is the diagnosis of this finding?

- A - Syringomyelia
- B - Spondylodiscitis
- C - Diastematomyelia
- D - Herniation

5 -A patient arrived at KKUH after a car accident. After X-ray Images were reviewed there was no clear fracture seen in the X-ray, but the doctor notest Soft tissue anterior to the spine was swollen so the doctor wanted to confirm the presence of fracture so he requested the patient to have?

- A - Plain Radiograph
- B - Ultrasound
- C - MRI
- D - CT

Team leaders:



Nouran Arnous



Omar Aldosari

Team members:



Faisal Alqifari



Rawan Alzayed



Moh Al-Huqbani

إن الله يعطي أصعب المعارك لأقوى الجنود فاستمر