



RADIOLOGY
TEAM 435

SPINAL CORD



Objectives:

- Identify and distinguish between common types of radiographic images.
- Recognizing the use, limitations, advantages and disadvantages of the different radiological modalities.
- Recognize the radiological presentation of the common spinal cord diseases and abnormalities.

Please check out the this [link](#) for any future changes or additions.

Red = Important

Grey = Extra notes

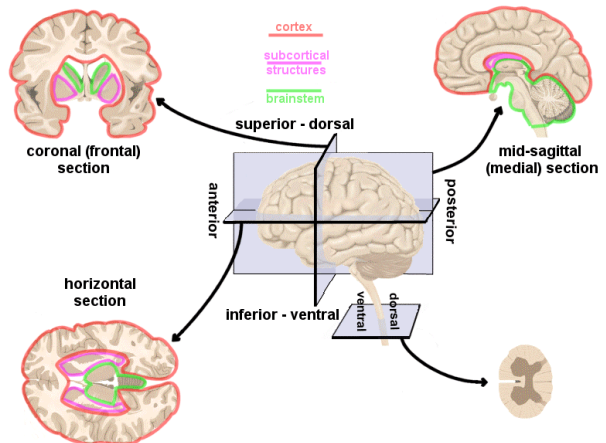
You can skip this page if you know them already.

❖ Introduction:

at the beginning we're going to review some basics.

❖ Body sections:

- Coronal (frontal) plane.
- Midsagittal (median) plane.
- Transverse (horizontal) plane.

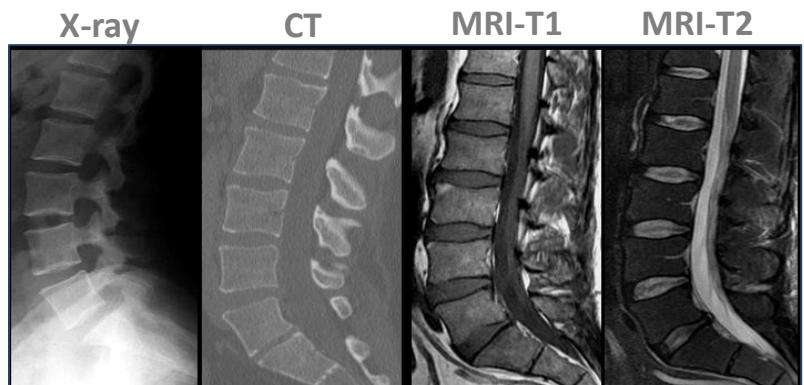


❖ Types of Imaging views:

- PA (posterior-anterior) view.
- AP (anterior-posterior) view.
- Lateral view
- Open mouth view.

❖ Imaging modalities:

- US (Ultra Sound)
- X-ray (Radiographs)
- Angiography.
- CT scan (Computerized Tomography)
- MRI (Magnetic Resonance Imaging)
 - T1 WI
 - T2 WI



❖ Coloration:

	US	X-ray	CT	MRI
Black coloration	Hypo-echoic	Radiolucent	Hypo-dense	Hypo-intense
White coloration	Hyper-echoic	Radiopaque	Hyper-dense	Hyper-intense



❖ Imaging modalities :

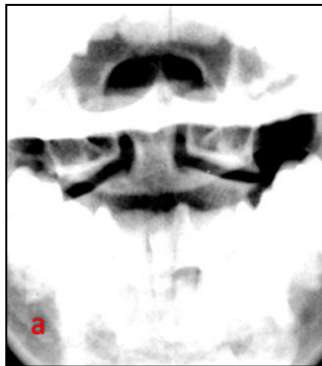
➤ X-Rays :

Often the first diagnostic imaging test ordered by physicians.

- quick and cheap.
- Uses small dose of radiation to visualize the bony parts.
- Can detect:
 - Spinal alignment and curvature.
 - Spinal instability – with flexion and extension views
 - Congenital (birth) defects of spinal column. (like scoliosis)
 - Fractures caused by trauma.
 - Moderate osteoporosis (loss of calcium from the bone)
 - Infections.
 - Tumors.
- **Important for assessing cervical spine.** Has to include all the cervical vertebrae + the junction between C7 and T1.



AP view - patient with scoliosis



Figures: a) open mouth view . b) an **adequate** AP view . c) an **adequate** lateral view . d) is **not an adequate** film; because only 6 vertebrae are seen , has to include all the 7 + the junction between C7 & T1.

➤ CT:

- Uses ionized radiation.
- Gold standard of imaging for Bone fractures
- Obtain 2-D images >> can be processed to 3-D images.
- Entire spine can be imaged within a few minutes.
- Detailed information regarding bony structures.
- **Limited information about spinal cord & soft tissues.**

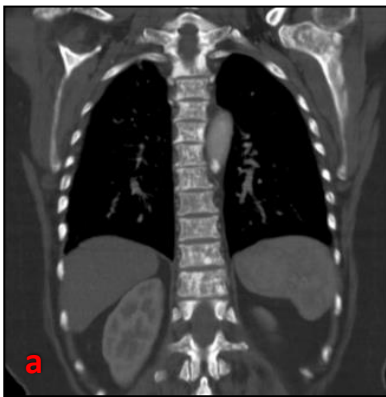


Sagittal plane

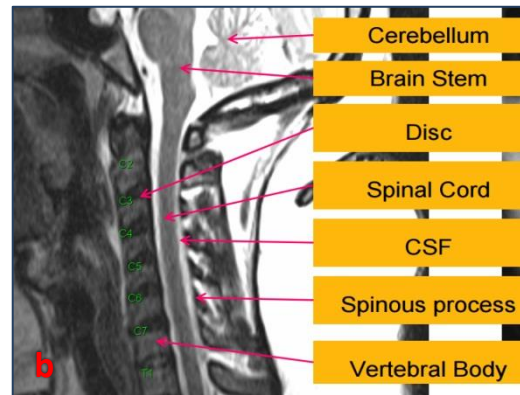


➤ MRI.

- Gold standard of imaging for spinal cord disorders.
- **No radiation**
- Can identify abnormalities of bone, soft tissues and spinal cord.
- Time consuming. (takes from 15 to one hour to get a full picture)
- Claustrophobic patients, uncooperative and children may need sedation or general anaesthesia
- **Contraindications include implanted devices e.g. cardiac pacemakers and electromagnetic devices.** (most of modern artificial joints and advanced cardiac pacemakers are MRI friendly)
- **Has 2 common sequences:**
 - **T1** weighted image. (Fat = light color and CSF = dark color)
 - **T2** weighted image. (Fat = dark color and CSF = light color)



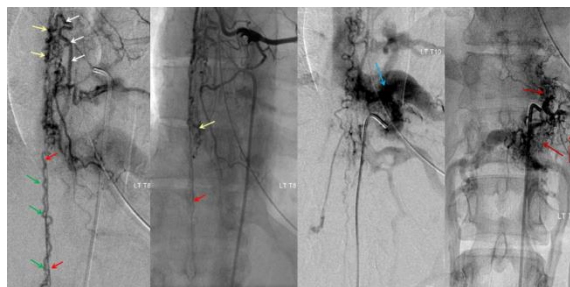
Figures: a) T2 WI – coronal section.



b) T2 WI – sagittal section.

➤ Angiography :

spinal angiogram is used to evaluate arteries and veins e.g. If you suspect arteriovenous fistula, arteriovenous malformation, vessel narrowing or blockage.



This image wasn't in the lecture its only for clarifying

❖ Abnormalities of the Spinal Cord:



Trauma



Demyelination



Congenital



Tumors

➤ Trauma :

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 .

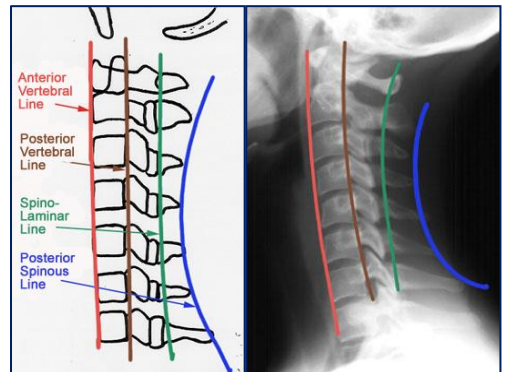
Any miss alignment in these lines will raise the suspicion of fractures

1-Anterior vertebral line. (which is the anterior margin of the vertebrae body)

2-Posterior vertebral line. (which is the posterior margin of the vertebrae body)

3-Spinolaminar line. (which is the posterior margin of the spinal canal)

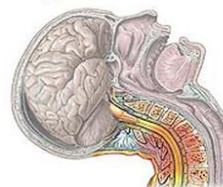
4-Posterior spinous line. (which is the tips of the spinous process)



Mechanism of Injury :

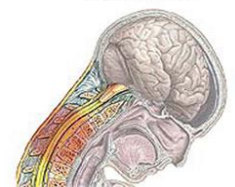
- **Hyperextension.** (a sudden backward acceleration of skull creating extreme extension of cervical spine, a common example like hanging and when the head hits the dash board in car accidents)
- **Hyperflexion.** (excessively flexion of the neck like when diving in shallow water, well cause paraplegia)

Hyperextension



Sprain or strain of cervical tissues

Hyperflexion

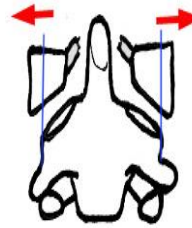


Spinal cord fractures :

- **Compression fracture.**
When you get a caudally directed force on your head (like when something heavy falls on yours head.)



Normal open mouth view



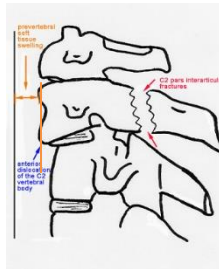
Lateral mass splitting, Displacement more than 2ml comparing to the normal



- **Hangman's fracture.**
A fracture which involves the pars inter-articularis of C2 on both sides, and a dislocation of C2 and its a result of hyperextension and distraction.



Normal lateral view



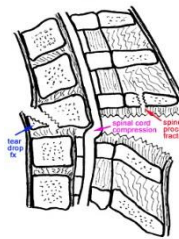
If you draw a **line** in the anterior margin of the vertebrae body you can see an anterior dislocation of C2 comparing to the normal view, and you can see C2 **intraarticular fracture**



- **Hyperflexion.**
Its usually present without a fracture but the patient will present with paraplegia (impairment in motor or sensory function of the lower extremities) so we can only assess it with MRI.
Sometimes there is a fracture and its most common to see it as tear drop fracture and sometime they have a subluxation of the posterior margin of the vertebral body which will compress the spinal cord (that's why they have paraplegia).



Normal lateral view



A **tear drop fracture** in the anterior margin of the vertebral body.

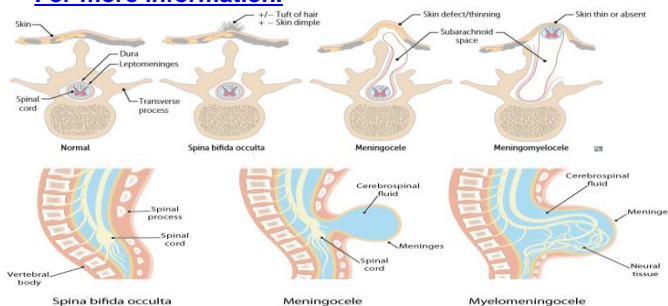


➤ Congenital defects :

- **Spina bifida.**

its when a pregnant mother has deficiency of folic acid then the baby neural tube gets defect.

-For more information.



a



b



c

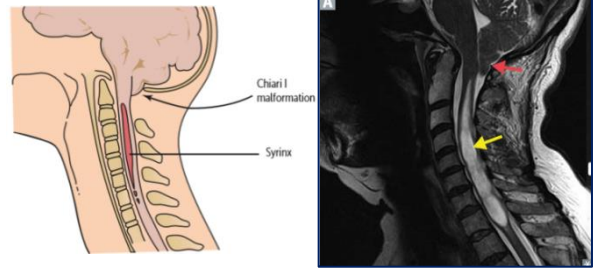
a)Spina bifida occulta.,CT scan. b)meningocele, MRI T1 WI. c)meningocele, MRI T2 WI. (in this image the CFS is not seen but we can see the fat is dark comparing to the T1 IW)



- **Syringomyelia**

It's a cystic dilation of the spinal canal. The patient will present with bilateral loss of pain and temperature sensation due to the compression of the decussated spinothalamic tract (the anterior white commissure).

[-For more information.](#)



➤ **Demyelination :**

- **Multiple sclerosis (MS) :**

Multiple sclerosis (MS) is a relatively common acquired chronic relapsing demyelinating disease involving the central nervous system. Characteristically disseminated not only in space but also in time.

[-for more information.](#)

- **Transverse myelitis (TM) :**

Inflamed cord of uncertain cause

- Viral infections
- Immune reactions
- Idiopathic

Myelopathy progressing over hours to weeks.

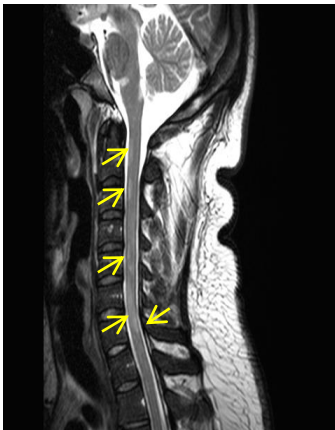
[-for more information.](#)

- **MS VR TM**

MS lesions in spinal cord are more likely multiple, focal and peripherally located don't cover the entire section on axial images, often **< 2 vertebral body heights (tiny lesions)** on sagittal images are disseminated in time and space. (they come and go)

Positive lesions in the brain unlike TM.

Transverse myelitis lesions extend over **>3 vertebral body heights on axial images (big lesions)** , often **> 6 vertebral body heights on sagittal images.**
no brain lesions.



MRI T2 WI



➤ Tumors :

Classified into.

- **Intramedullary lesions.** (in the spinal cord)

Its location determined within the spinal cord. (e.g. astrocytoma and ependymoma)

- **Extramedullary lesions.** (out of the spinal cord)

May be related to nerve roots and may extend into the foramen (e.g. schwannomas and neurofibromas) or they may have a broad dural attachment (e.g. meningioma's)

[-for more information.](#)

Astrocytoma :

Smooth lesion with no hemorrhage or necrosis.

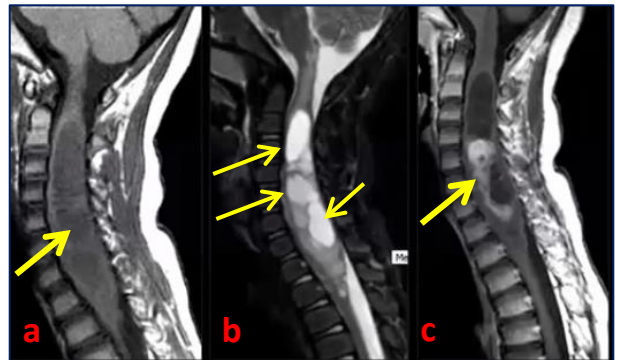
-Figures :

a) MRI T1 WI, hypodense lesion.

b) MRI T2 WI, hyperdense lesion.

c) MRI T1 WI, hypodense lesion.

All lesions are smooth with no necrosis or hemorrhage.



Ependymoma :

Like astrocytoma but hemorrhage and necrosis are common in the lesion.

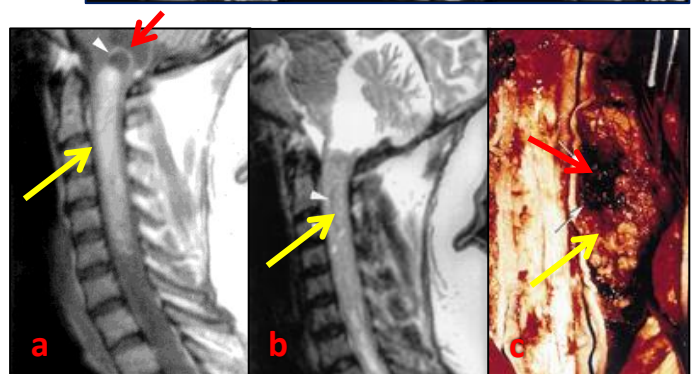
-Figures :

a) MRI T1 WI, hypodense lesion,

hemorrhage within the **tumor**.

b) MRI T1 WI, hypodense lesion.

c) **Tumor** and **hemorrhage** within.



Modalities Summary

	X-ray	CT	MRI
Indications	Trauma - Intra-operative-localization	Trauma	Pts with "red flags" case – Radiculopathy –Tumor - Myelopathy
Advantages	Inexpensive - Widely available – Quick - Portable	Visualization of bony structures - Widely available - Quick	Visualization of soft tissue structures (e.g. relationship of disc to nerve) - No radiation exposure
Disadvantage	Radiation exposure-Difficulty in interpretation - High rate of false-positive findings	Less useful at visualizing soft tissue structures - Radiation exposure -Expensive	Contraindications: presence of ferromagnetic implants, cardiac pacemakers, intracranial clips, Claustrophobia - Not widely available -Expensive

Thanks for checking our team!

Suffer now and live the rest of your life as a great doctor !

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