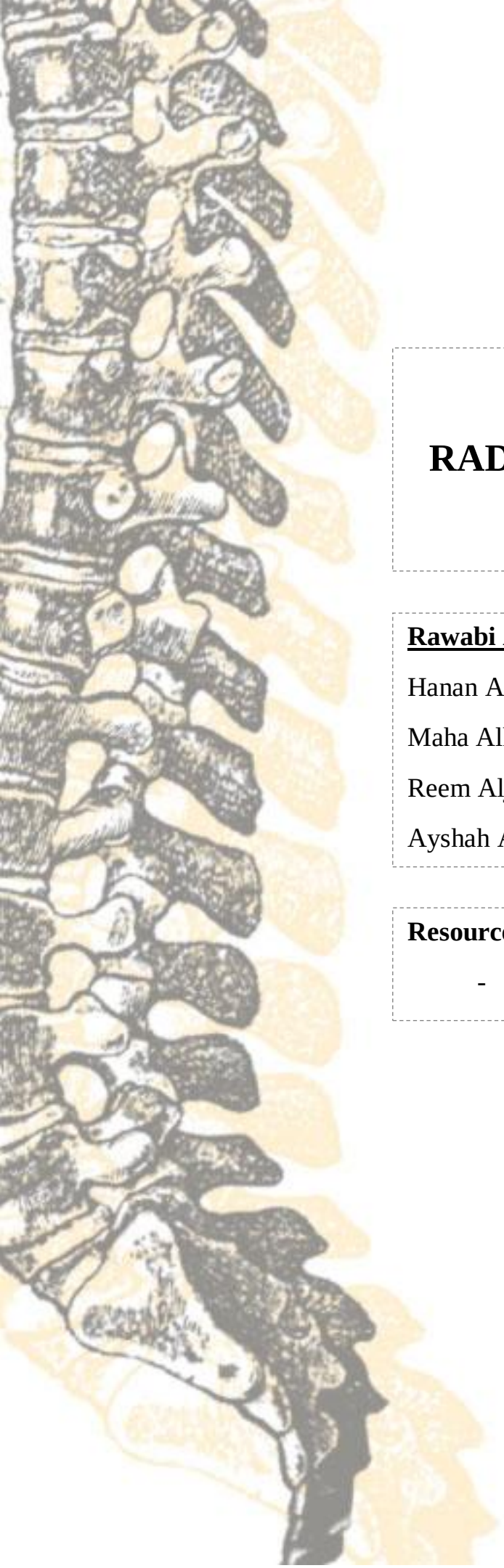

Lecture (No.8)

RADIOLOGY of SPINE DISEASES

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Resources:

- Lecture by dr. Sajjad Hussain

Imaging Methods to Evaluate Spine

The Imaging Methods to Evaluate Spine are:

- Plain X-Ray Films
- Myelogram – injection of contrast medium in CSF followed by x-ray images. Rarely performed now-a-days
- Computed Tomography (CT Scan)
- Magnetic Resonance Imaging (MRI)
- Discogram - injection of contrast medium in the disc followed by x-ray images.
- Spinal angiography – to evaluate arteries and veins
- Ultrasound – more in children
- Radionuclide Bone Scan – intravenous injection of radioactive material bound to phosphonates which deposit in bones, followed by images by gamma camera.
- DEXA – radionuclide scan for bone density (osteoporosis)

1- X-RAYS (RADIOGRAPHS):

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 (ie; bending forward and backward) to assess for instability

2- COMPUTERIZED TOMOGRAPHY (CT SCAN):

Uses radiation to obtain 2-D and 3-D images, Patients must lie still on a table that moves through a scanner, Cross-sectional images are obtained of the target areas. Much detailed information regarding bony and soft tissues.
Better in visualizing:

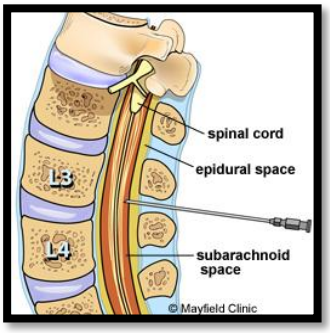
- Degenerative or aging changes, Herniated discs.
- Spinal alignment.
- Fractures and fracture patterns.
- Congenital / childhood anomalies.
- Areas of narrowing in spinal canal through which spinal cord and spinal nerve roots pass.

✓ Entire spine can be imaged within a few minutes.
✓ A contrast material may be injected intravenously or intrathecally to make some areas clear.
✓ Poor in visualizing inner details of spinal cord.

3- MYELOGRAM:

A contrast material is injected into CSF
(usually between L3 & l4) to better identify areas where spinal cord or spinal nerves may be compressed.
the procedure:
Under local anesthesia, a needle is placed into lower lumbar spinal canal, and then CSF flow is confirmed. Contrast medium is then injected which mixes with CSF around spinal cord, making it visible on x-ray images Often a CT scan is also performed after this
May be performed when MRI is contraindicated.

MYELOGRAM PROCEDURE



MYELOGRAM shows , the with color is contrast, while the black is nerve root.

4- Magnetic Resonance Imaging (MRI):

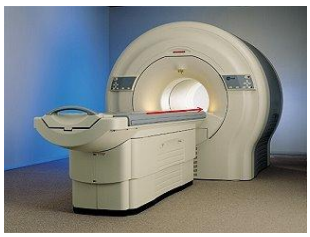
The gold standard of imaging for spinal disorders. Does not use ionizing radiation. Can identify abnormalities of bone, discs, muscles, ligaments and spinal cord. Intravenous contrast is sometimes administered to better visualize certain structures or abnormalities, Patient lies still in a tunnel like structure for about **25** minutes. Claustrophobic (phobia from close spaces) patients may need sedation (also we can use MRI scanner the open type), and children often need general anesthesia. Contraindications include:

- Implanted devices e.g. cardiac pacemakers and other electromagnetic devices.
- Certain metal clips and stimulators.
- Artificial joints and spinal hardware may still have MRI scans.

✓ MR images are multi-planar

✓ MR images are very high resolution

MRI SCANNER (closed type)



MRI SCANNER (open type)

Entire spine imaged by MRI which is better than CT in detecting minor lesions and does not use ionizing radiation.

5- DISCOGRAM:

Discs are the cushions between the vertebral bodies while MRI and CT scans can provide structural information, discogram better identifies the relationship of disc to pain.

PROCEDURE:

A needle is placed into center of the disc under fluoroscopy (continuous x-ray imaging)

A contrast material (dye) is injected. Radiologist then observes if patient experiences pain that is similar to his/her usual pain, and is increased by injecting contrast. X-rays (± CT scan) are then done to see if dye stays within the center of the disc or leaks to outer border of the disc indicating a tear in annulus fibrosus of disc which can be a source of pain.

Congenital Anomalies

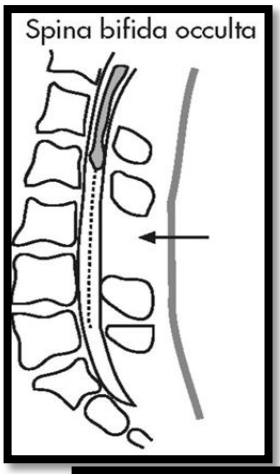
Usually the congenital anomalies of the **spinal cord coexists with the spinal** (the vertebral bodies, spinal process…etc) **anomalies.**

MRI is the best to assess the contents of the cavity, extent of abnormalities, and **spinal cord**.

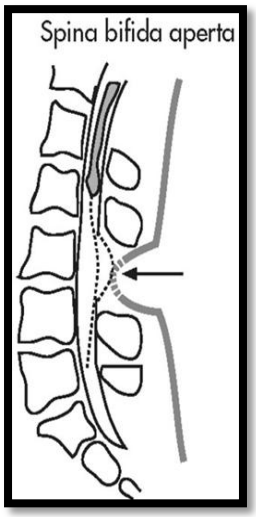
CT shows bony structures the best and is often used **before surgery**.

Skin covered defects :Spina bifida occulta.

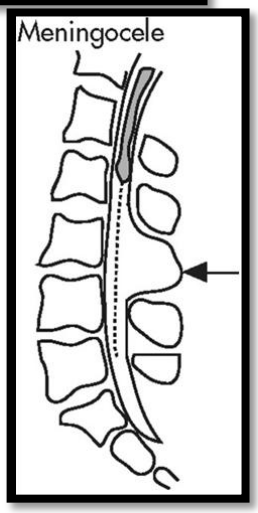
Open skin defects:Spina bifida aperta , Miningocele and Meningomyiolocele.



occulta= means hidden
You do not see the anomaly by your eyes
But you can feel the missing spinal process



Aperta::
you can see the anomally through an open skin



Meningocele:
The maningese are herniated but no spinal cord bulging

Maningomyilocele:
The maningese herniated with spinal cord bulging .

Multiple fusion abnormalities of vertebrae on plain film

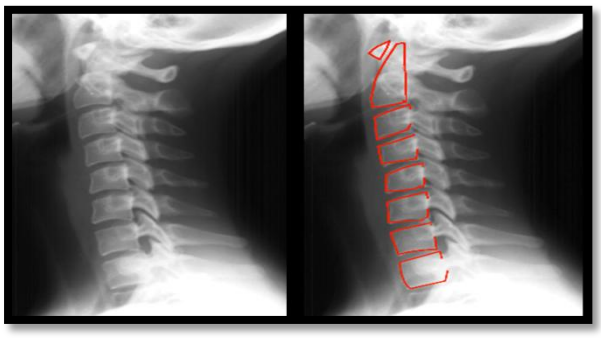
TRAUMA

To assess the trauma we do an X.ray without moving the traumatic patient. We look to 2 important things.

1- Alignment – by drawing lines different lines on the image.

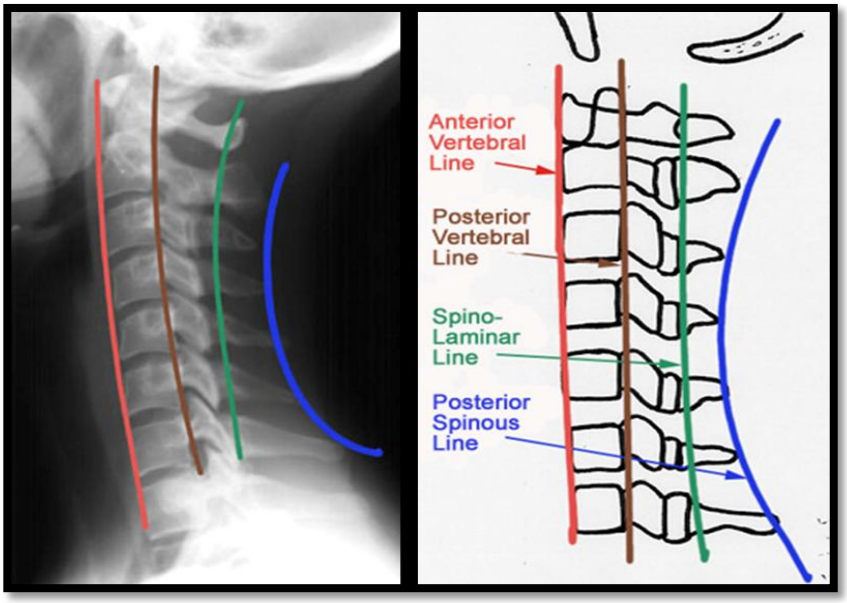
2-prevertibral soft tissue.

If both r normal , that means usually there is no significant injury.

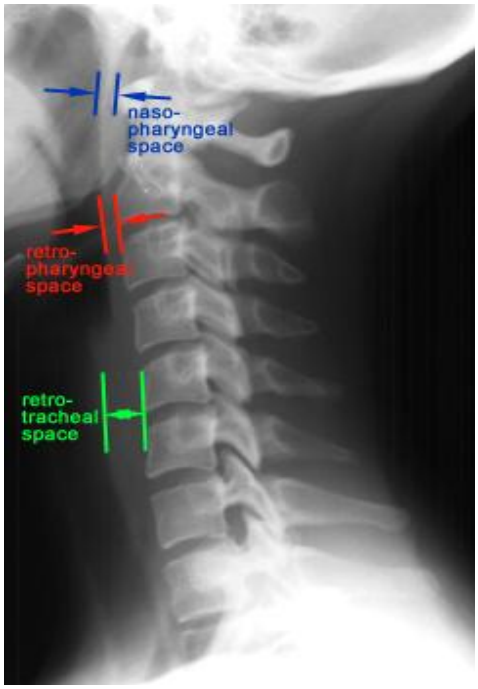


Plain film assessment of trauma
– the first imaging method-

Alignment should be normal – check by drawing lines

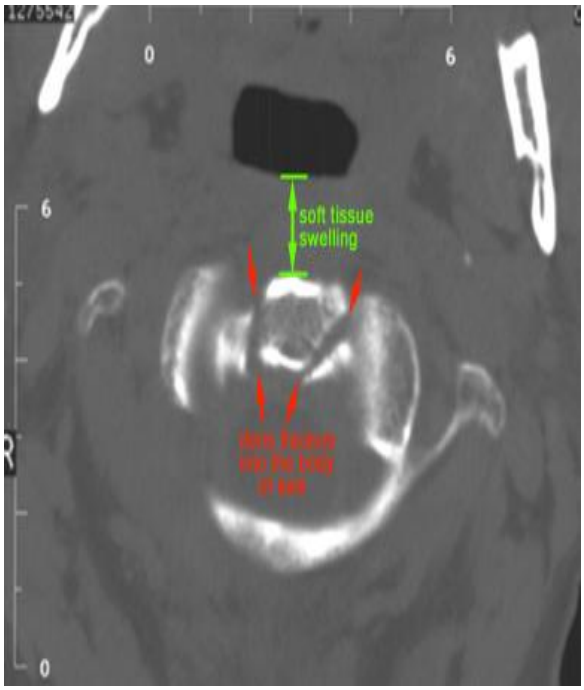


Memorize those normal images :



Abnormal (trauma) example :

1- Alignment – normal .
2- soft tissue- abnormal
patient get trauma on x.ray we found abnormal soft tissue may be due to hemorrhage, this is fracture suspicious case we have to send the patient to CT scan (IMP) .

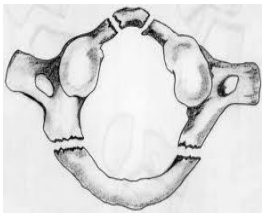


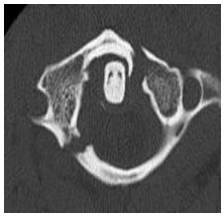
Soft tissue anterior to spine
- very important

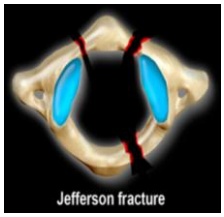
CT scan shows dens fracture into the body of axis

Jefferson Fracture :

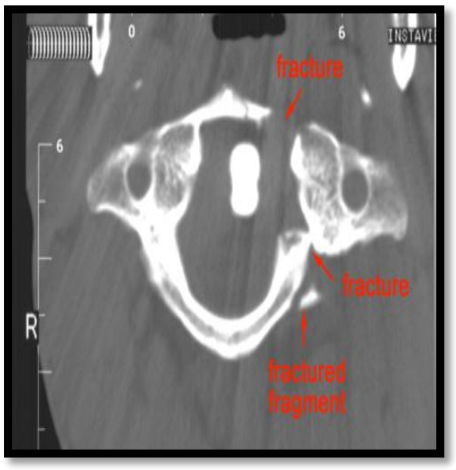
Fracture on both **anterior and posterior** C1.

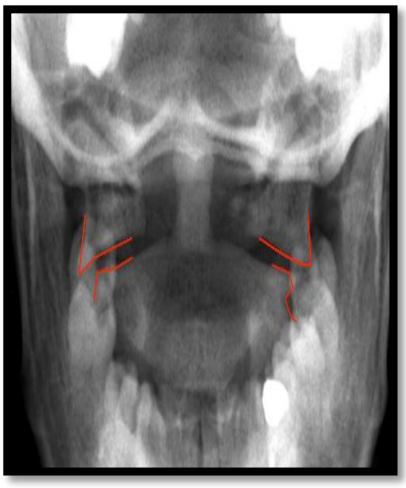


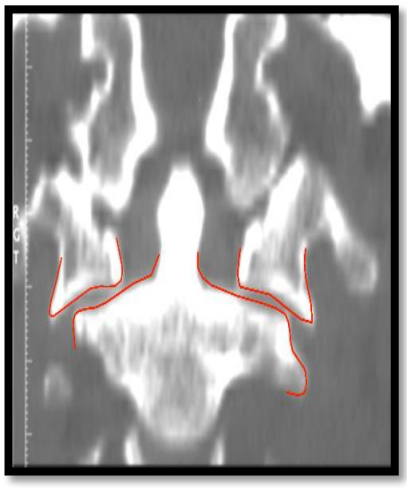




- ✓ Lateral displacement of C1
- ✓ Coronal reconstruction from a CT confirms the findings from the odontoid view
- ✓ Axial CT clearly shows the location of the fractures of C1







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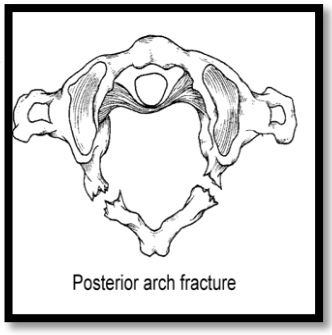
This Fracture on c1 but not called Jefferson fracture , it is posterior arch fracture



Notes :

Jefferson Fracture mechanism is : axial loading.

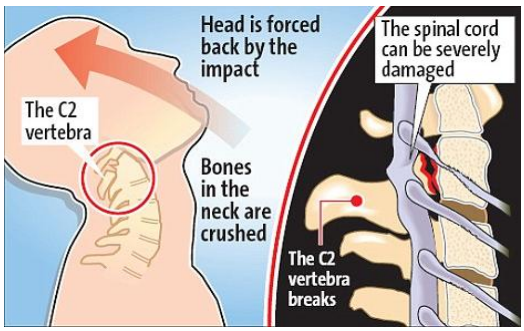
مثالها: عامل بناء يرتدي خوذة تحمي جمجمته عند وقوع جسم ثقيل عليه ولكن قد تصاب

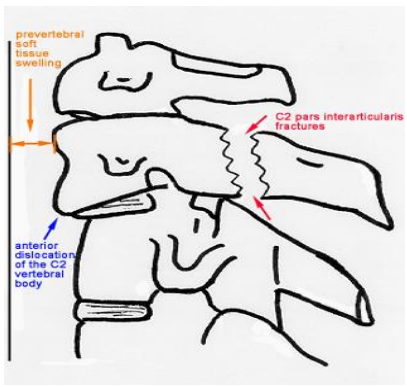
C1

شخص متحمس و يهوى السباحة ، يقفز للمسبح و الماء قليل فيصاب بكسر في

C1

Hangman's Fracture (C2 fracture):





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

Radiographic features: (best seen on lateral view)
1. Prevertebral soft tissue swelling
2. Avulsion of anterior inferior corner of C2 associated with rupture of anterior longitudinal ligament.
3. Anterior dislocation of C2 vertebral body
4. Bilateral C2 pars interarticularis fractures .

Bilateral Facet Dislocation

Complete anterior **dislocation of vertebral body** resulting from extreme hyperflexion injuryAssociated with a very high risk of cord damage.

(vertebral body compress an another vertebral body)

Unilateral Facet Dislocation

Facet joint dislocation and rupture of the apophyseal joint ligaments resulting from rotatory injury
Mechanism: simultaneous flexion and rotation such in boxing.

> Note : 1 facet injury , patient could be stable. But if 2 facet or 1facet and 1 vertebral body injured patient will be unstable.

Burst Fracture :

Results from axial compression
Injury to spinal cord is **common** due to displacement of posterior fragments
CT is required for all patient to evaluate extent of injury

INFECTIONS

Discitis and Osteomyelitis:

Usually the result of blood–borne agents
Especially from lung and urinary tract. Most common pathogen is staphylococcus, Streptococcus less common. Gram-negative rods in IV drug abusers or immunocompromised patients E. Coli ,Proteus ,Non-pyogenic ,Tuberculosis and Coccidioidomycosis. 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
Site of involvement
L3/4
L4/5
Unusual above T9
Usually involvement of one disk space (occasionally 2)

IMAGING FINDINGS

PLAIN FILMS

Narrowing and destruction of an intervertebral disk

Earliest plain film sign

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

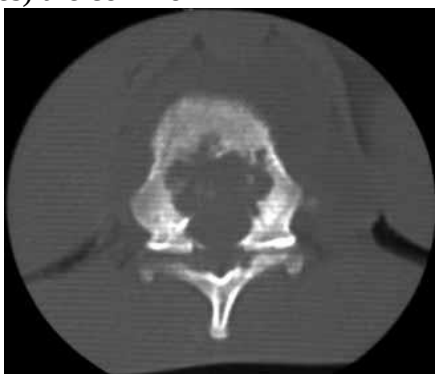
MRI

Bone marrow edema in infected vertebrae, discs and paraspinal soft tissues

Dark on T1 and bright on T2 images

Enhancement of inflammed tissues after contrast

Fluid collections (abscesses) are common

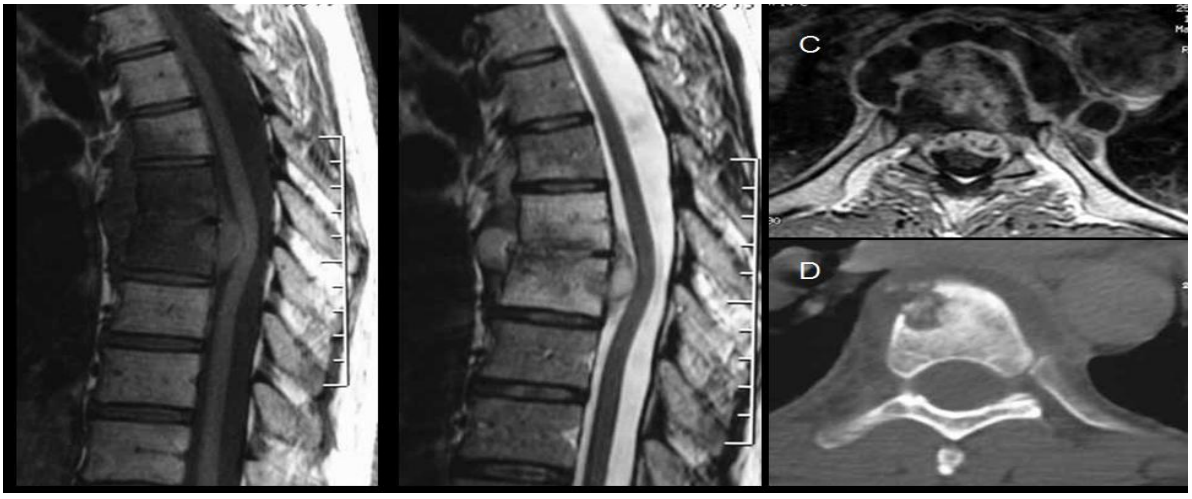


A. Sagittal T1 MRI shows decreased signal of vertebral bodies and disc with end plate destruction

B. Sagittal T2 MRI shows increased signal in corresponding areas with anterior subligamentous abscess, epidural involvement and extension of inflammation in T6 with preserved endplate

C. Axial contrast-enhanced T1 MRI shows peripheral enhancement of paravertebral abscess and marked enhancement of epidural tissues causing displacement of spinal cord

D. CT shows lytic lesion in vertebral body and paravertebral abscess with calcifications



Note:: things that doctor mentioned in infections are:

_Osteomyelitis >> vertebral bone

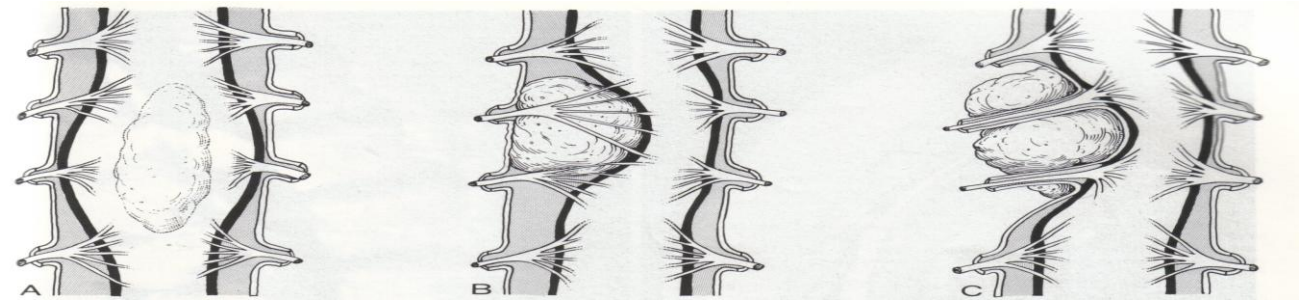
Discitis >> the disc

Both usually combined

The cuse , bloodborn, post surgery, lumberpuncture and …graphy

TUMORS

MCQ ::
tumor inside the cord >> the cord will be big and expanded.
Tumor outside the cord >> the cord will be displaced and thin.



Inside the cord , but the cord not changed, so it is not tumor.

انتهى ، بالتوفيق ☺