MED439
KING SAUD UNIVERSITY

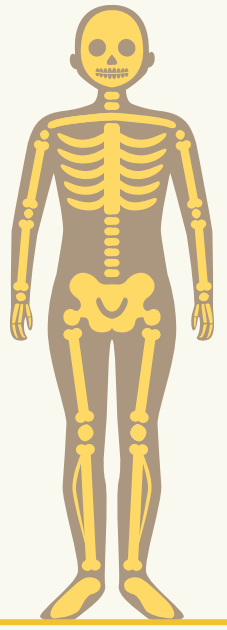
Revised & Approved

Abdullah Alsubaihi
Rania Almutiri

RADIOLOGY TEAM 439

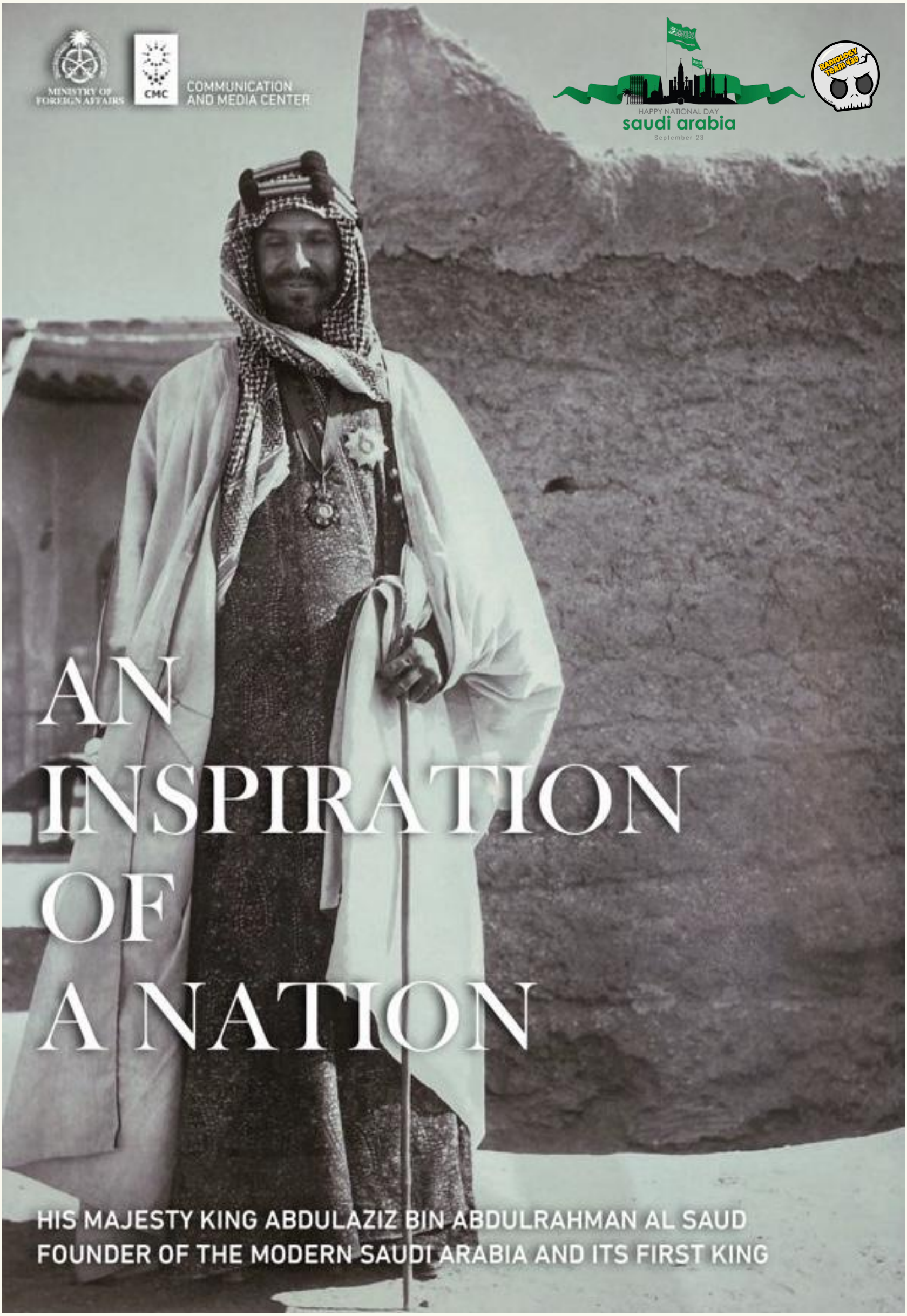
Radiology of Spinal Cord

-CNS BLOCK-



Color index:

Black: Main text
Red: Important ★
Yellow: Drs notes
Gray: Extra


MINISTRY OF FOREIGN AFFAIRS
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September 23
RADIOLOGY TEAM 439
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FOUNDER OF THE MODERN SAUDI ARABIA AND ITS FIRST KING

Objectives

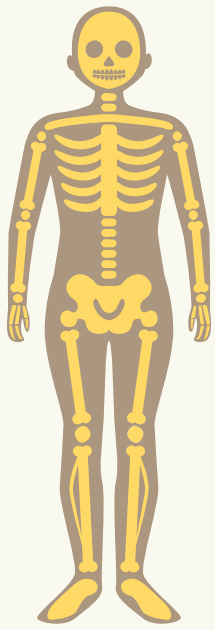
By the end of this lecture you should know:

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

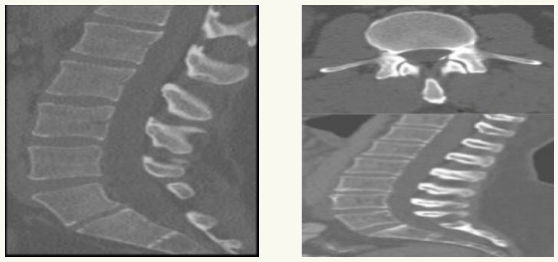
X-Rays

-Often the first diagnostic imaging test, quick and cheap Small dose of radiation to visualize the bony parts of the spine Can detect:

- ❖ spinal alignment and curvature
- ❖ Spinal instability- with flexion and extension views
- ❖ Congenital (birth) defects of spinal column
- ❖ Fractures caused by trauma
- ❖ Moderate osteoporosis (loss of calcium from the bone)
- ❖ Infections
- ❖ Tumors

-May be taken in different positions (flexion and extension) to assess for instability

CT ★

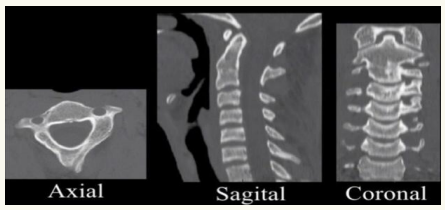


1. Uses radiation
2. Obtain 2-D images > can be processed to 3-D images
3. Entire spine can be imaged within a few minutes
4. Detailed information regarding bony structures
5. Limited information about spinal cord & soft tissues

Better in visualizing:

1. Degenerative or aging changes, Herniated discs
2. Spinal alignment
3. Fractures and fracture patterns
4. Congenital / childhood anomalies
5. Areas of narrowing in spinal canal through which spinal cord and spinal nerve roots pass

Radiation load in CT is higher than X-ray

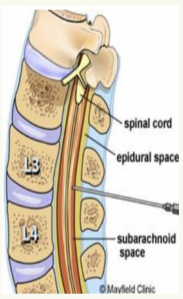


MRI ★

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
6. Intravenous contrast is sometimes administered to better visualize certain structures or abnormalities
7. Patient lies still in a tunnel like structure for about 25 minutes

Best choice to diagnose tumors + infection + multiple sclerosis

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

Radionuclide Bone Scan

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

ULTRASOUND

- More in children

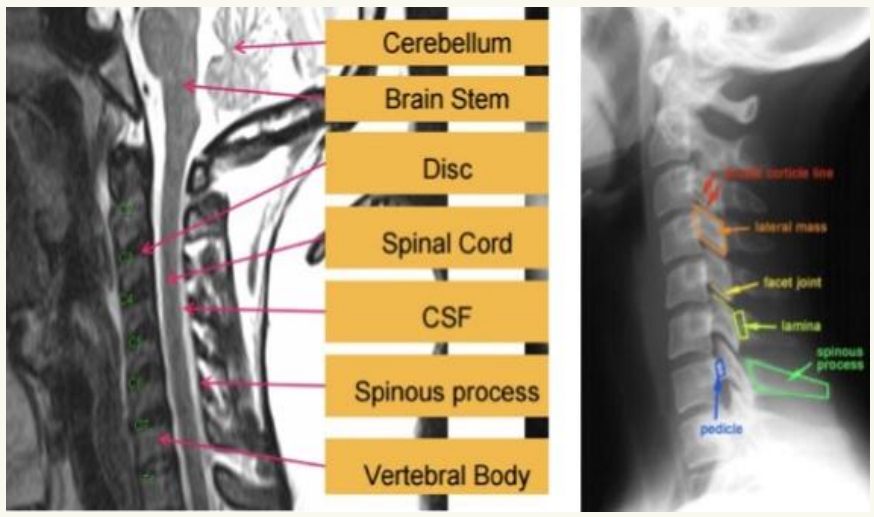
DEXA

- radionuclide scan for bone density (osteoporosis)

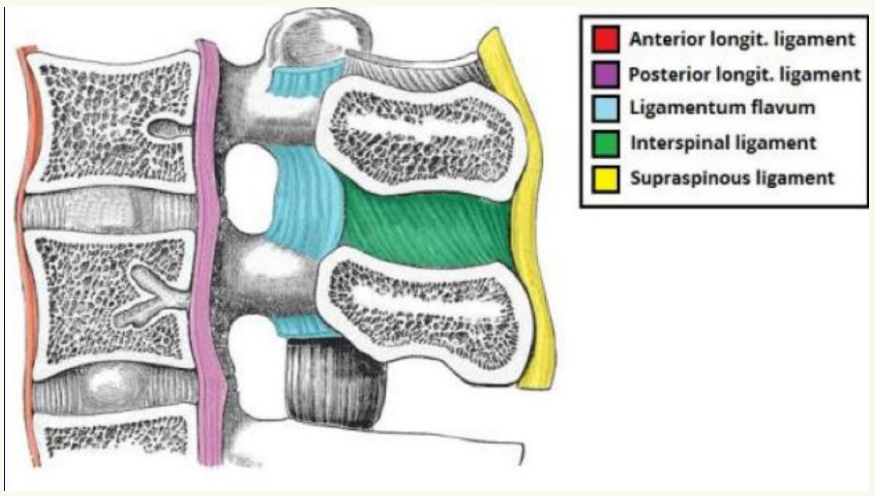
Modalities	X-rays	CT	MRI
Indication	1. Trauma 2. Intraoperative localization	- Trauma	1. "Red flags" patients[1] 2. Radiculopathy[2] 3. Tumor 4. Myelopathy[3]
Advantages	1. Inexpensive 2. Widely available 3. Quick 4. Portable	1. Better Visualization of: - bony Structures (Fractures and fracture patterns) - Degenerative or aging changes - Spinal alignment - Herniated discs - childhood anomalies 2. widely available 3. Quick	1. Visualization of soft tissue structures (e.g.relationship of disc to nerve) 2. No radiation exposure
Disadvantages	1. Radiation exposure 2. Difficulty in interpretation 3. High rate of false positive findings	1. Less useful at visualizating soft tissue structures 2. Radiation exposure 3. Cost$	1. Contraindications ferromagnetic implants, **cardiac pacemakers**, intracranial clips, claustrophobia[4] 2. Not widely available 3. Cost$ 4. Time consuming

1.Red flags are signs and symptoms found in the patient's history and clinical examination.
2.pinched 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.extreme or irrational fear of confined places. #MED438

Radioanatomy

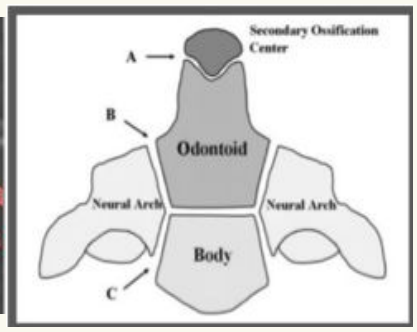


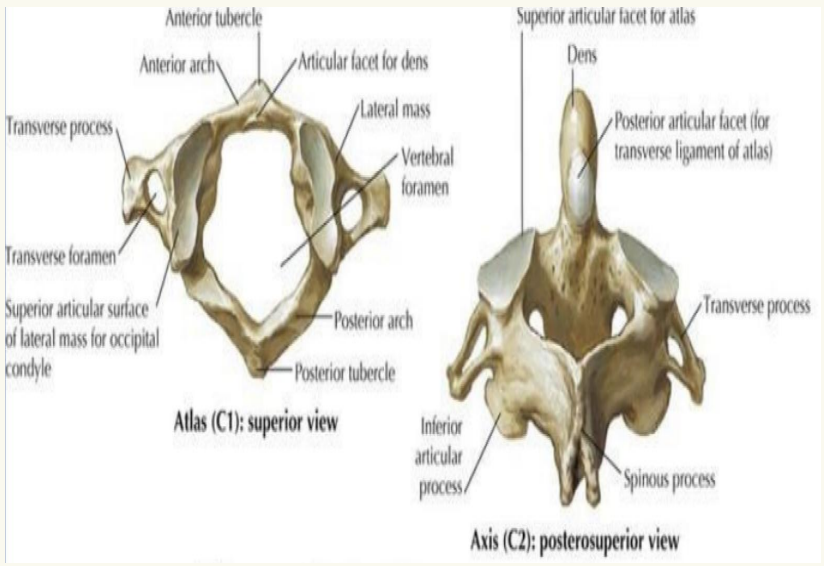
Spinal Ligaments

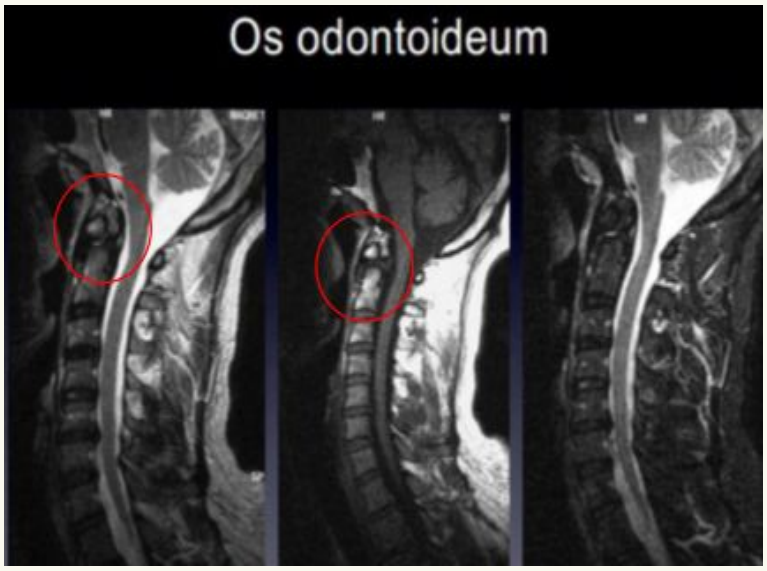


Craniocervical junction

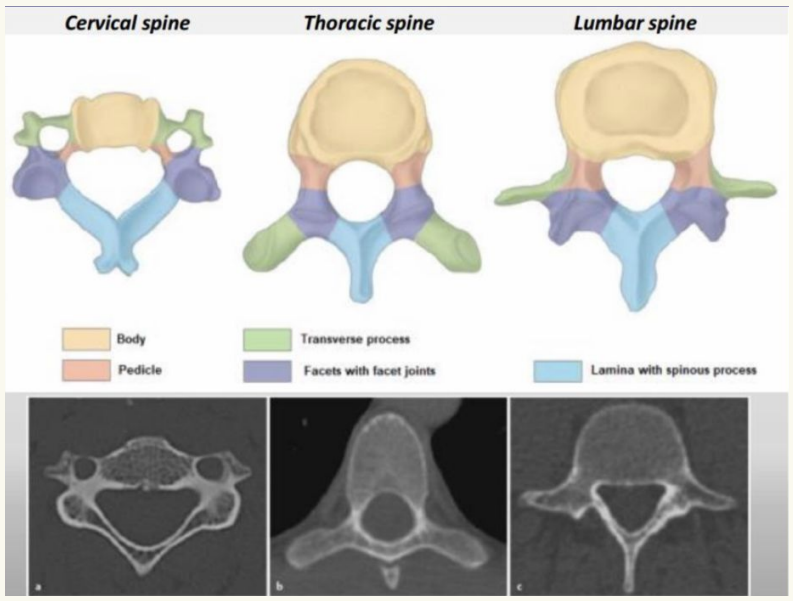
- Craniocervical junction = C1 + C2







Vertebrae



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

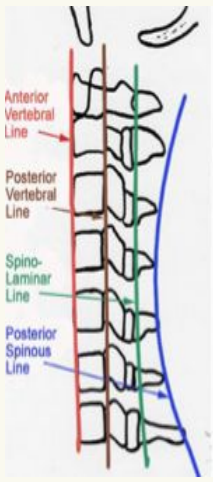
1) Trauma

➢ 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.

Assess four parallel lines:

Alignment should be normal :
Check by drawing lines

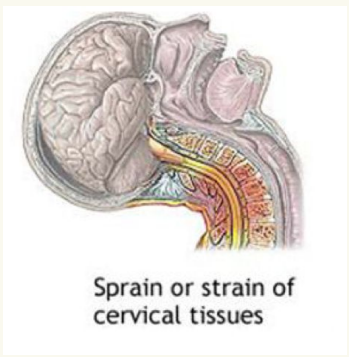
1. Anterior vertebral line
2. Posterior vertebral line
3. Spinolaminar line
4. Posterior spinous line



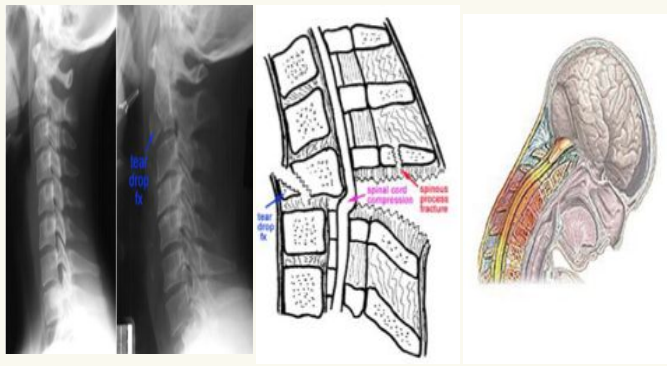
- **Injury:**

To diagnose fractures you have to use CT

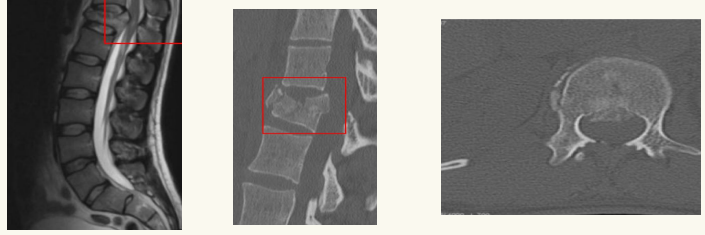
Hyperextension



Hyperflexion

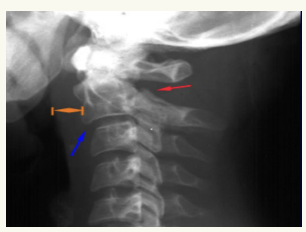


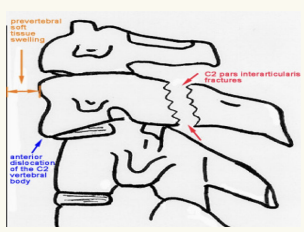
Burst Fractures



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

Hangman's Fracture



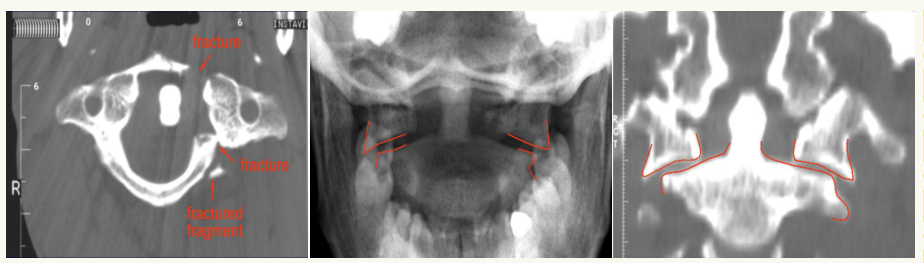


Fractures through the pars interarticularis of C2 resulting from hyperextension and distraction be a secondary sign of Hyperextension (e.g. hanging, chin hits dashboard in road accident)
Radiographic features: (best seen on lateral view)

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

Hangman's Fracture is Unstable which means it can cause further damage to the spinal cord

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.
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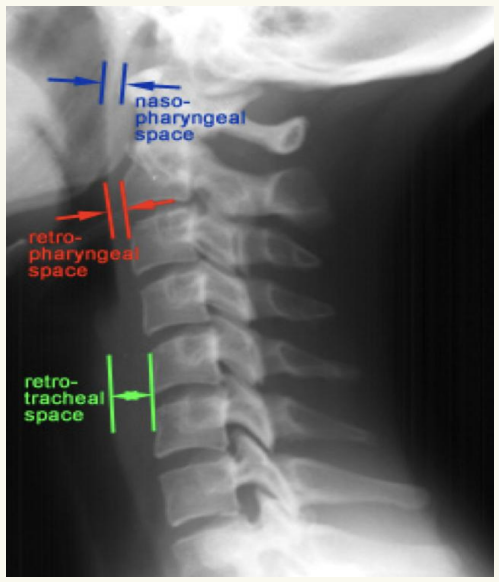
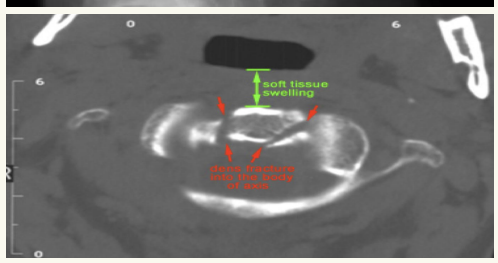
Abnormalities Of Spinal Cord

1) Trauma cont..





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

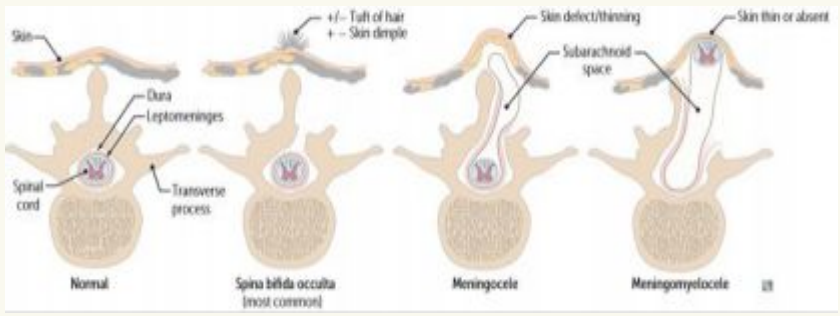
And after CT scan it will proof presence of fracture caused by trauma which caused the soft tissue swelling

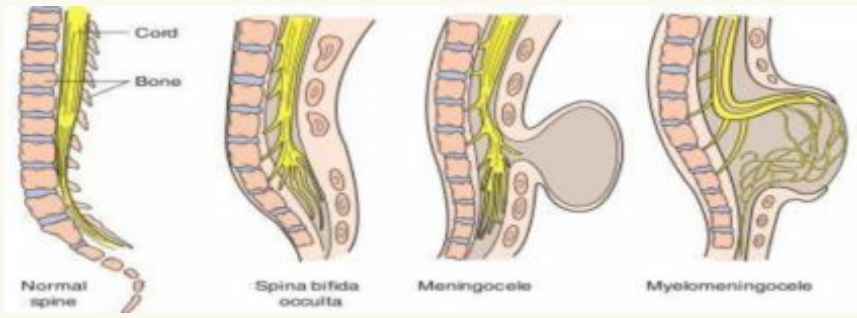
2) Congenital Defects

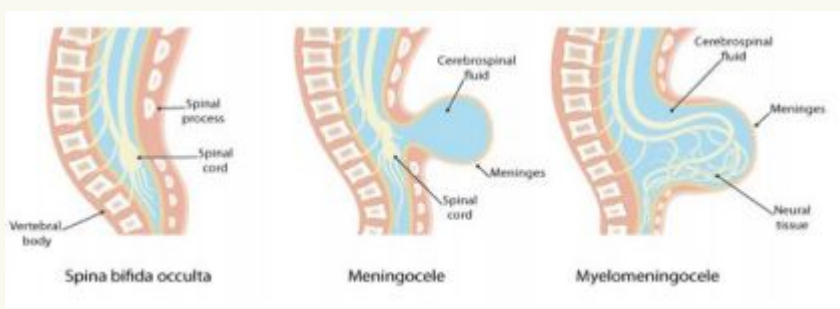
- MRI is the best to assess the contents of the cavity, extent of abnormalities, and spinal cord.
- CT shows bony structures the best and is often used before surgery

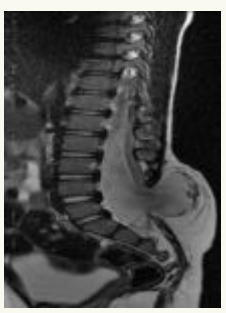
Spina Bifida

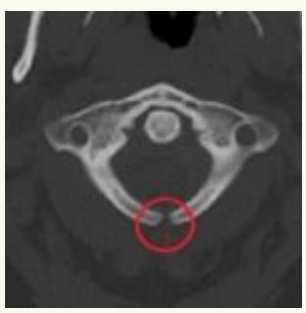
birth defect when portion of the neural tube fails to develop or close properly, causing defects in the spinal cord and in the bones of the spine.









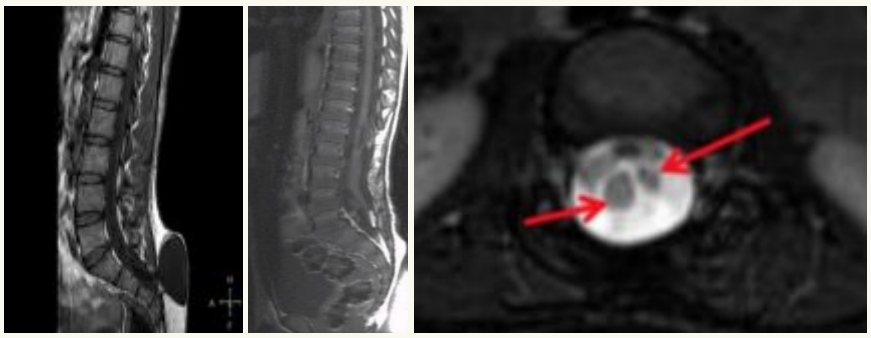


Abnormalities Of Spinal Cord

2) Congenital Defects cont..

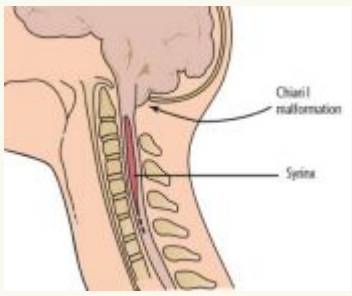
Split low lying cord (diastematomyelia)

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



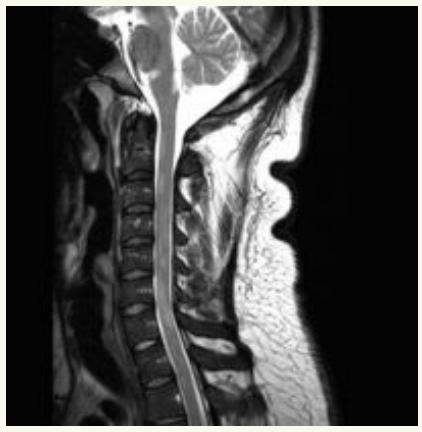
3) INFLAMMATORY

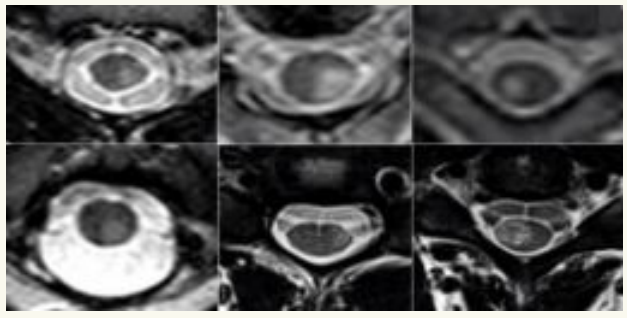
Multiple Sclerosis

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

To diagnose MS (Q might say Demyelinating disease) You have to use MRI





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

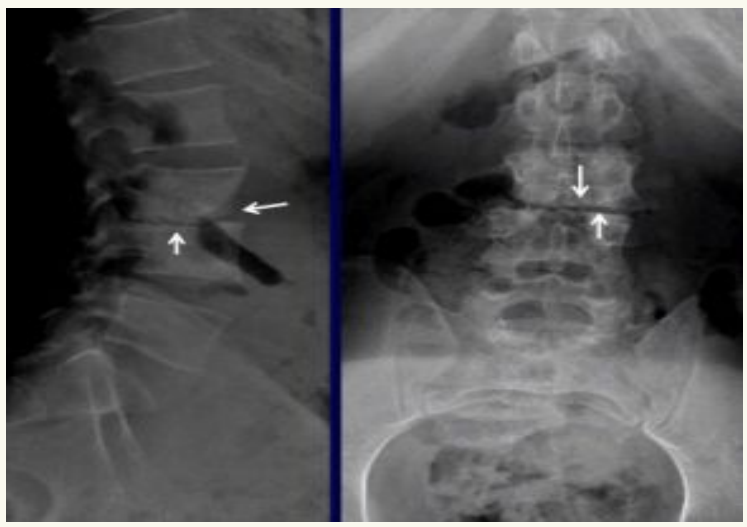
- **Discitis and Osteomyelitis:**

To diagnose You have to use MRI with contrast

➢ 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



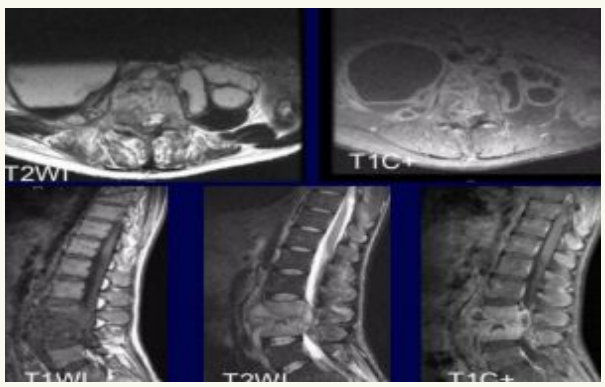
Narrow and destruction of L3-L4 disc space with irregular erosions of opposing end-plates Spondylodiscitis

We use MRI to Diagnose **and follow up** spondylodiscitis (to watch out for intraspinal epidural abscess formation)

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



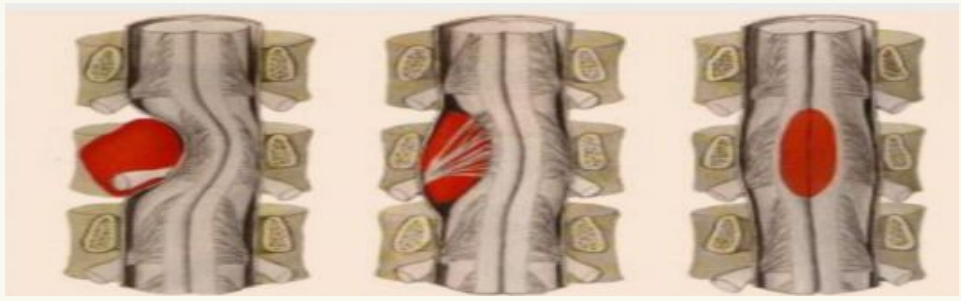
➢ Sagittal T1WI shows decreased signal of vertebral bodies and disc with end plate destruction.
➢ Sagittal T2WI shows increased signal in corresponding areas with anterior subligamentous and intraspinal epidural abscess.
➢ Sagittal contrast-enhanced T1-fat sat shows intense enhancement the involved area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

Abnormalities Of Spinal Cord

5) Tumors

To diagnose You have to use MRI with contrast ★

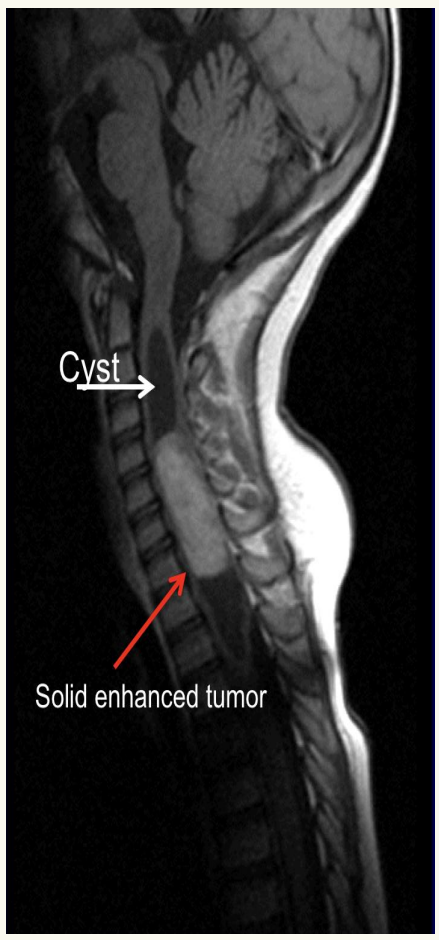
- **Classification:** ★

Extradural	Intradural extramedullary	Intramedullary
		
EX: metastasis	EX: meningioma & schwannoma	EX: Ependymoma & Astrocytoma

- **Ependymoma:**

Astrocytoma and ependymoma are intramedullary

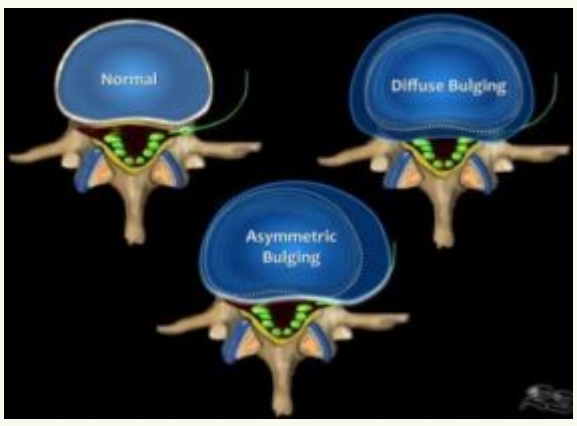
- **Astrocytoma:**



DISC DISEASE

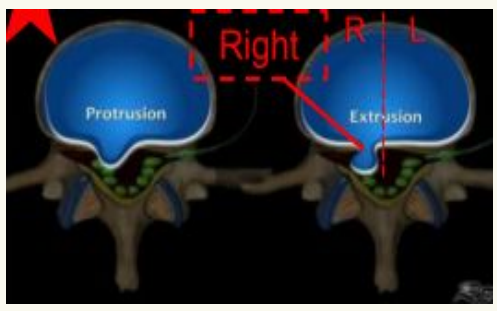
The herniation is shown on the opposite side of what is shown on the image [Axial images]

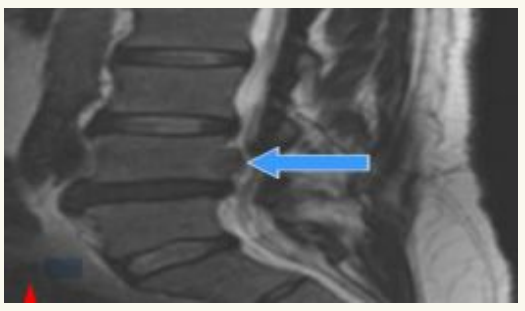
Bulging

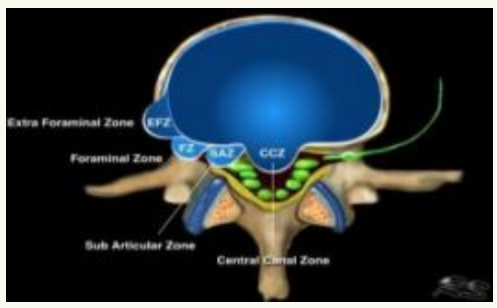


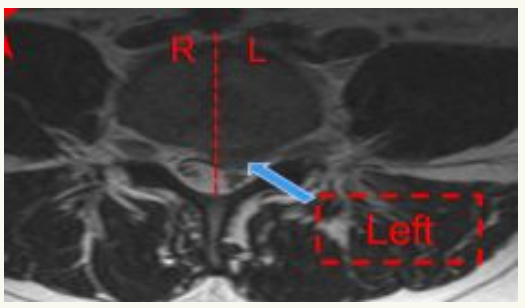
A bulging disc can commonly be referred to as a slipped disc or a protruding disc. However, when the disc bulge is significant enough for the disc nucleus to come out of the annulus, it is known as a herniated disc.

Herniation









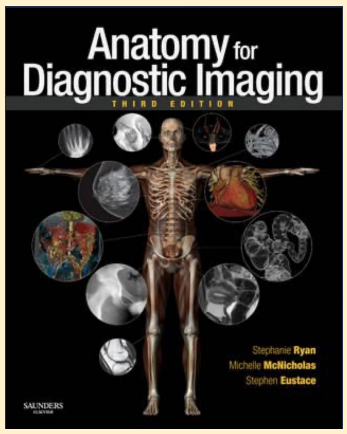
MCQs

1- the gold standard for imaging spinal cord ?			
A) CT scan	B) MRI	C) X- Rays	D) Ultrasound
2-best method to diagnose Multiple sclerosis is to use ?			
A) CT scan	B) MRI	C) X-Rays	D) Ultrasound
3- unstable fracture that can cause further damage to spinal cords is …….			
A) Burst fracture	B) Jefferson fracture	C) Hangman's fracture	D) all of them
4-patient with implanted device came to hospital with spinal cord disorder and the doctor asked for an image which of the follow is contraindications for him ?			
A) CT scan	B) MRI	C) X-Rays	D) Ultrasound
5- multiple sclerosis is less common in			
A) thoracic region	B) lumbar region	C) cervical region	D) A and C
6- Schwannoma and meningioma are …….			
A) Extradural	B) intramedullary	C) intradural and extramedullary	D) none

C A B C B B

1. 2. 3. 4. 5. 6.

Source



MED439
KING SAUD UNIVERSITY

Team leaders

- Ibrahim Alabdulkarim
- Reem Alamri

Team members

- Abdullah Almazro
- Abdulaziz Alomairy
- Renad Alosaimi
- Sara Alrashidi
- Abdulrahman Addweesh

Organizer

- Reema Alhadlq

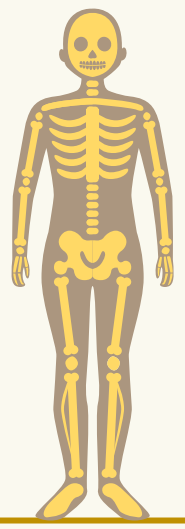
Reviewer

- Mansour Albawardy

Note taker

- Homoud Algadheb

Editing file



Work done by

@TeamRadiology

Radiology439@gmail.com