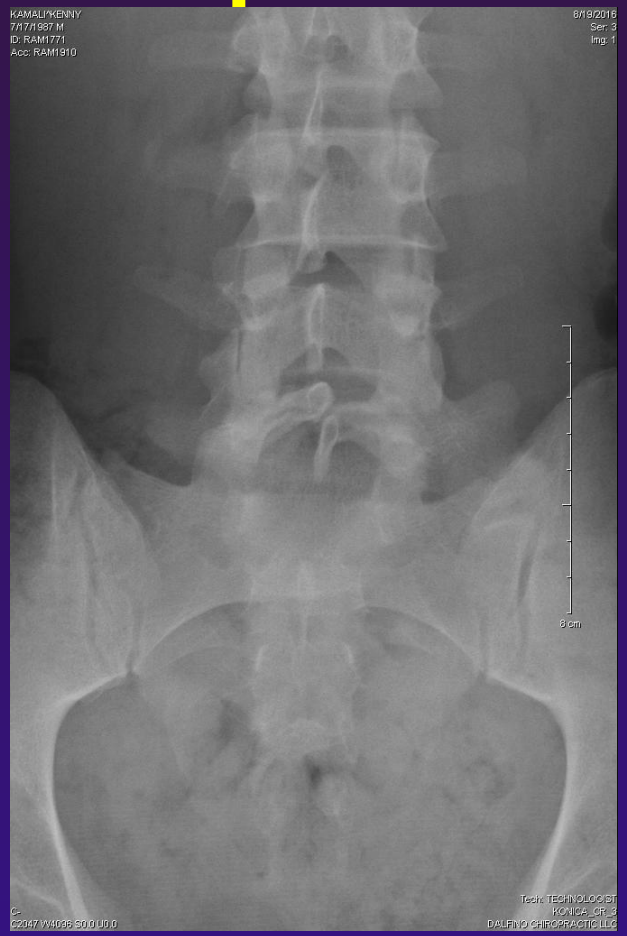
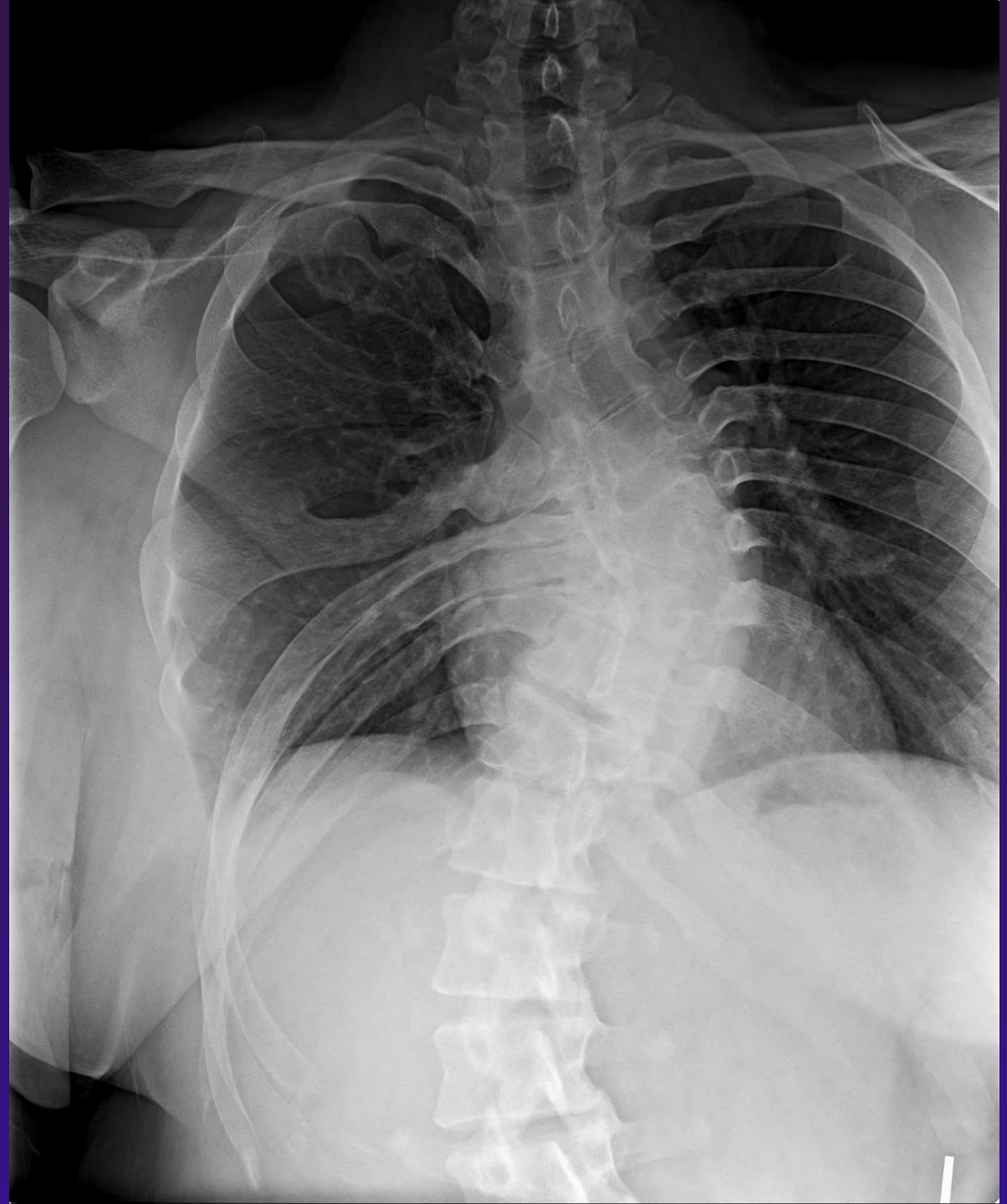
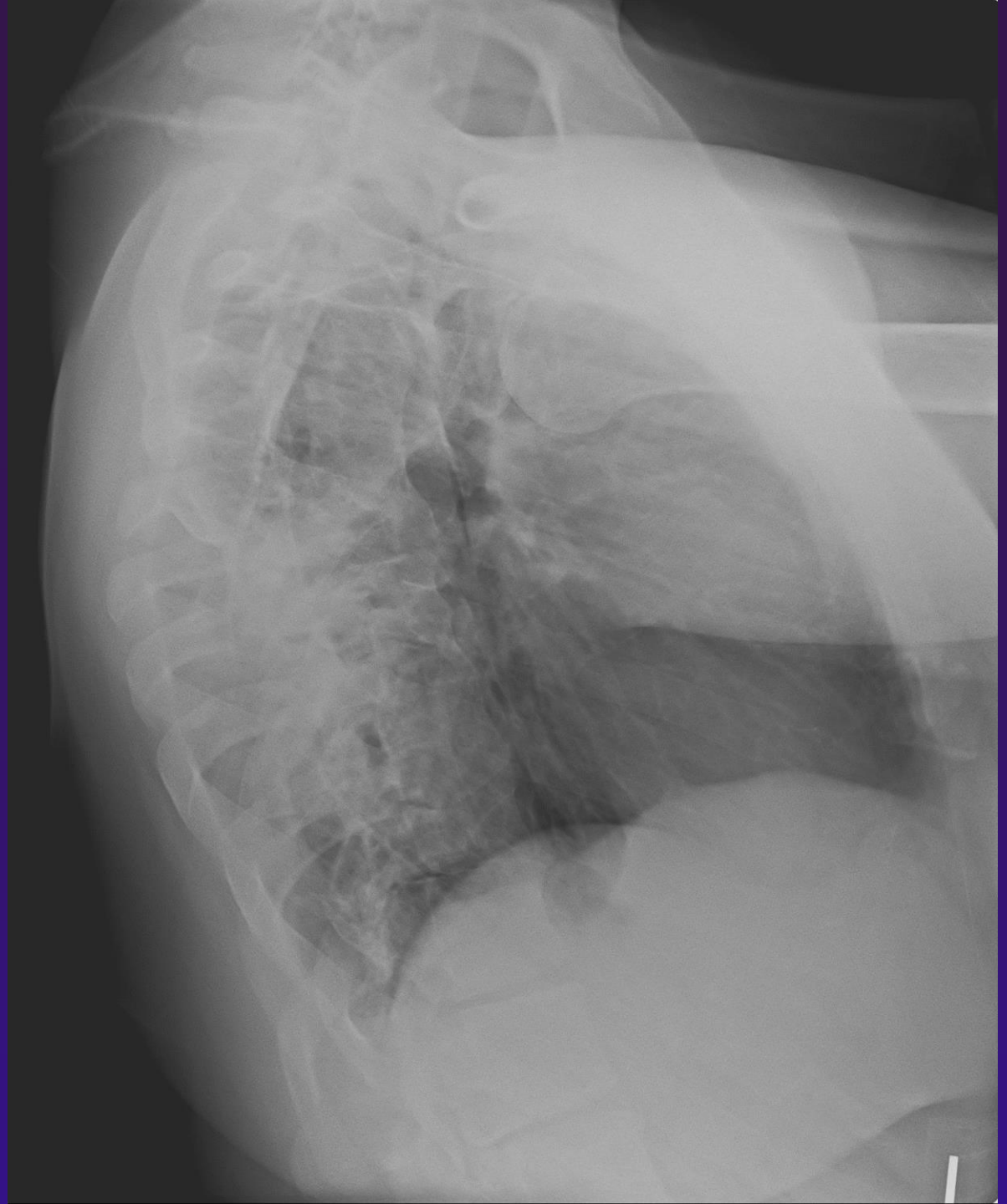
Anomalies & Variants of the Spine



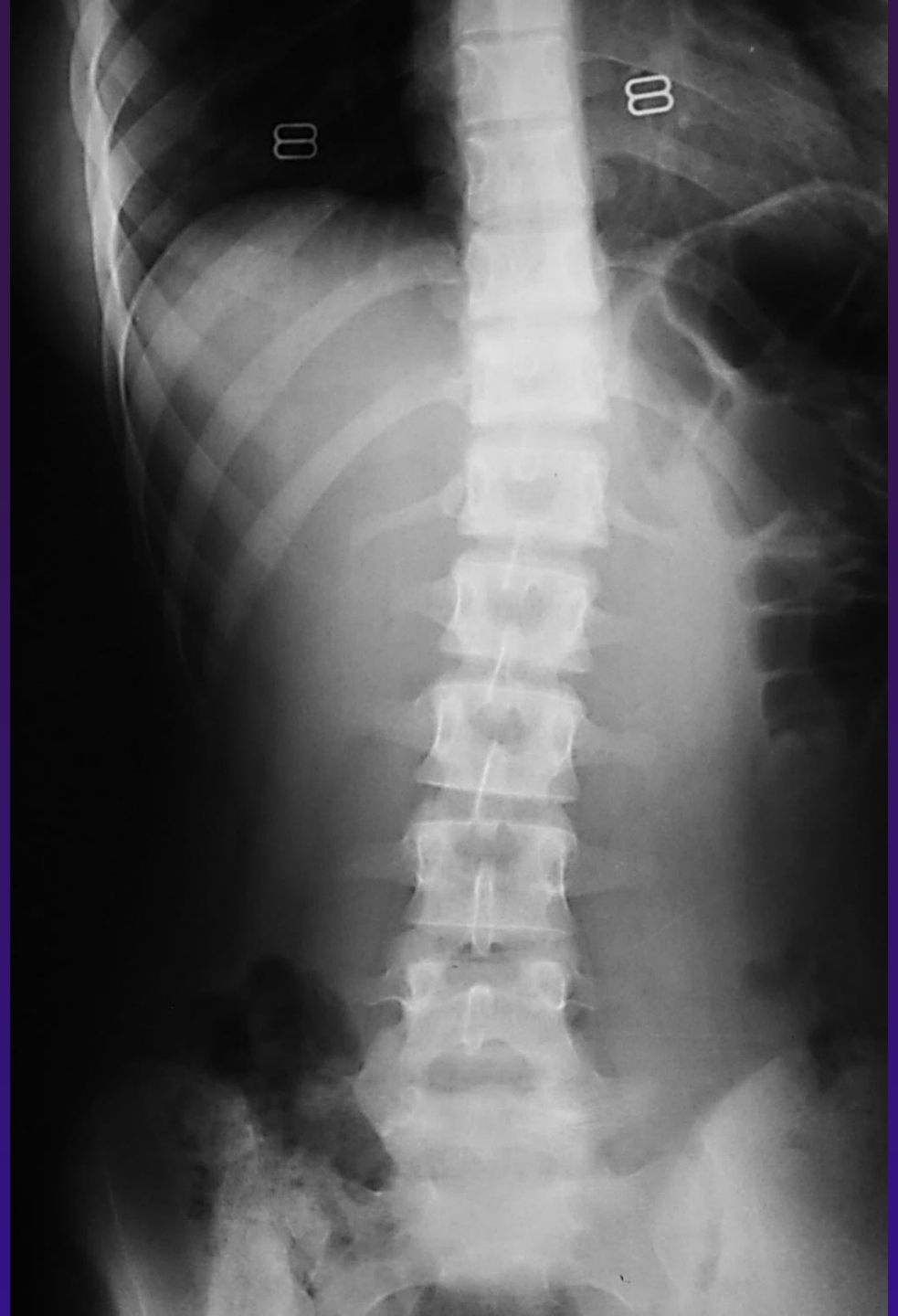
Should we ignore it or pay attention?





Left sided scoliosis

- Because most idiopathic scoliosis are right-sided, left sided scoliosis warrants further investigation.
  - Especially if rapidly progressing (either side) or of significant angulation
  - Associated (positive) spinal/neural abnormalities include:
    - Hemivertebra
    - Chiari malformation
    - Syringohydromyelia
    - Tethered cord syndrome
    - Diastemtomyelia
    - Meningocele/myelomeningocele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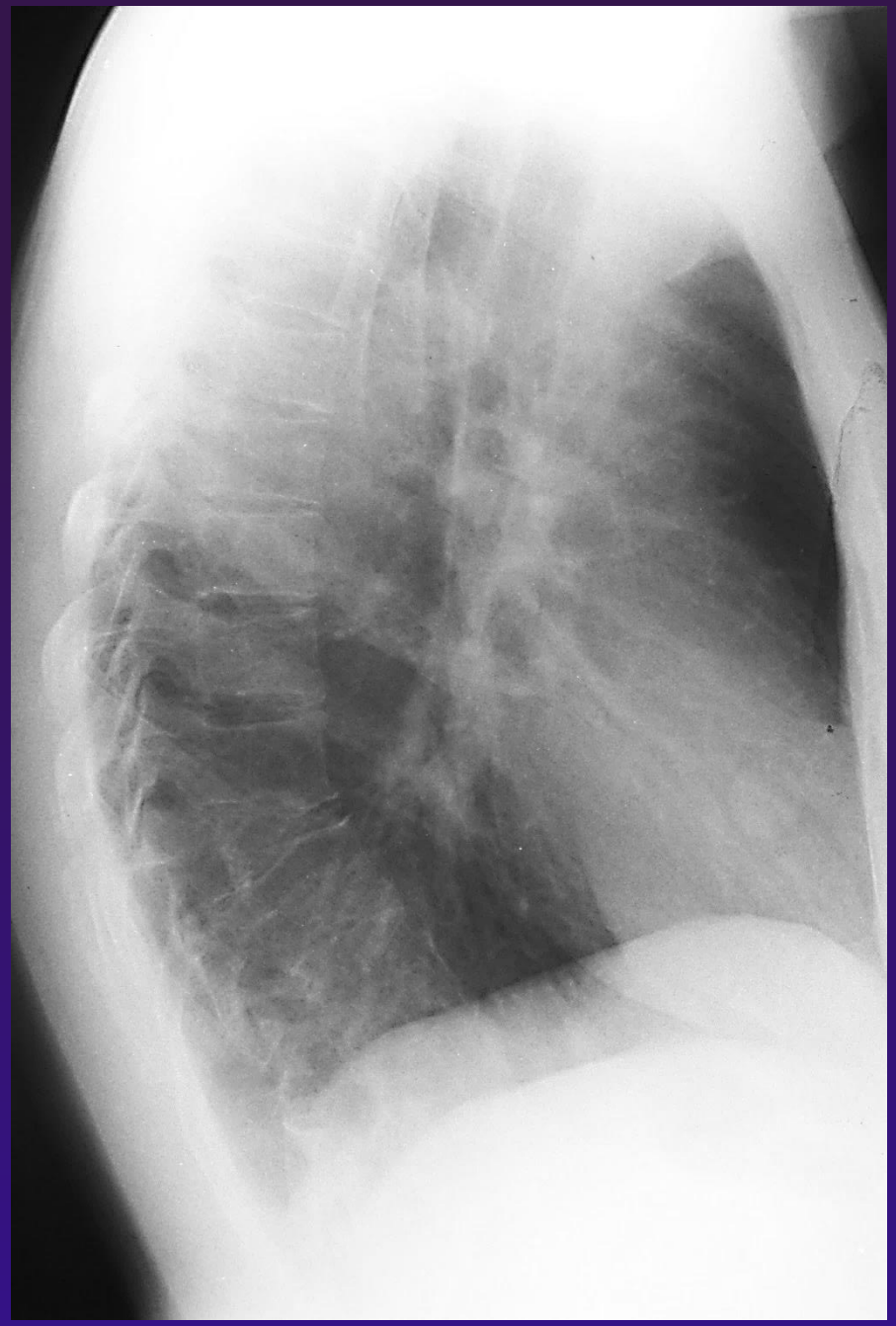
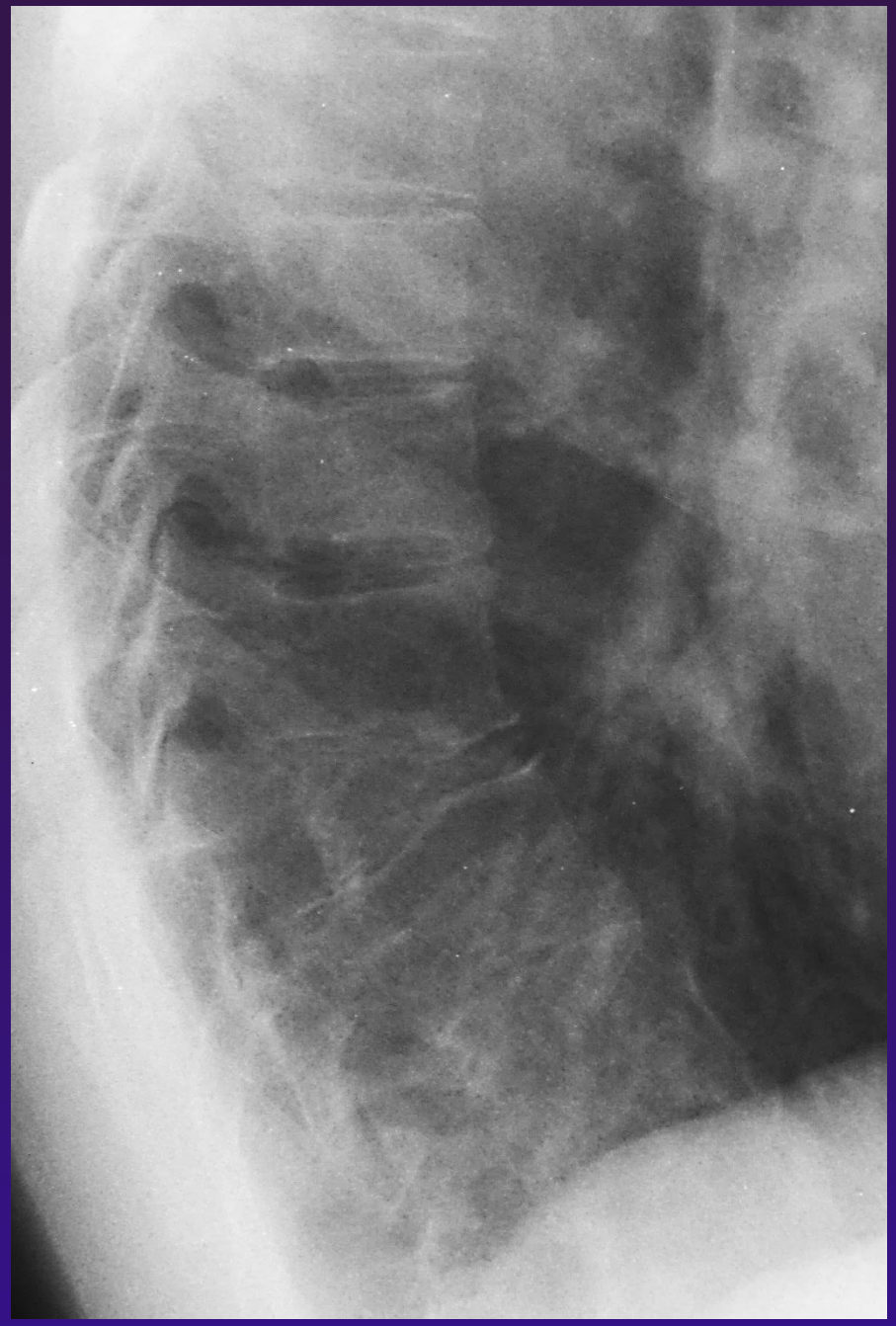




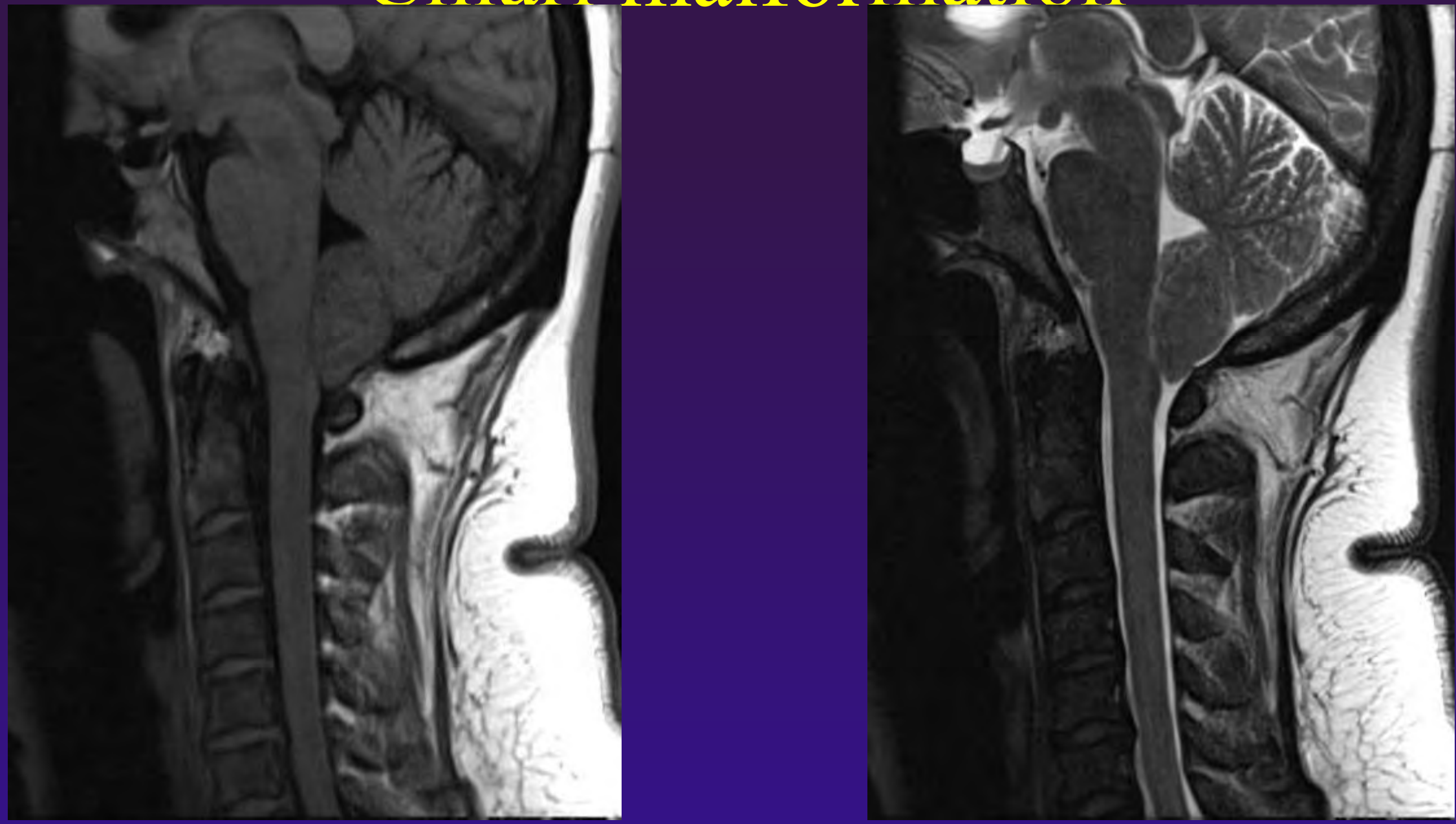
Dorsal hemivertebra

- Probably a vascular problem during development preventing full development of the anterior vertebral body.
  - Usually results in progressive kyphotic gibbous formation (child).
  - Anterior apex often does not reach anterior vertebral body margins
  - Acute onset of spasticity paraparesis most common with this type
    - Usually occurs by 20 years of age
  - Secondary degenerative disc disease can lead to increase kyphosis.
  - Seen in numerous congenital conditions.

Hemivertebrae

- **Incarcerated hemivertebrae**
  - Adjacent endplates accommodate the shape of the hemivertebra
  - Usually have a disc space
  - Less tendency for progressive scoliotic deformity
- **Non-incarcerated hemivertebrae**
  - Trapezoidal in shape often extends to contralateral side of spine
  - Adjacent vertebral bodies are normal in shape with no accommodation
  - Greater tendency for progression of scoliotic deformity

Chiari malformation



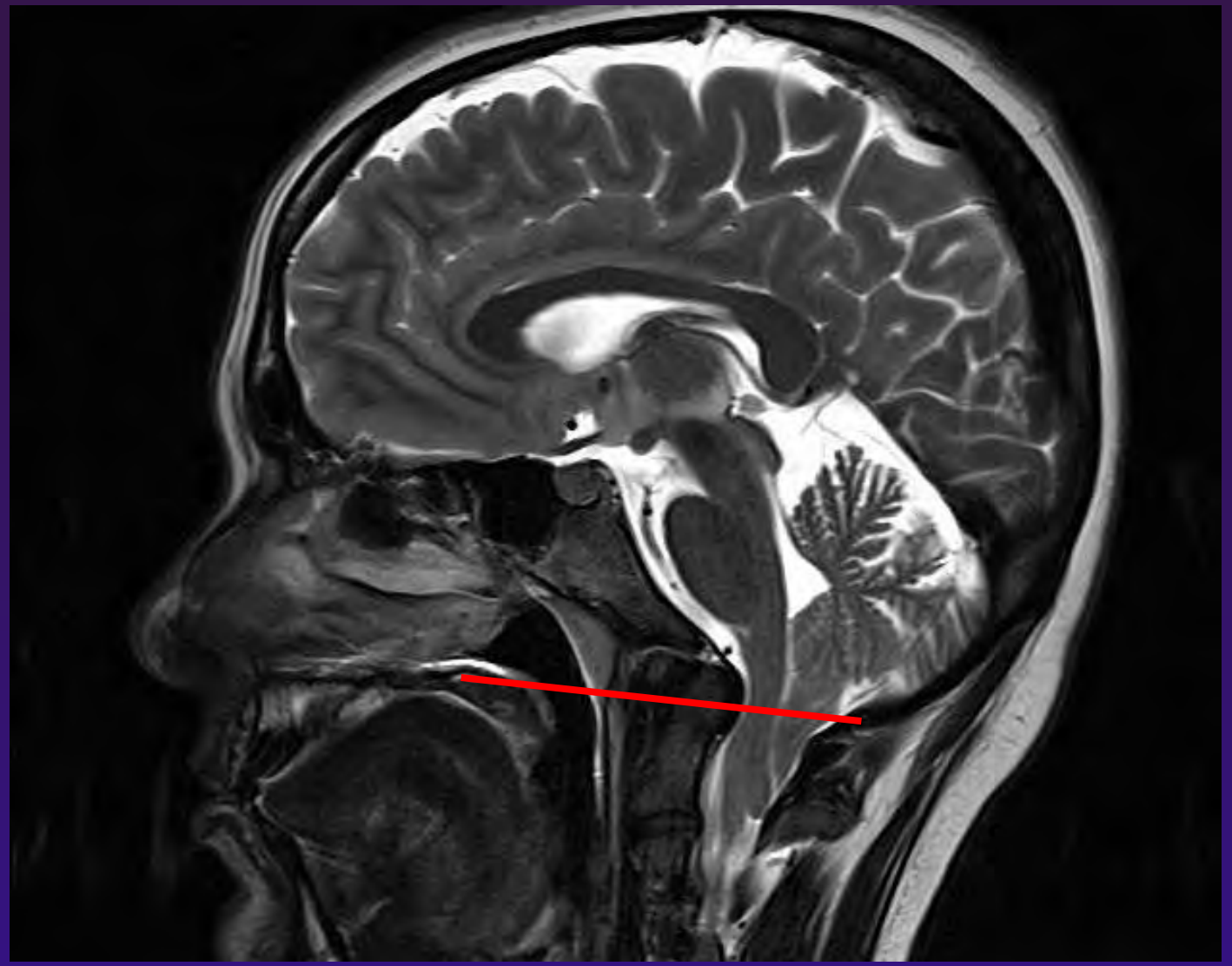
Chiari malformation

Chiari malformations are group of defect associated with congenital caudal displacement of the cerebellum and or brainstem.

>5 mm below the foramen magnum

Currently Chiari malformations run from Chiari 0 malformations (syrinx) to Chiari V.

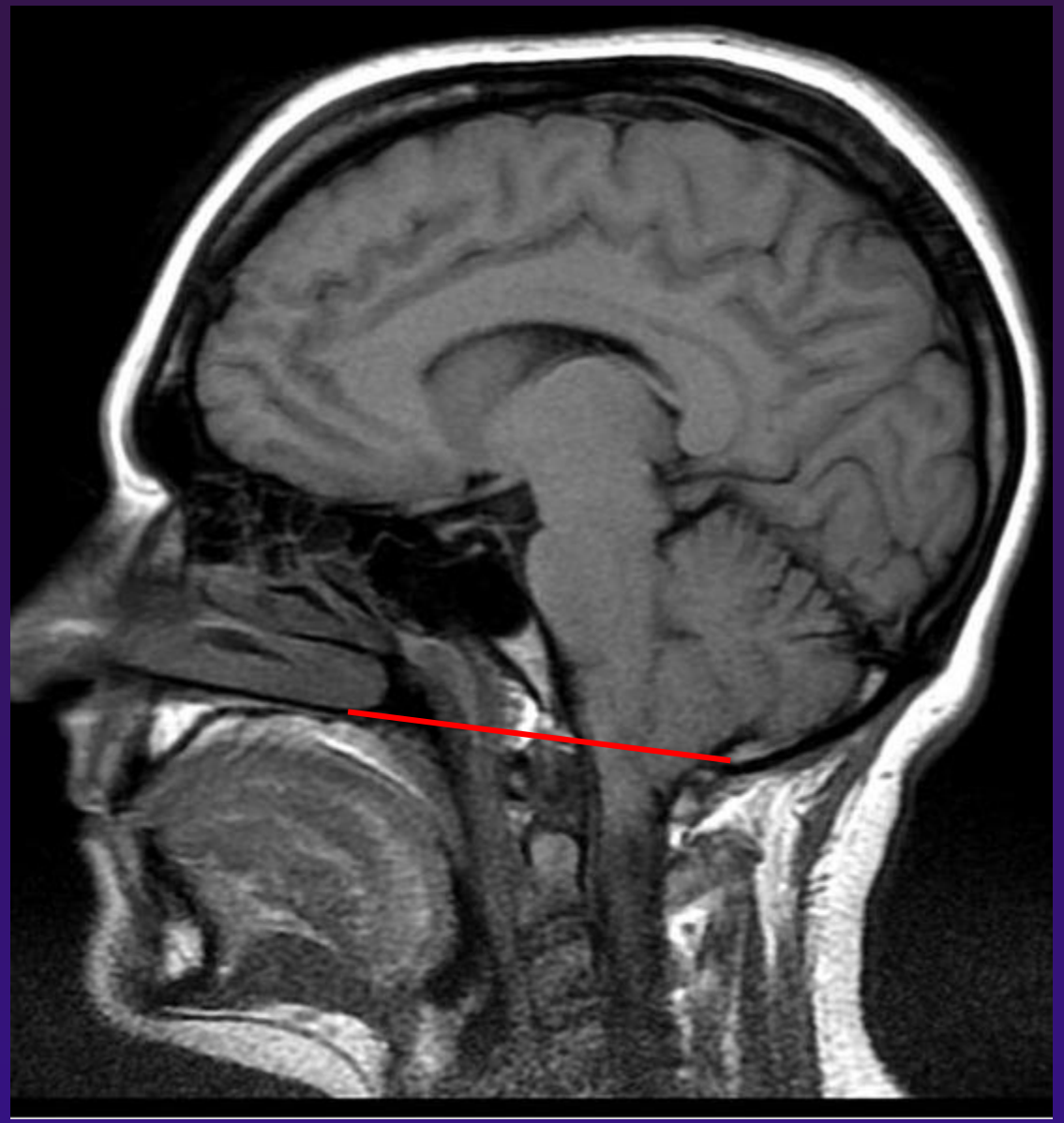
As the numbers increases so do the malformations.

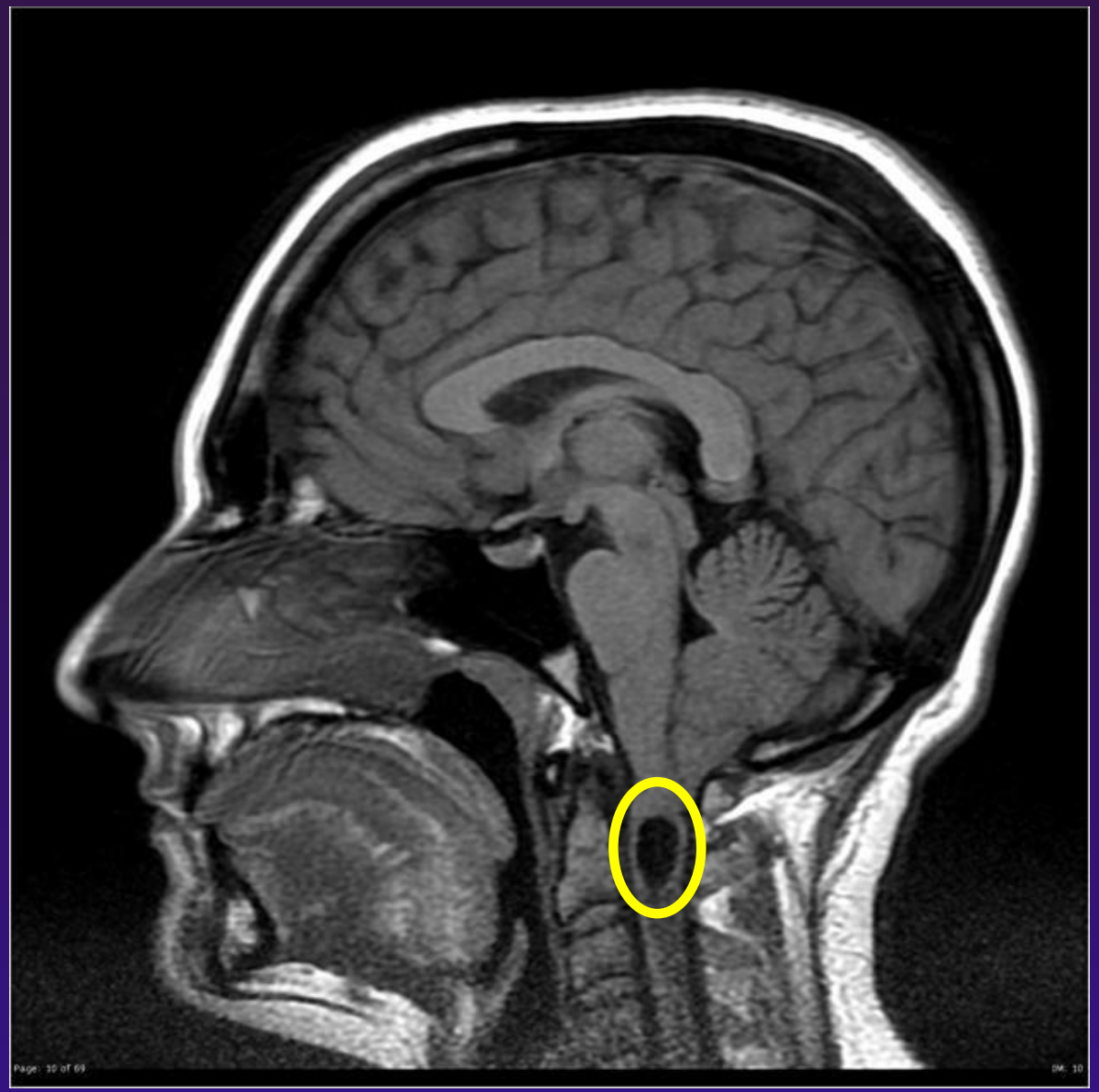


Case courtesy of Dr Rodrigo Dias Duarte, Radiopaedia.org, rID: 50409

Chiari Type 1.5 or bulbar Chiari malformation

Chiari malformations





Case courtesy of A.Prof Frank Gaillard, Radiopaedia.org, rID: 15819

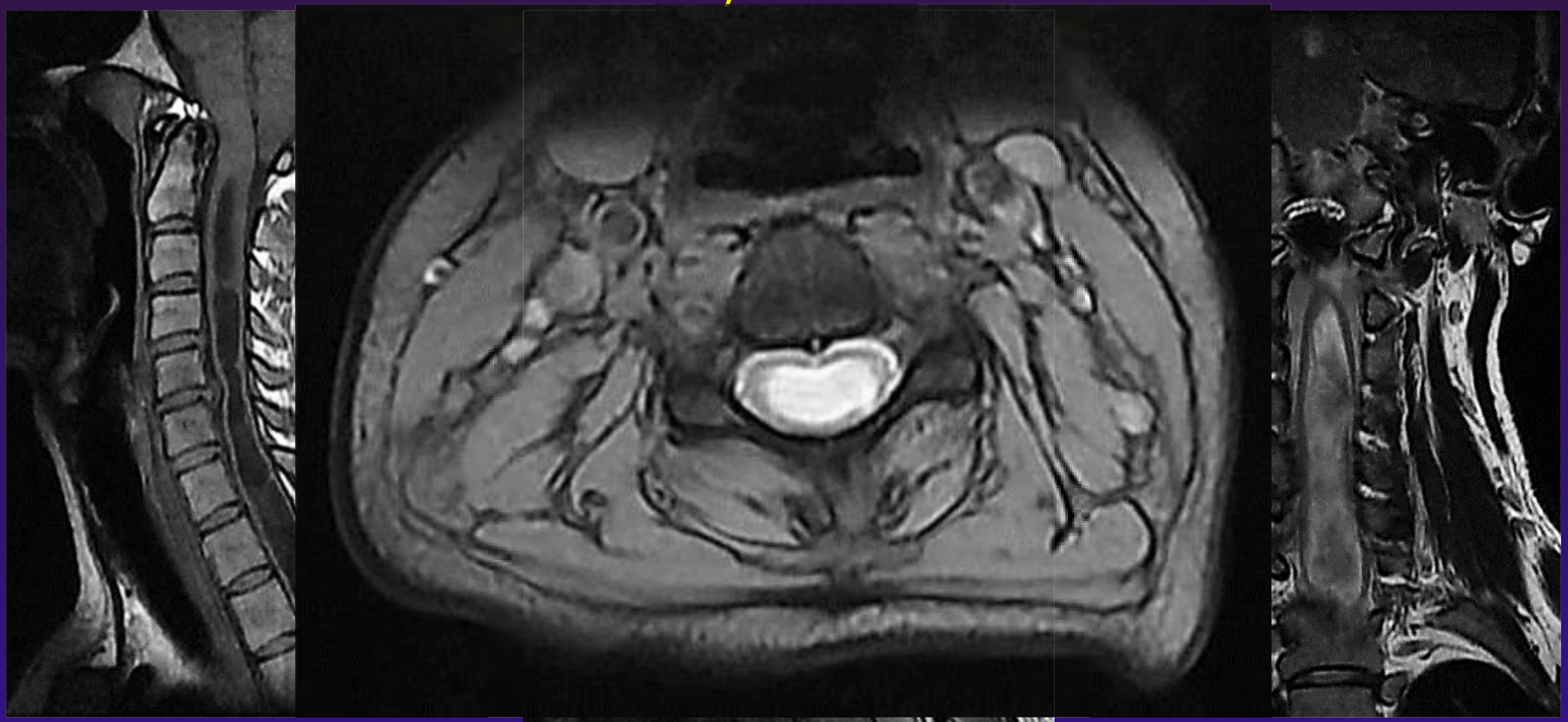
Syrix

- Collective term to includes:
  - Hydromyelia: *Dilation of central canal*
  - Syringomyelia
  - Syringobulbia
    - The latter two involve dissection through ependymal lining and collection within cord itself.
      - Not usually an imaging differentiation

Symptoms of syrinx

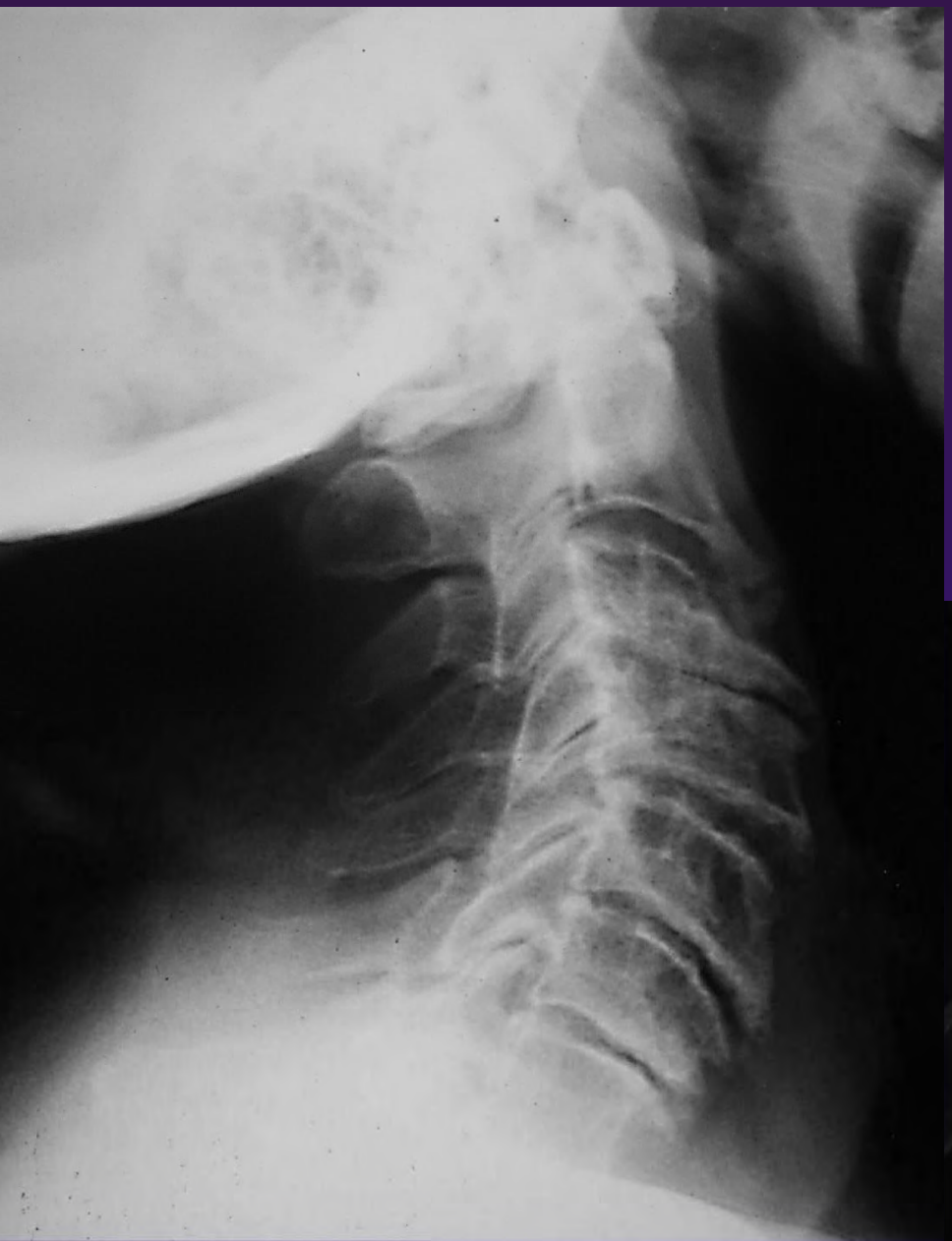
- May not occur immediately
- Can include:
  - Flaccid weakness in the hands and arms
  - Possible “cape–like” distribution of pain and temperature sensory loss with preservation of position, vibration and touch
  - May be in up to 40% of patients with Chiari 1 malformation

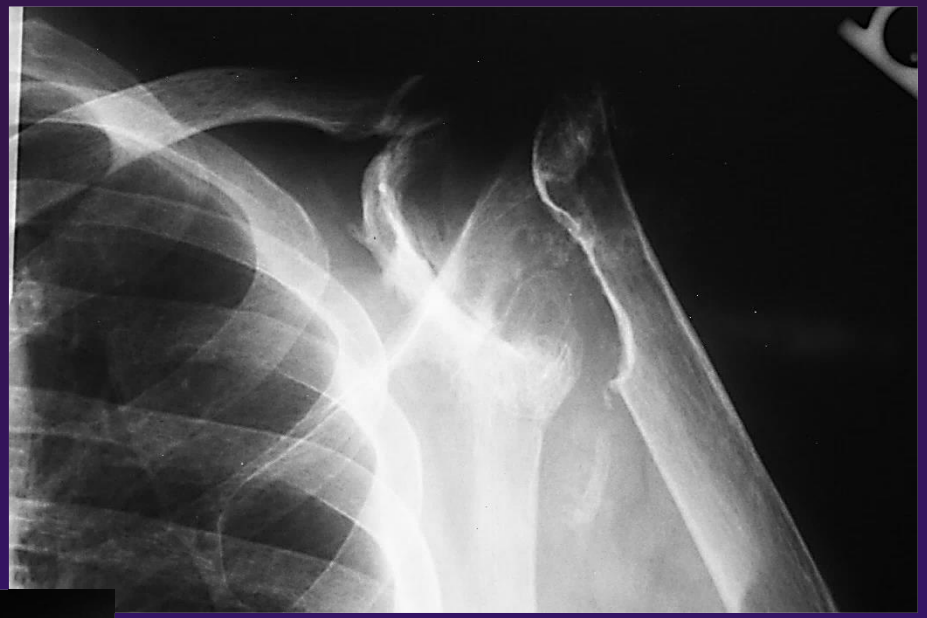
Syrinx

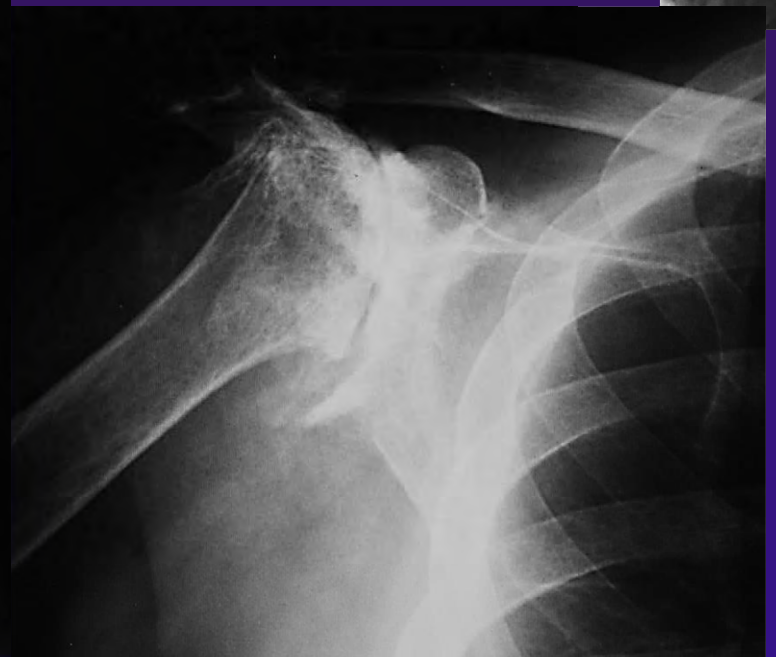


Case courtesy of Dr Mohammad A. ElBeialy, Radiopaedia.org, rID: 24077

56 y.o. male neck pain shoulders “unstable”







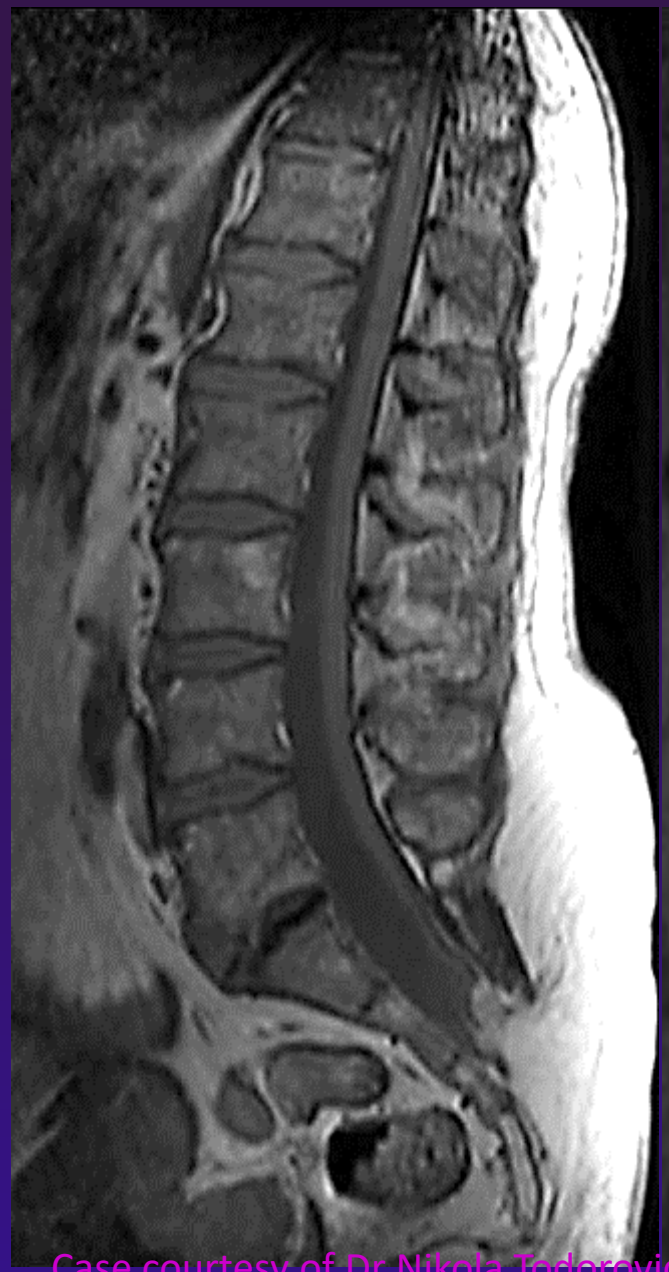
Tethered cord

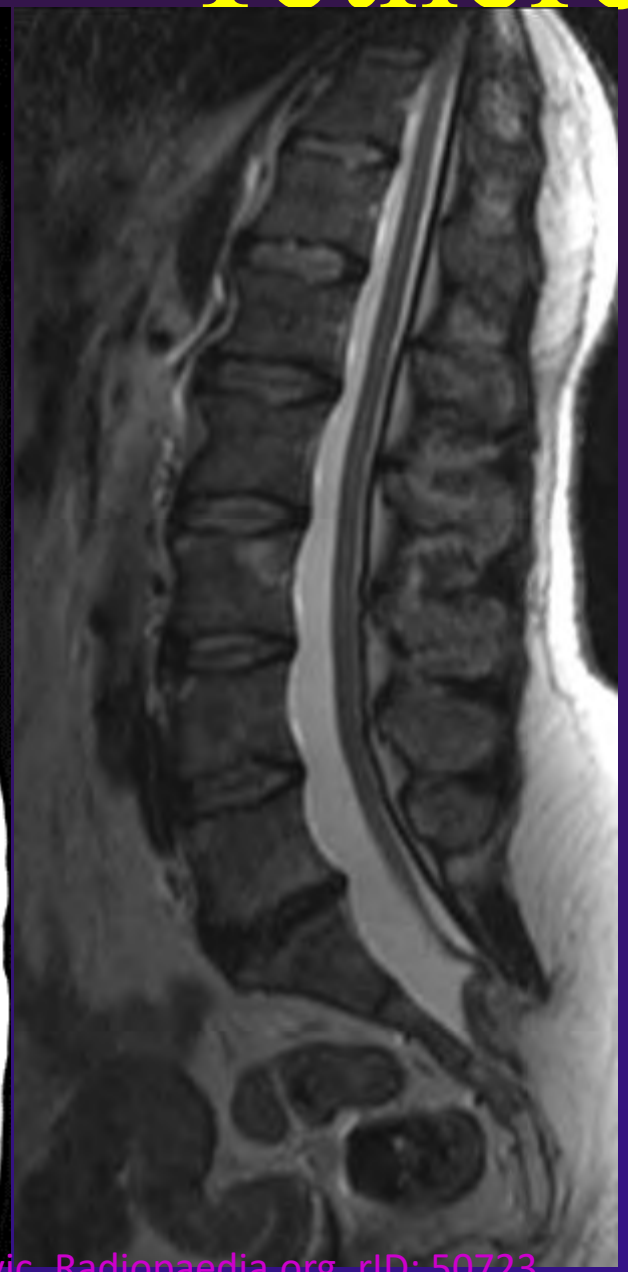
- Is a neurologic disorder resulting from congenital attachment of the terminal end of the cord limiting the motion of the spinal cord within the spinal column.
    - Associated with spina bifida
    - May show stigmata (Hairy patch/dimple/subcutaneous lipoma).
    - Associated foot and spinal deformities, leg weakness, low back pain, scoliosis and incontinence are possible.
        - Can show in childhood; however can go undiagnosed until adulthood with development of sensory and motor problems, loss of bowel/bladder control

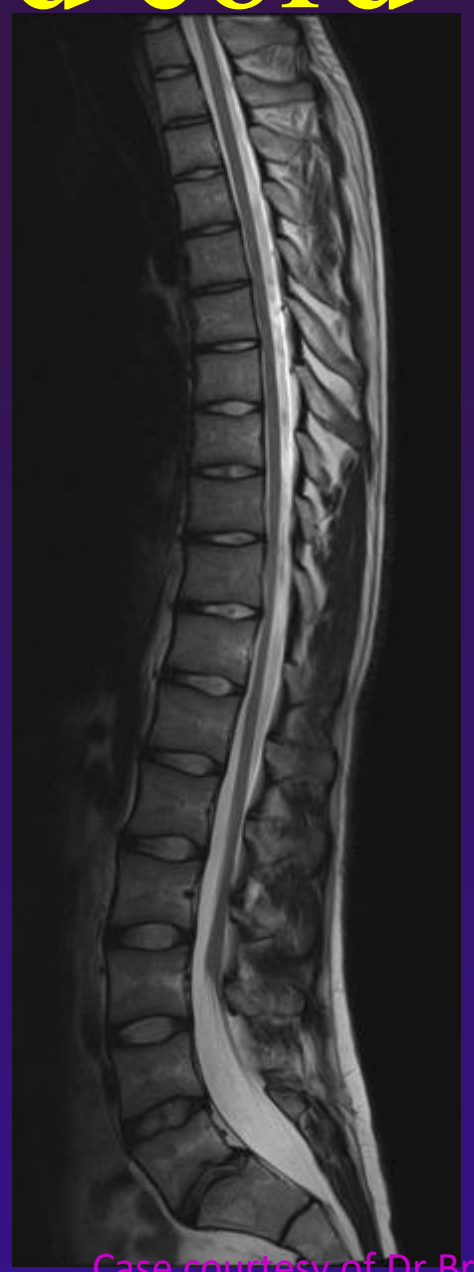
Tethered cord

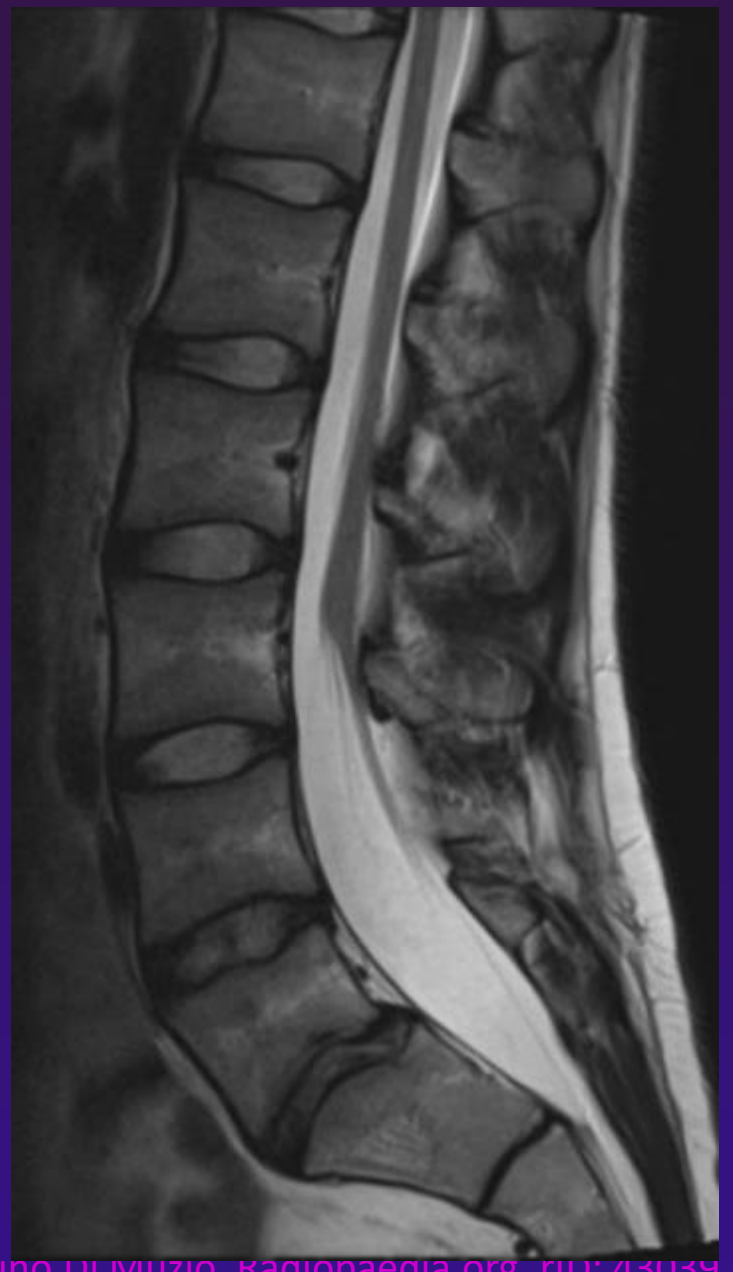
- Primary tethered cord is an isolated anomaly
- Secondary tethered cord is associated with other abnormalities (Fibrolipoma, Filum terminale lipoma etc)
- MRI:
  - Low set filum terminale (below L2)
  - Thickened filum terminale (> 2mm)

Tethered cord





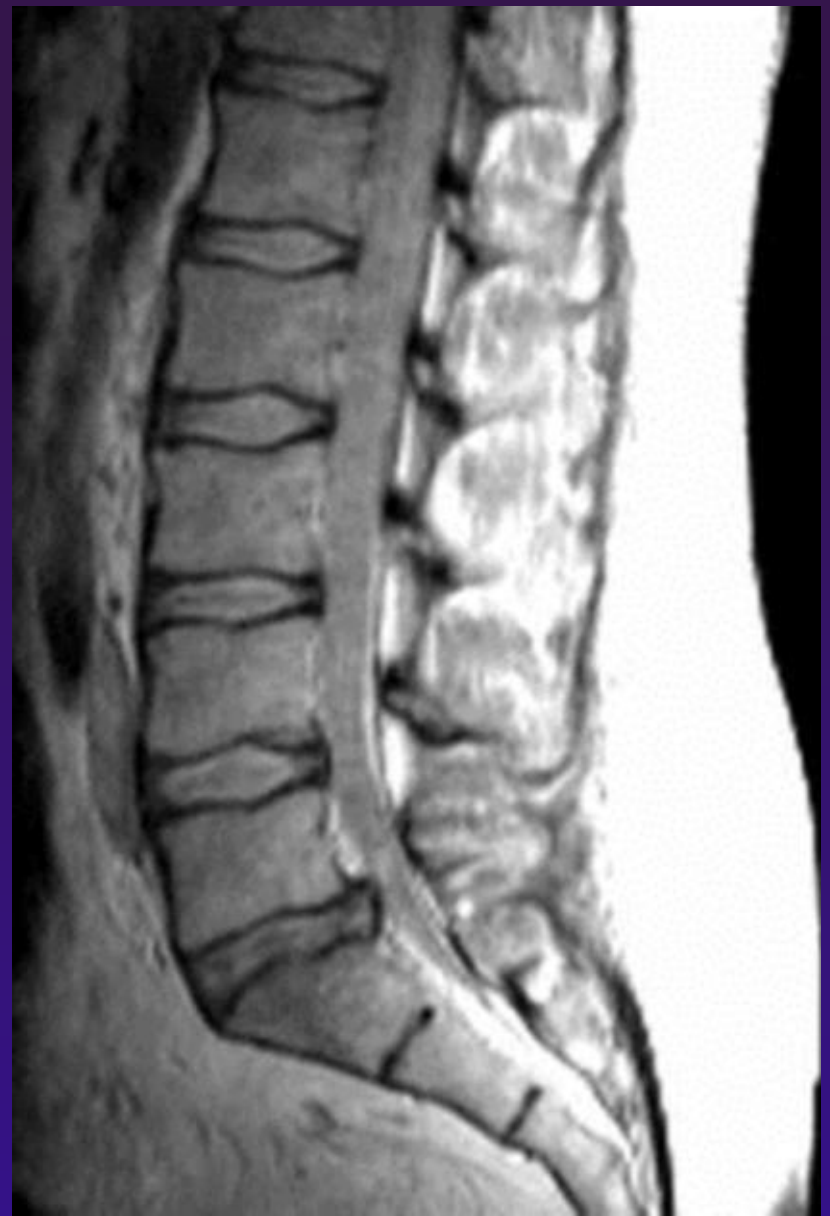


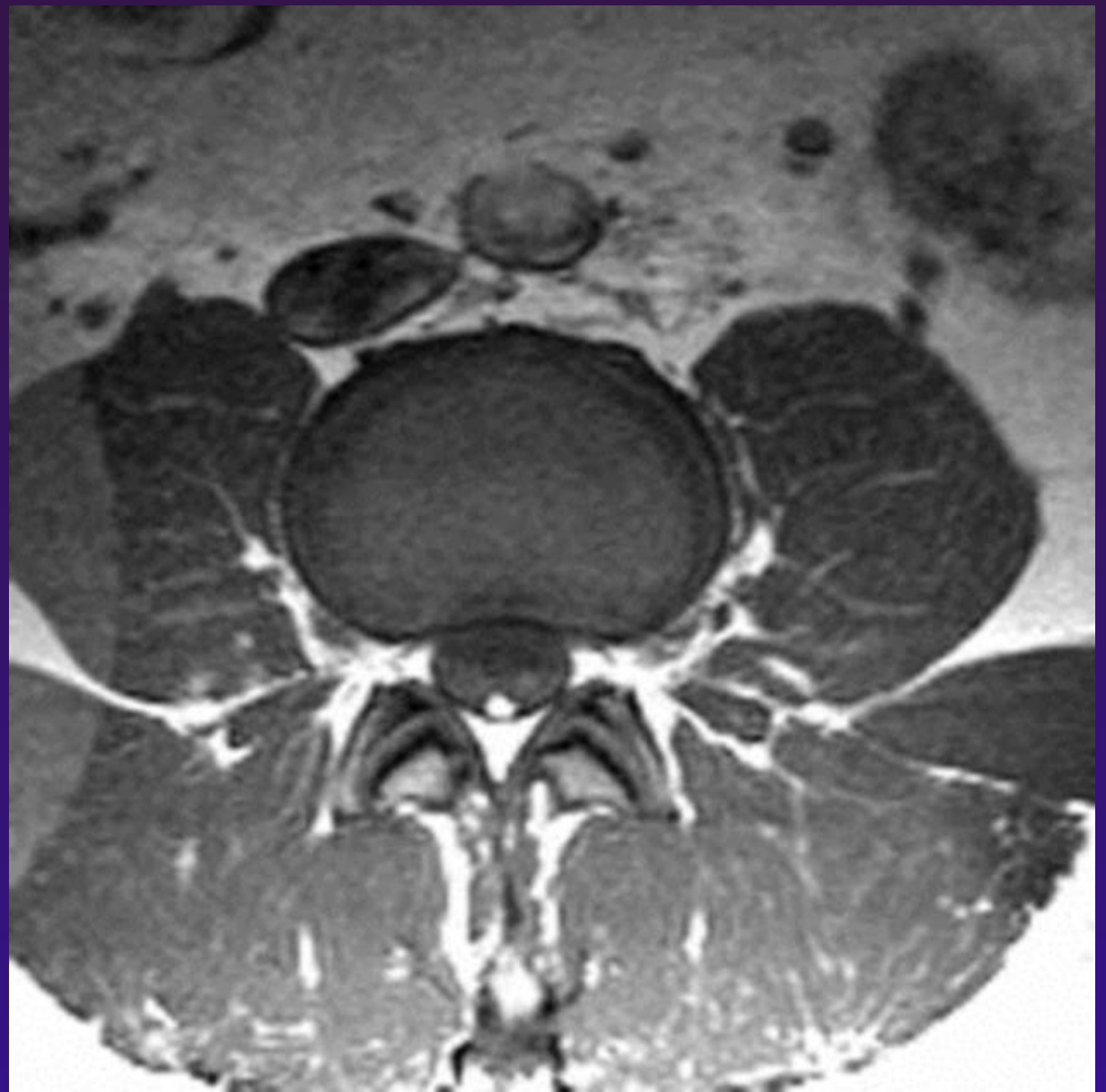


Case courtesy of Dr Nikola Todorovic, Radiopaedia.org, rID: 50723

Case courtesy of Dr Bruno Di Muzio, Radiopaedia.org, rID: 43039

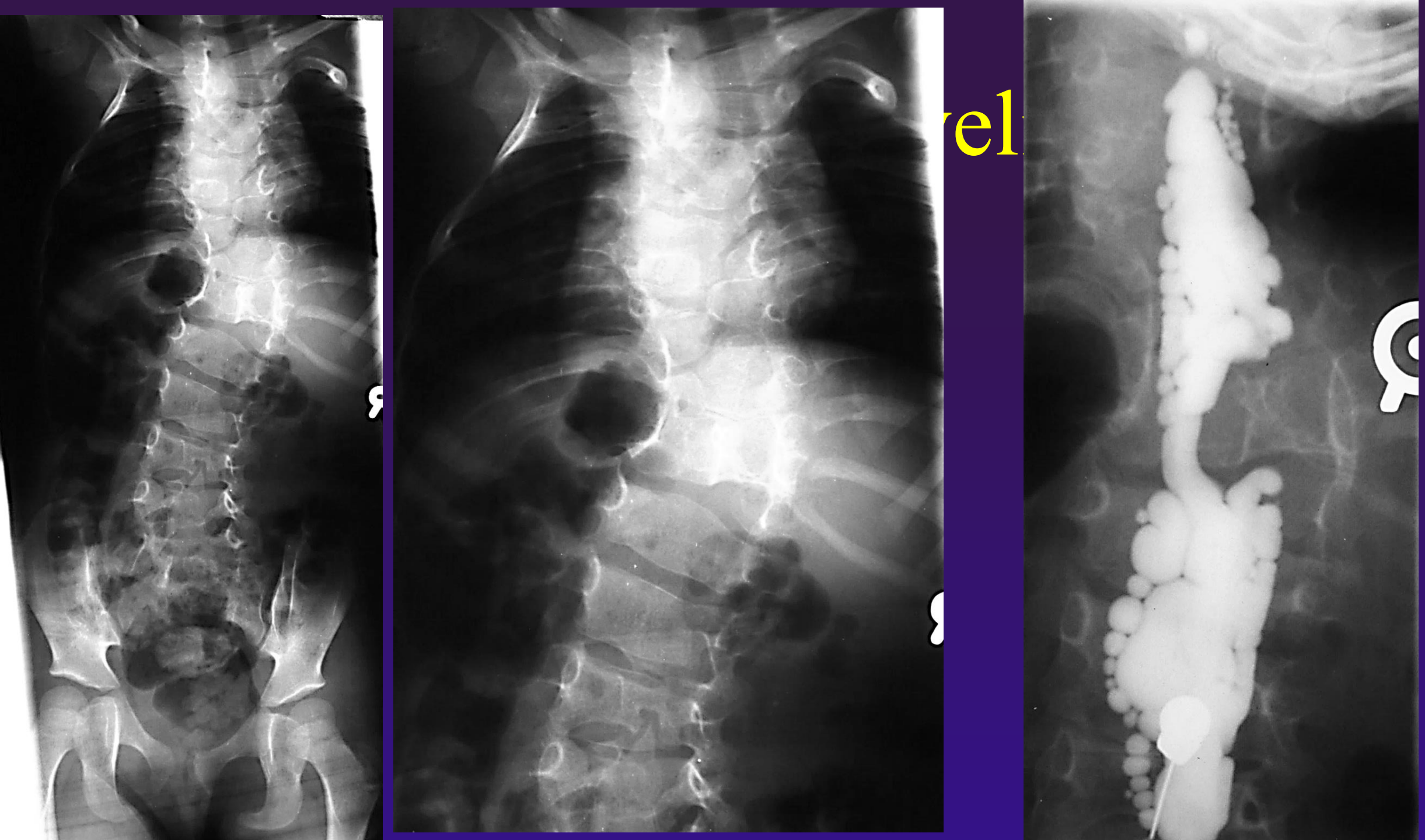
Fibrolipoma





Diastematomyelia

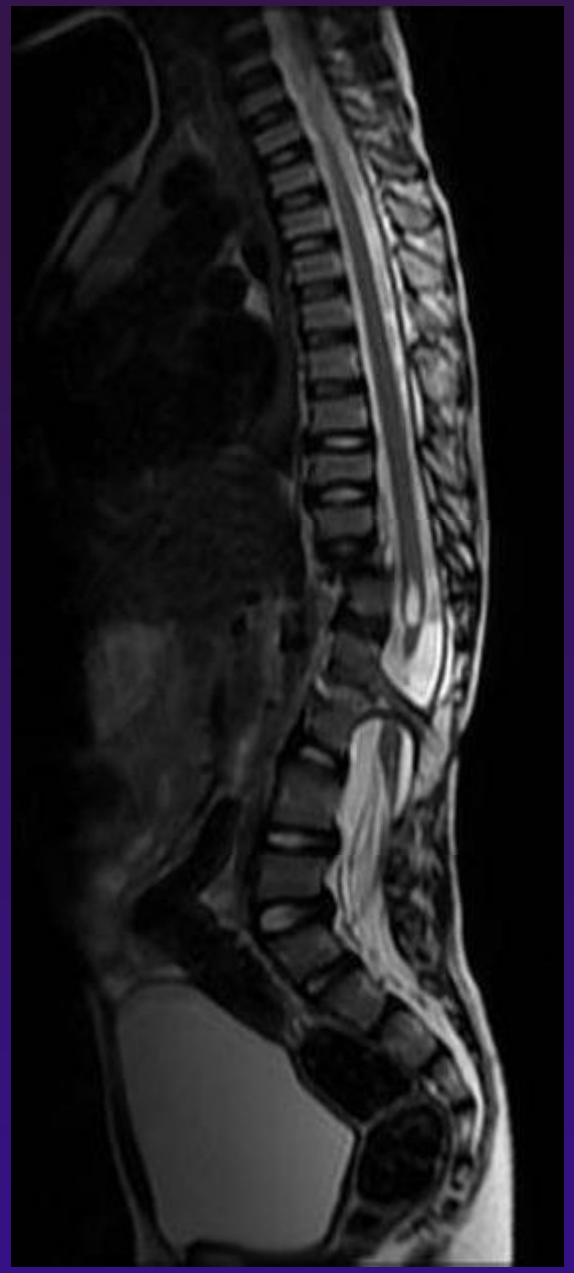
- A type of spina bifida occulta
  - Presents with a concomitant longitudinal split of spinal cord
    - Often with bony/fibrous spurring running through the split cord
      - 2 Types:
        - Type 1 – has bony/fibrous spur usually most symptomatic
        - Type 2 – single dural sac, usually no spur formation, less symptomatic
  - Symptoms:

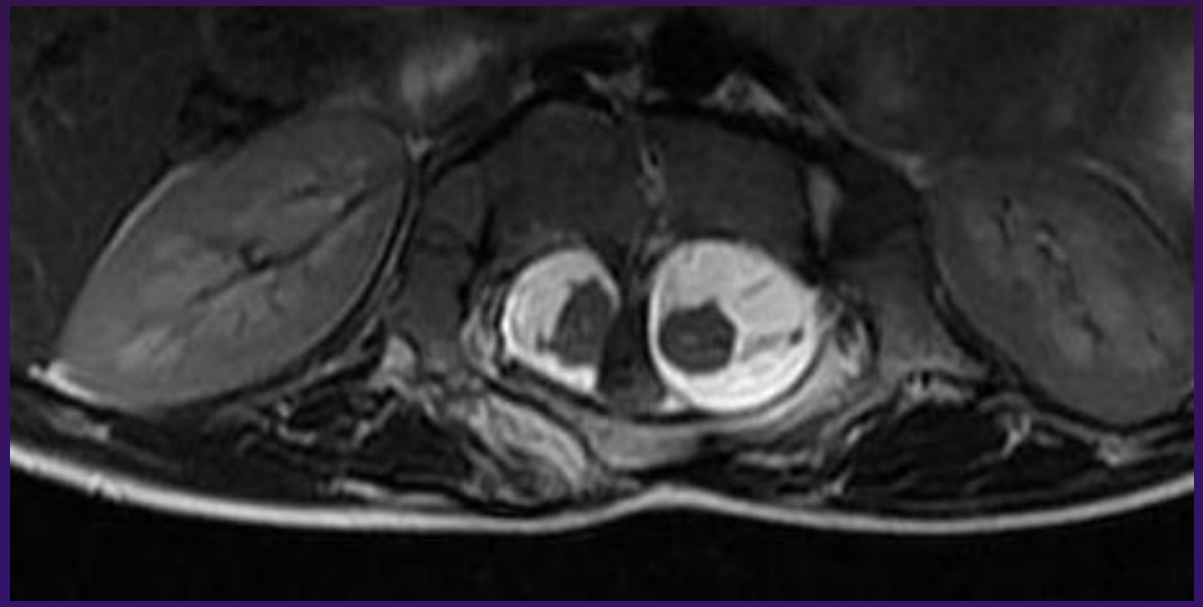


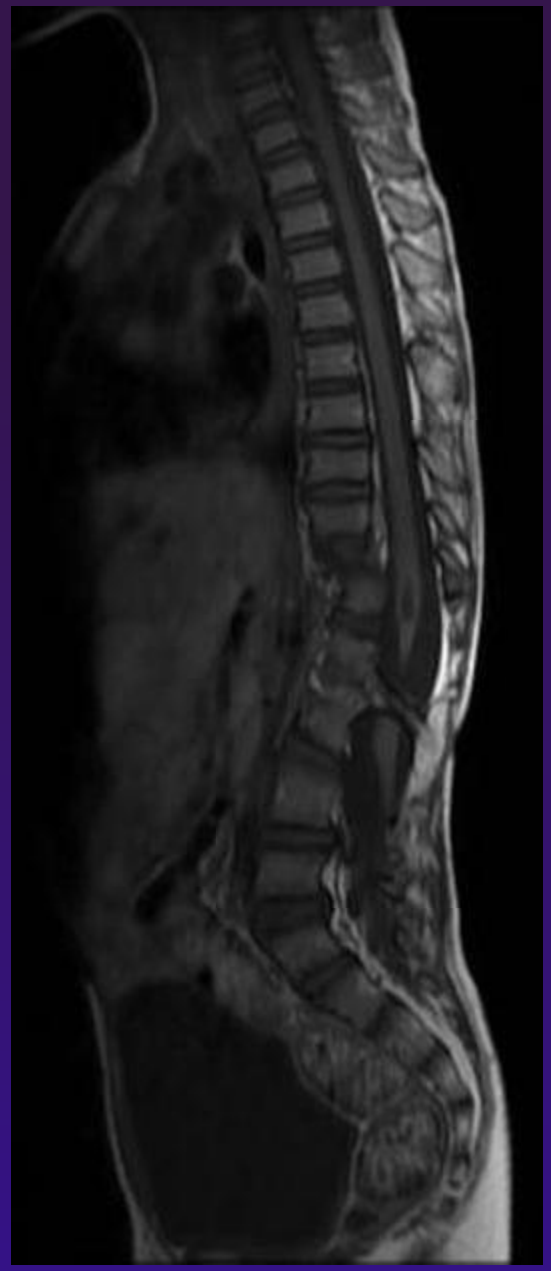
Diastematomyelia

- Symptoms:
  - Foot and spinal deformities
  - Lower extremity weakness
  - Low back pain
  - Scoliosis
  - Incontinence

Diastematomyelia





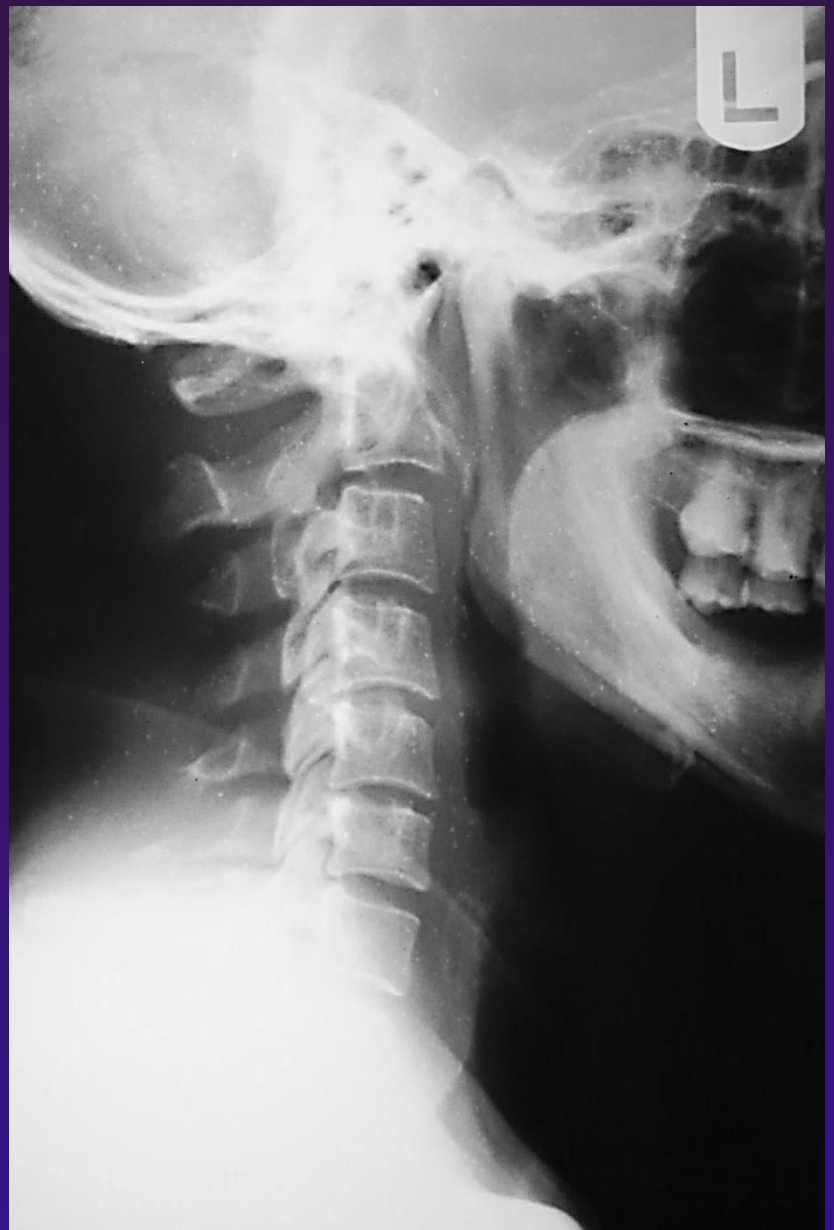


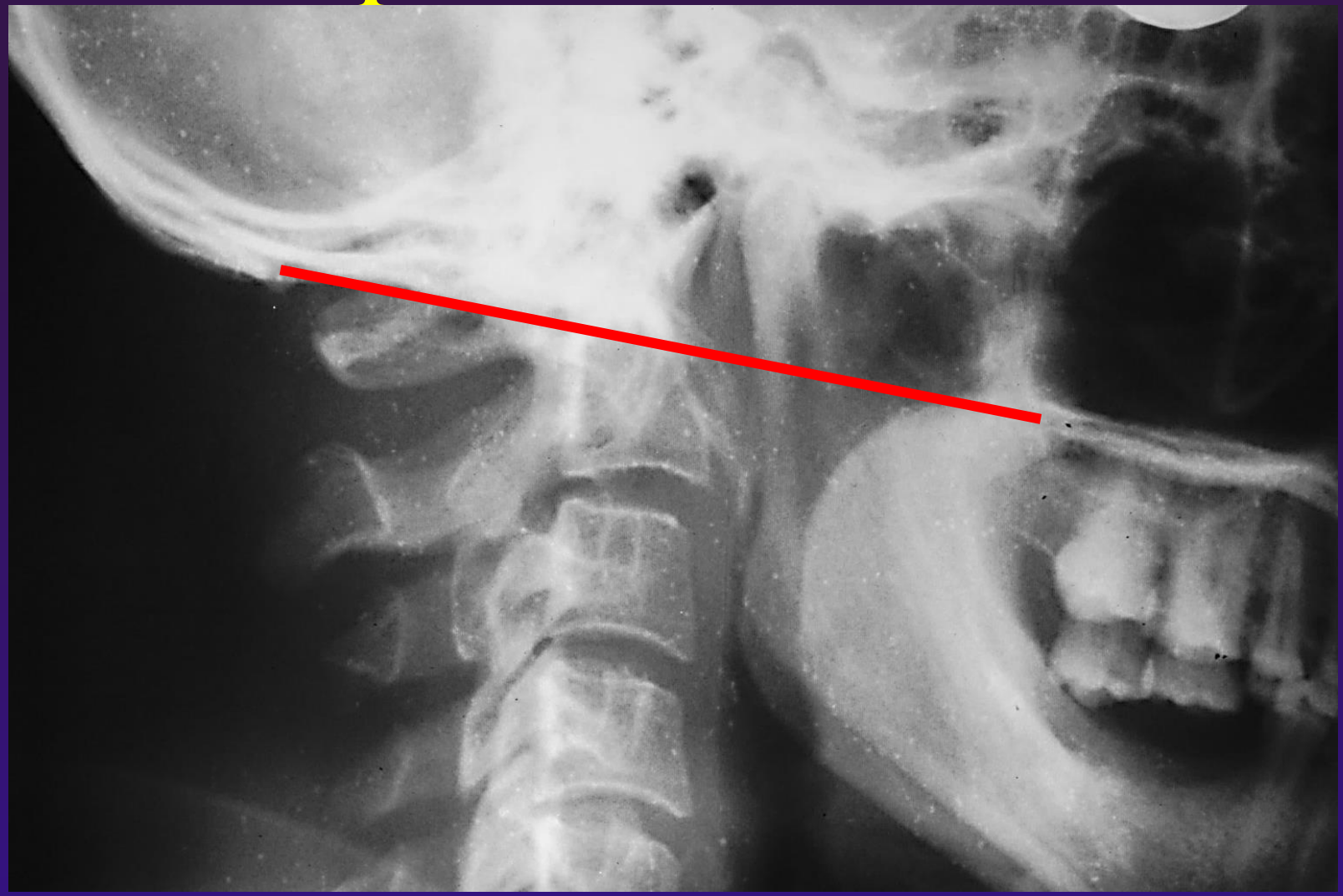
Case courtesy of Dr Aneesh km, Radiopaedia.org, rID: 17658

Basilar Impression

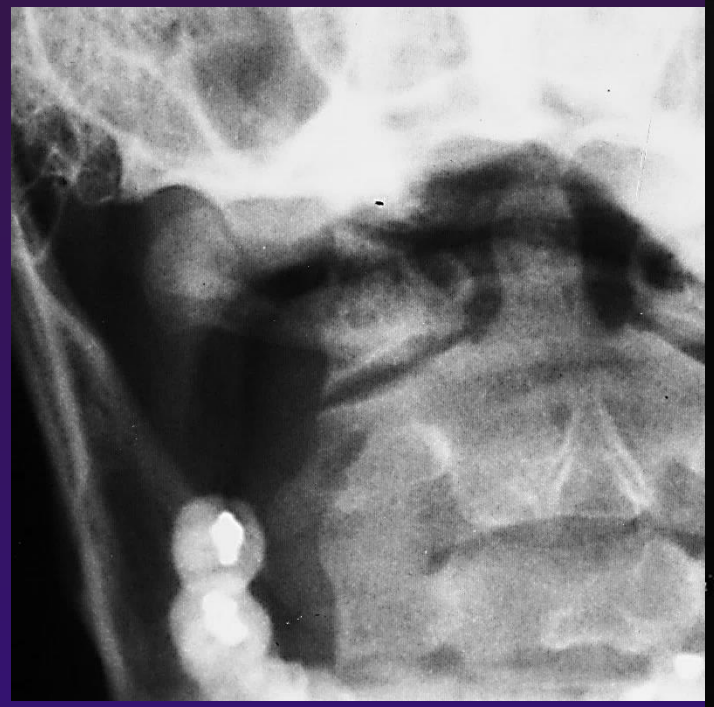
- Involves superior migration/positioning of the upper cervical vertebra in relation to the base of the skull/foramen magnum
  - Primary impression: congenital in origin and is associated with numerous vertebral anomalies (i.e. Occipitalization, SBO of C1, Chiari malformation etc.)
  - Secondary impression: acquired condition resulting from bone softening diseases (i.e Paget's disease, Fibrous dysplasia)

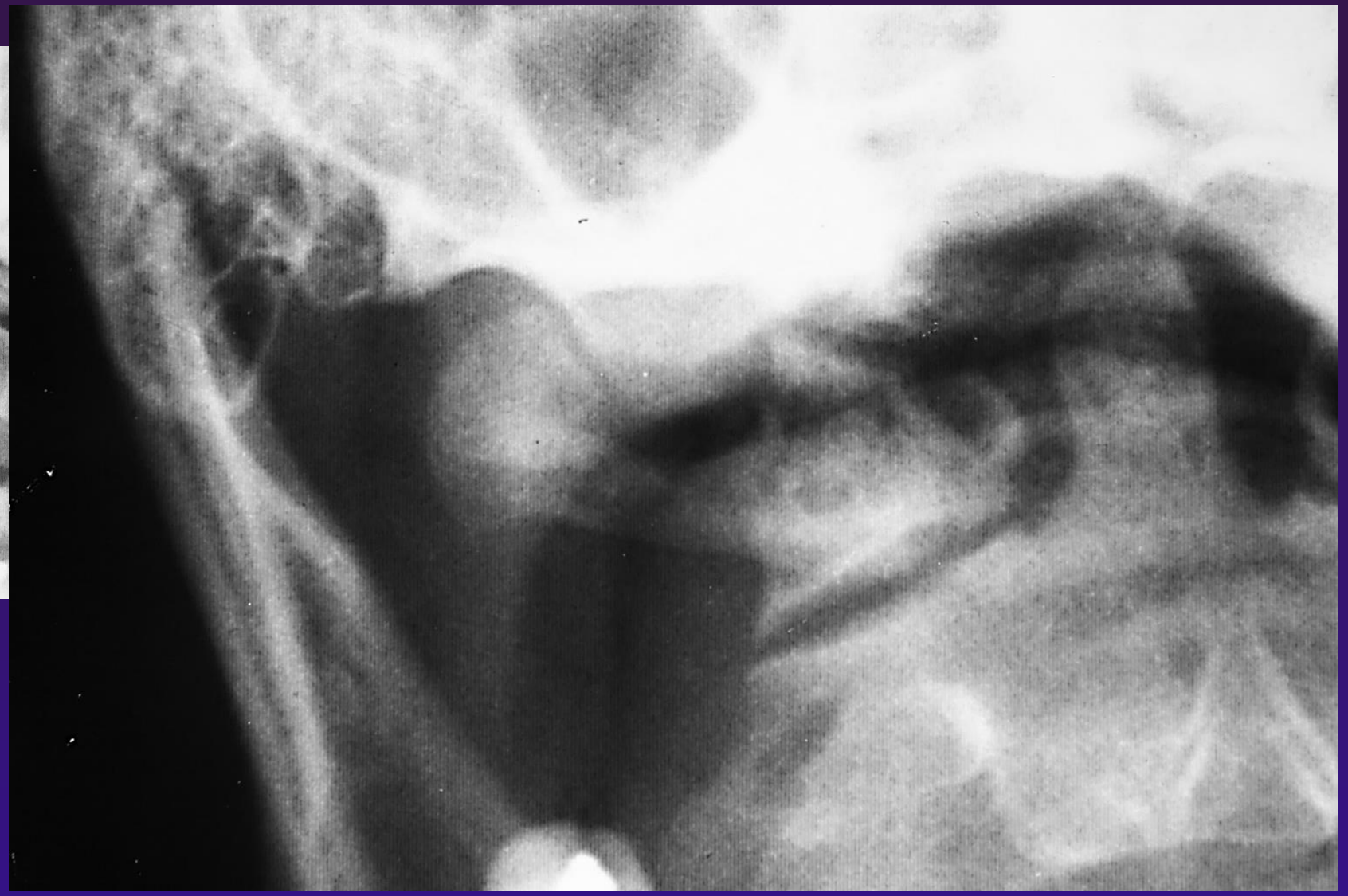
Basilar impression





Patient with previous condition

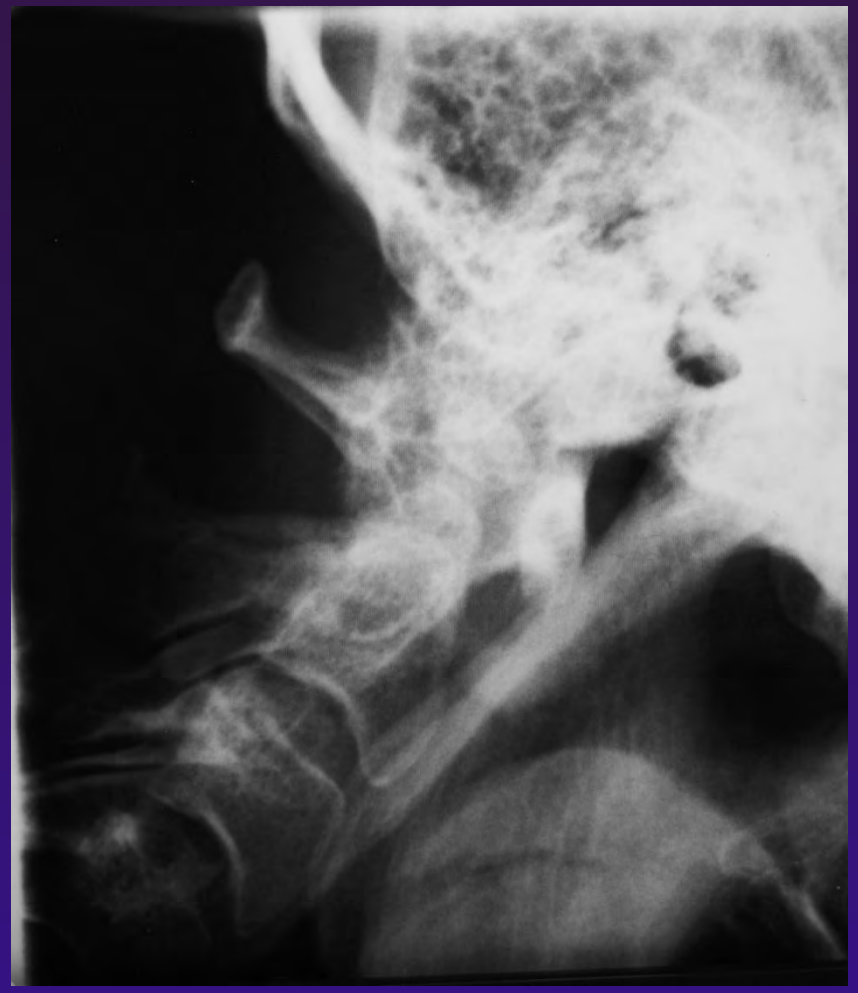


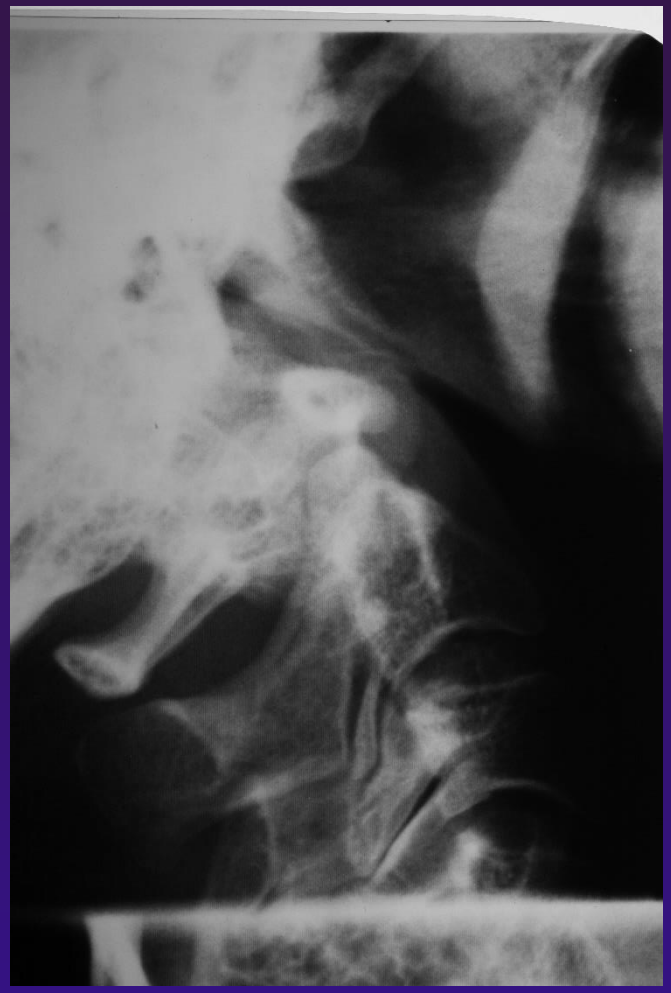


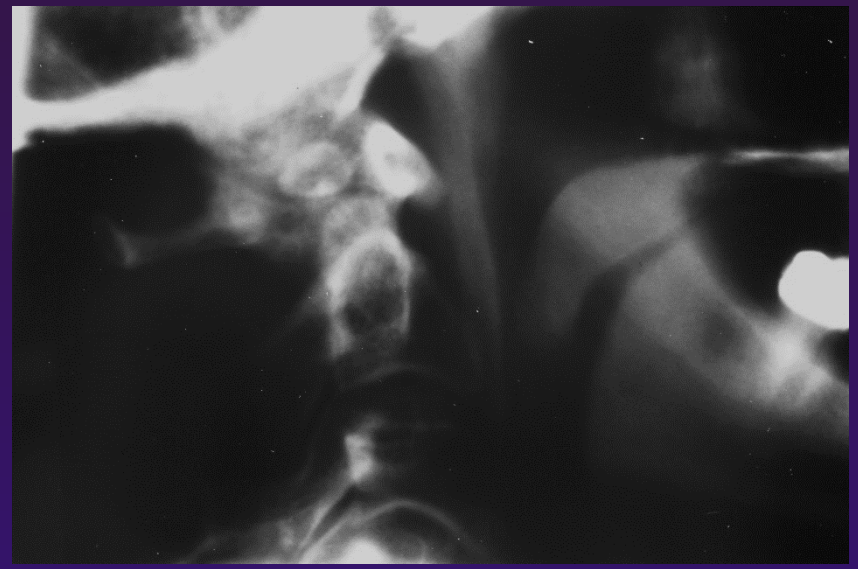
Epitransverse or parachondylar process

- Variations of congenital bone bars that extends from the occiput to the transverse process of C1.
  - Paracondylar/paramastoid processes: extend from the occiput region towards transverse process of C1.
  - Epitransverse processes: attached from the transverse process of C1 and directed superiorly toward the adjacent occiput (less common)

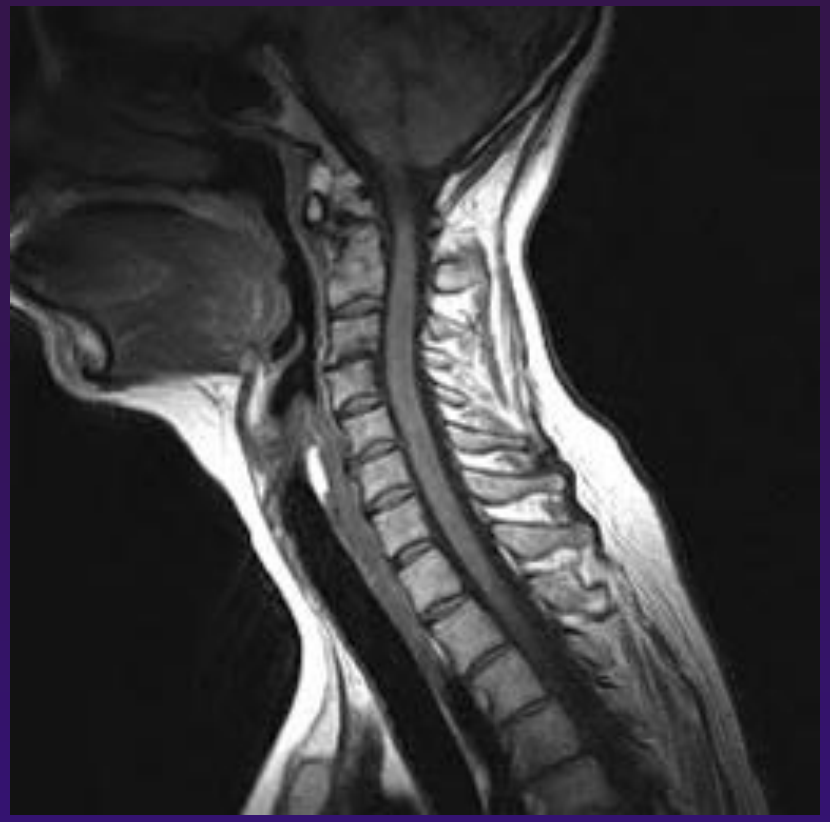
Os Odontoideum



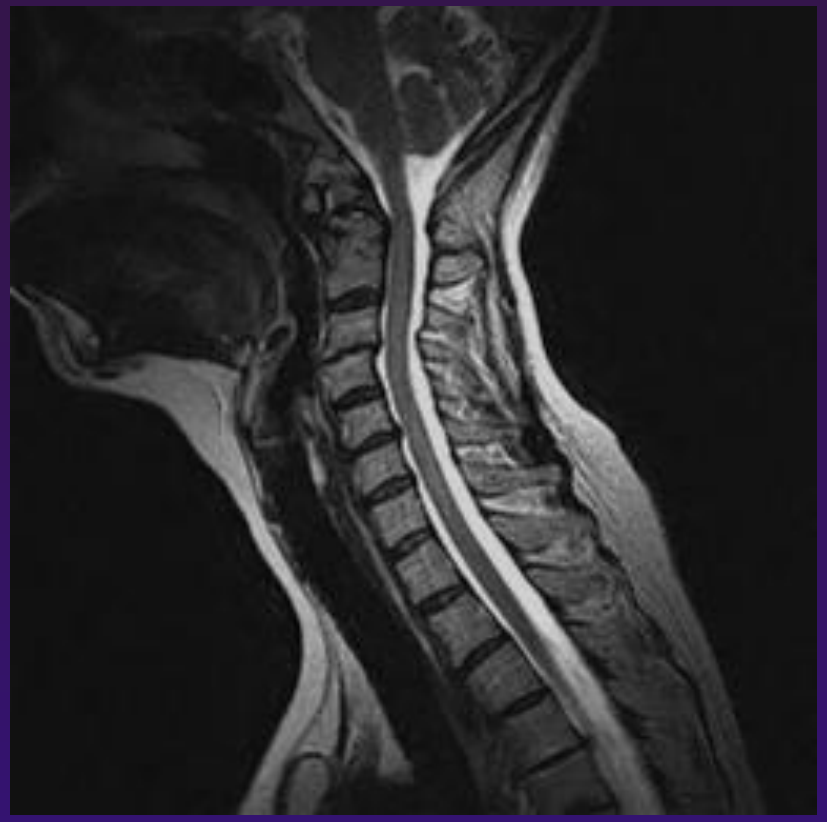




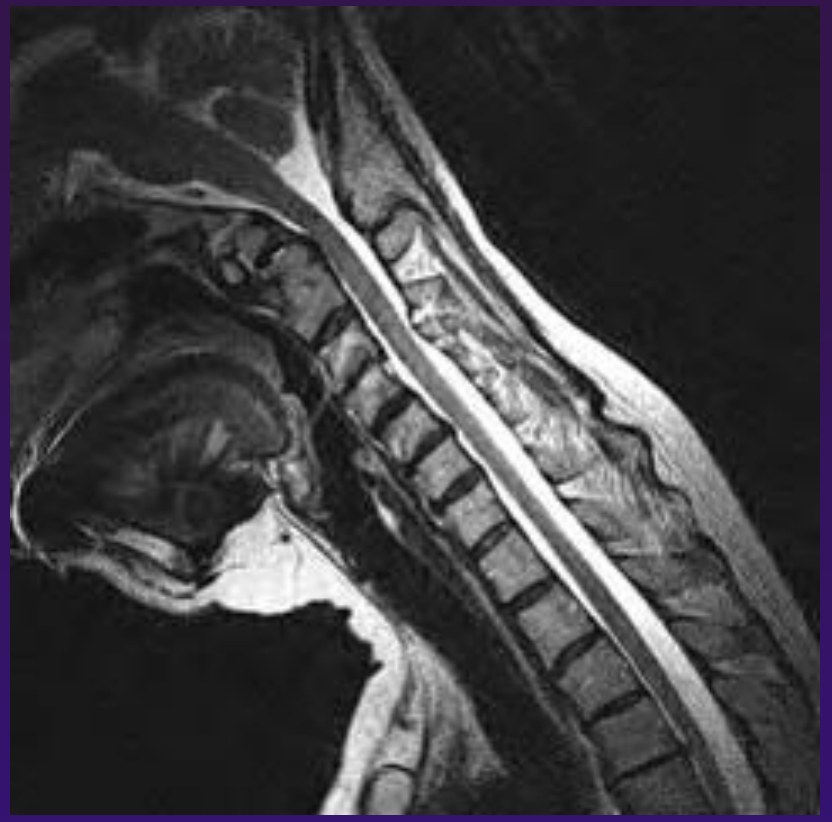
Os Odntoideum



T1 Neutral

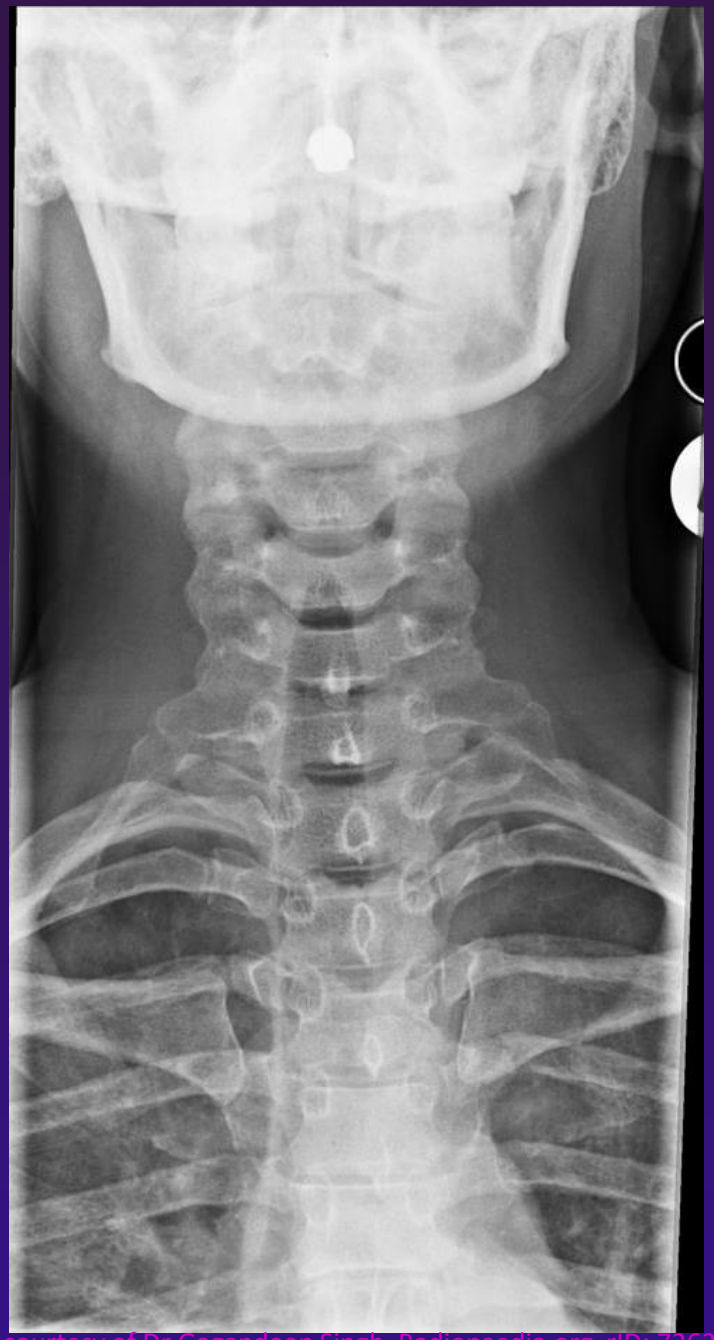


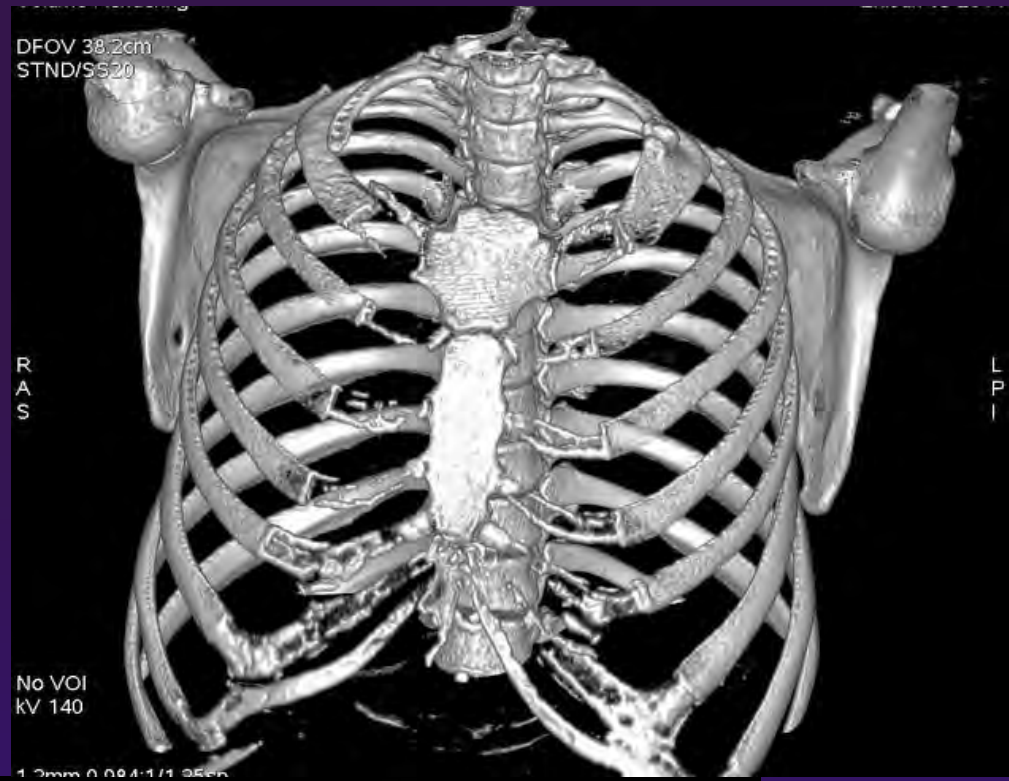
T2 Neutral

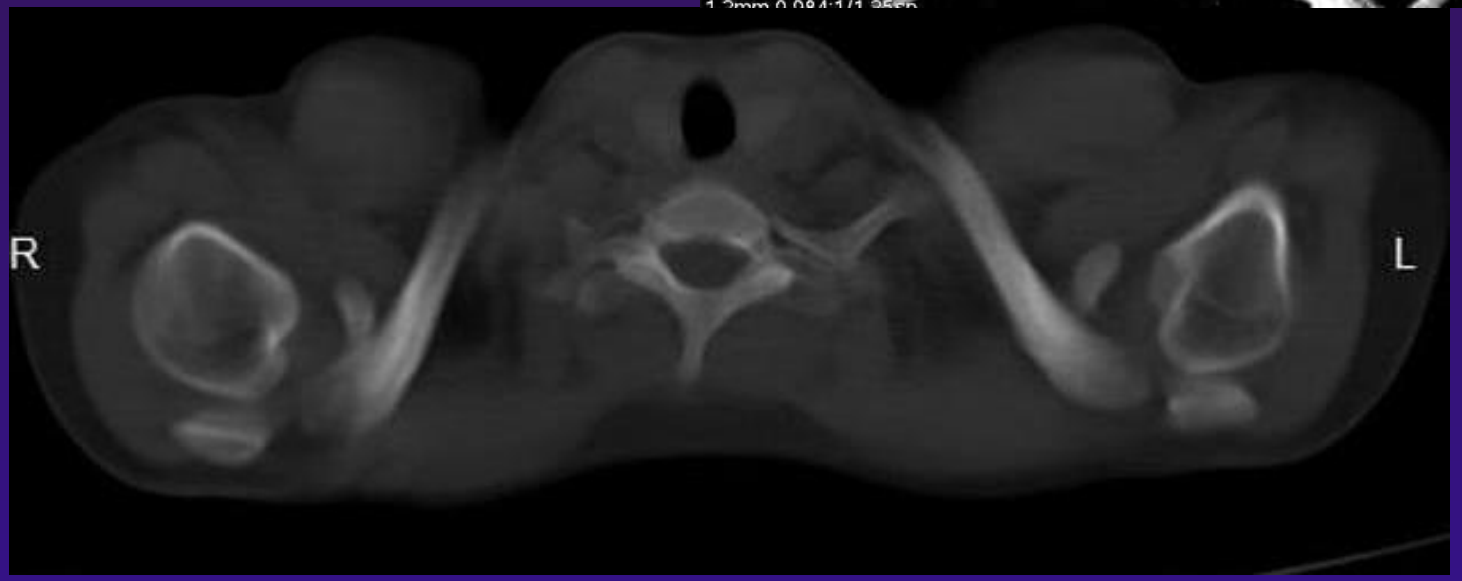


T2 Flexion

Cervical Rib



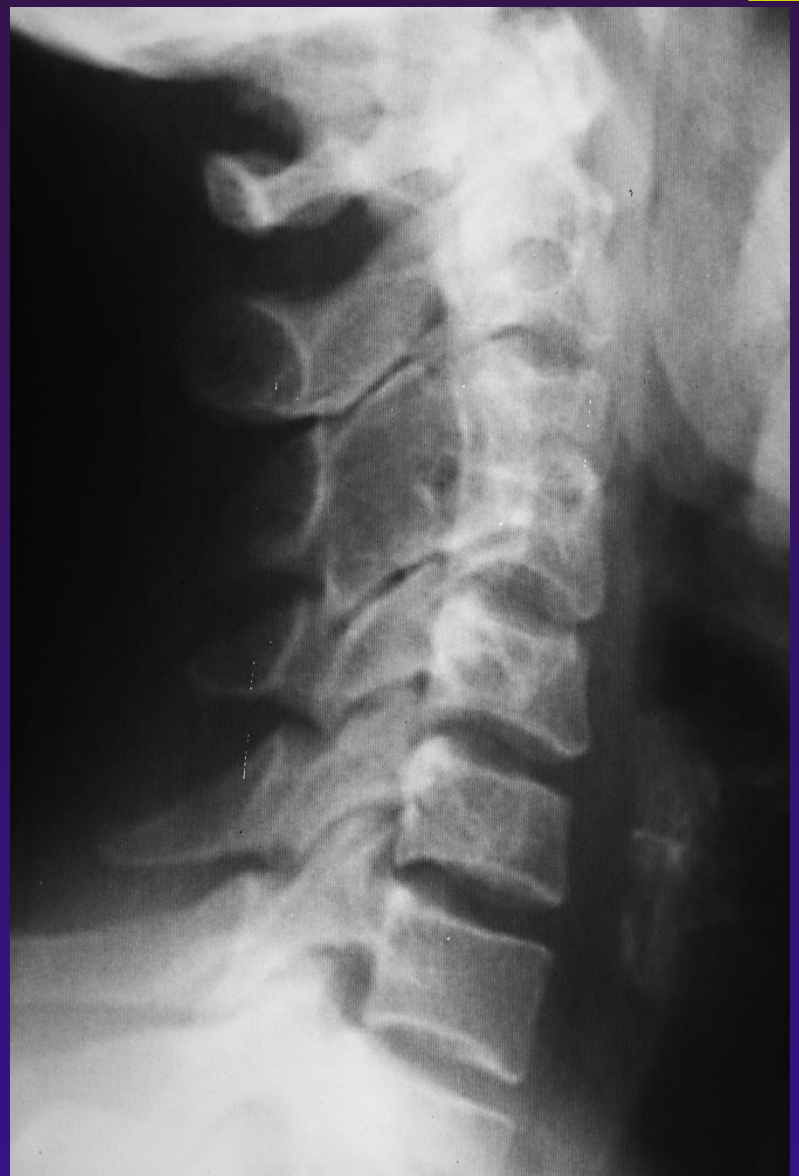


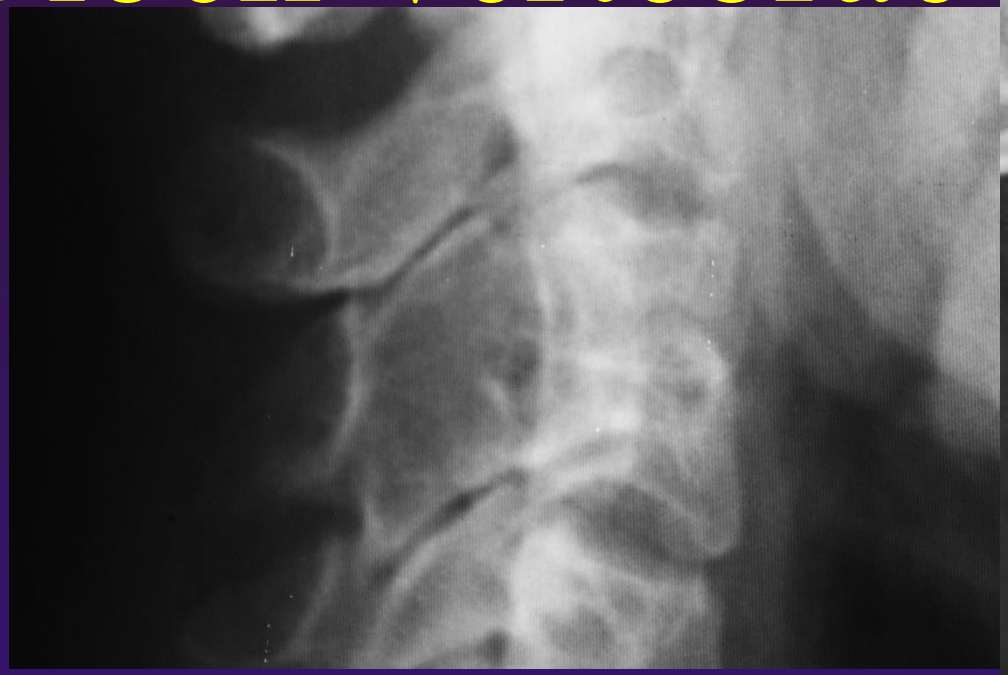


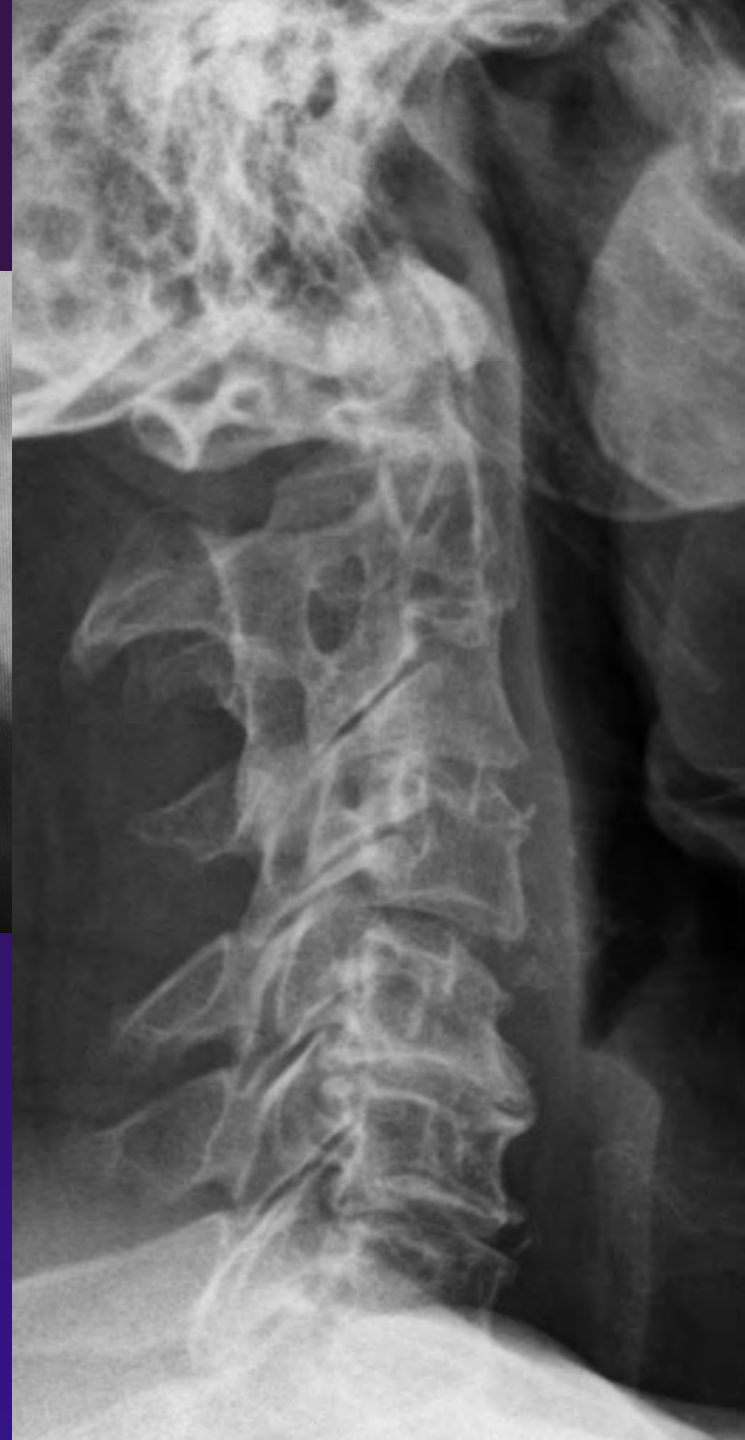
Case courtesy of Dr Gagandeep Singh, Radiopaedia.org, rID: 7262

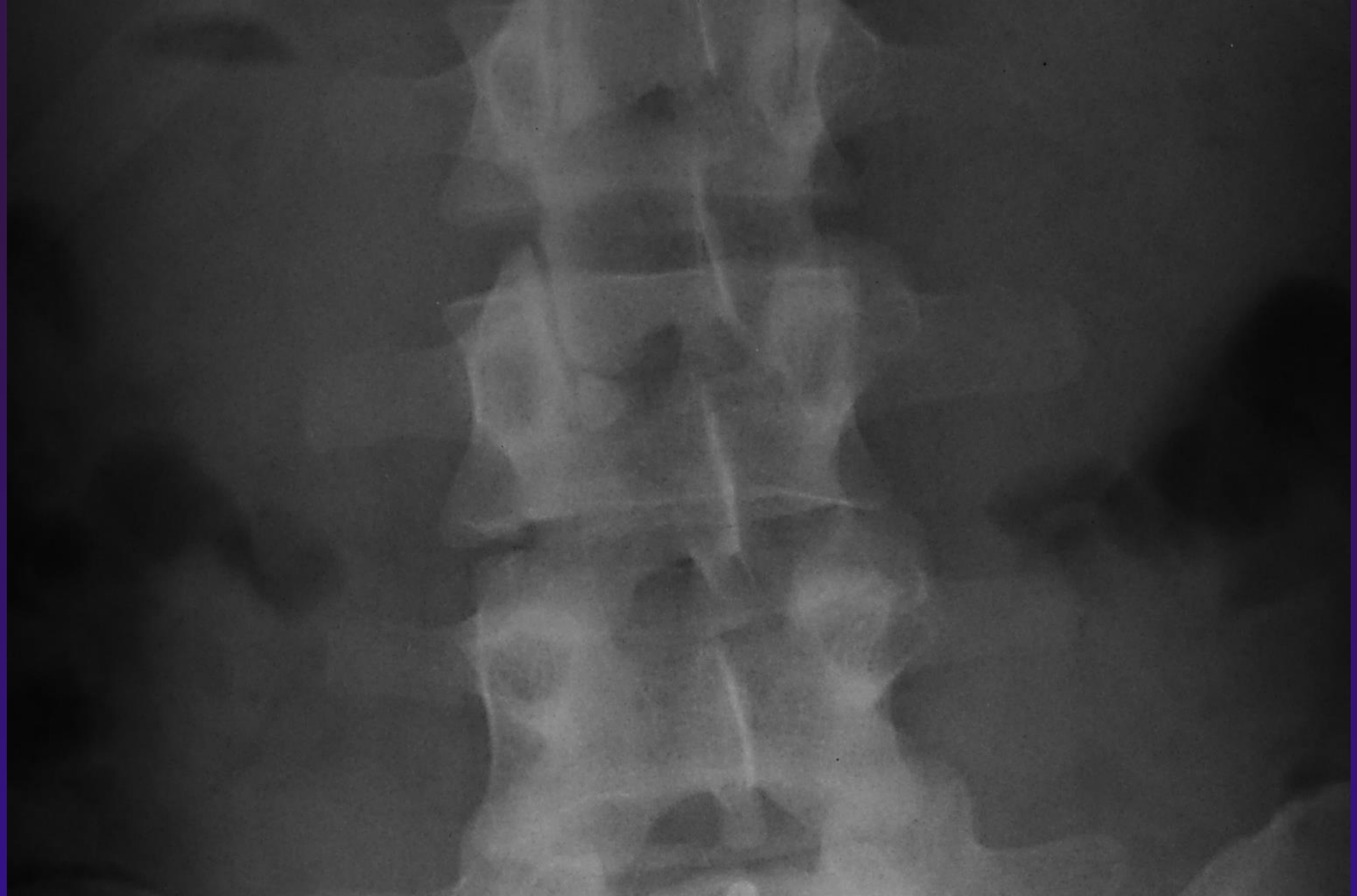
Case courtesy of Dr Ruslan Esedov, Radiopaedia.org, rID: 7518

Block Vertebrae



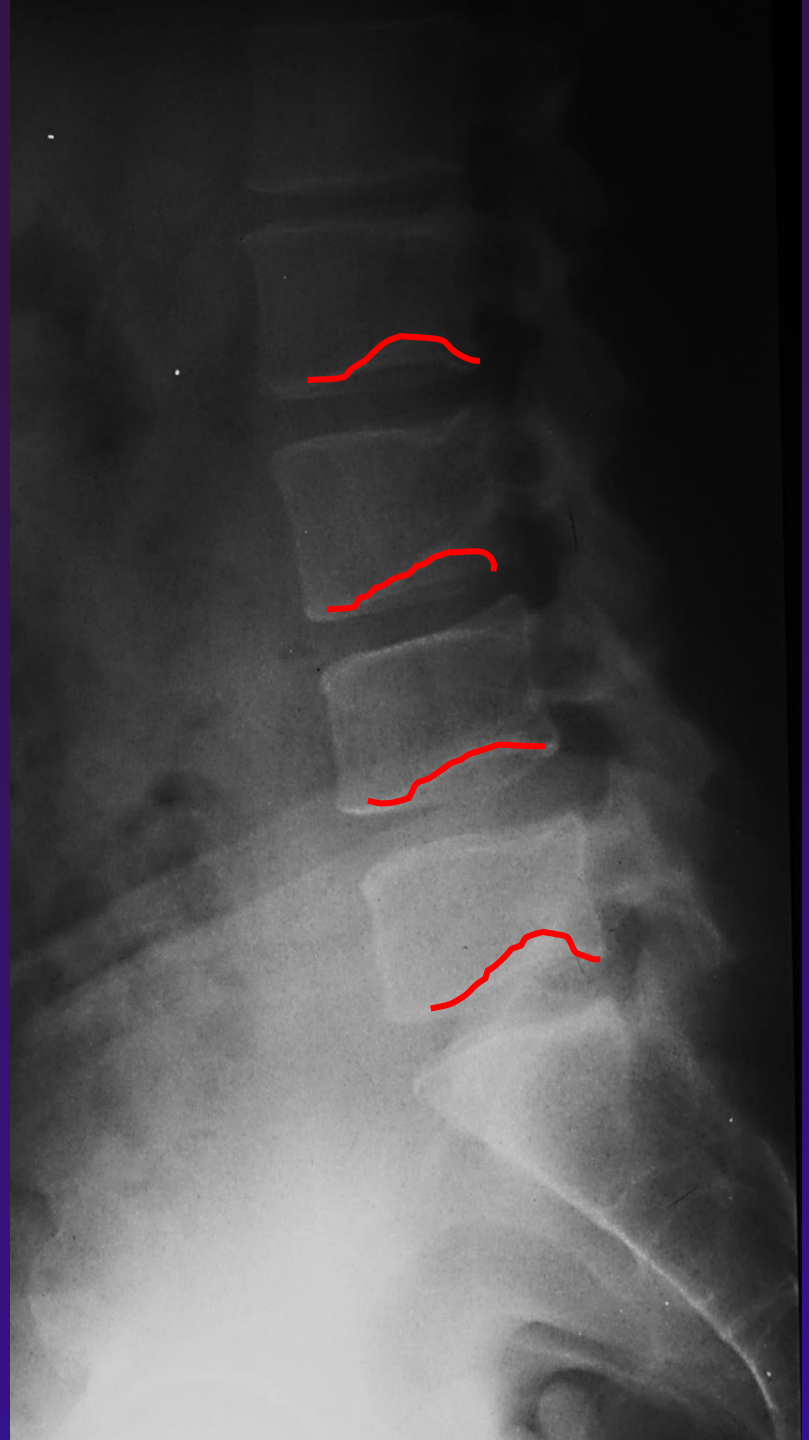


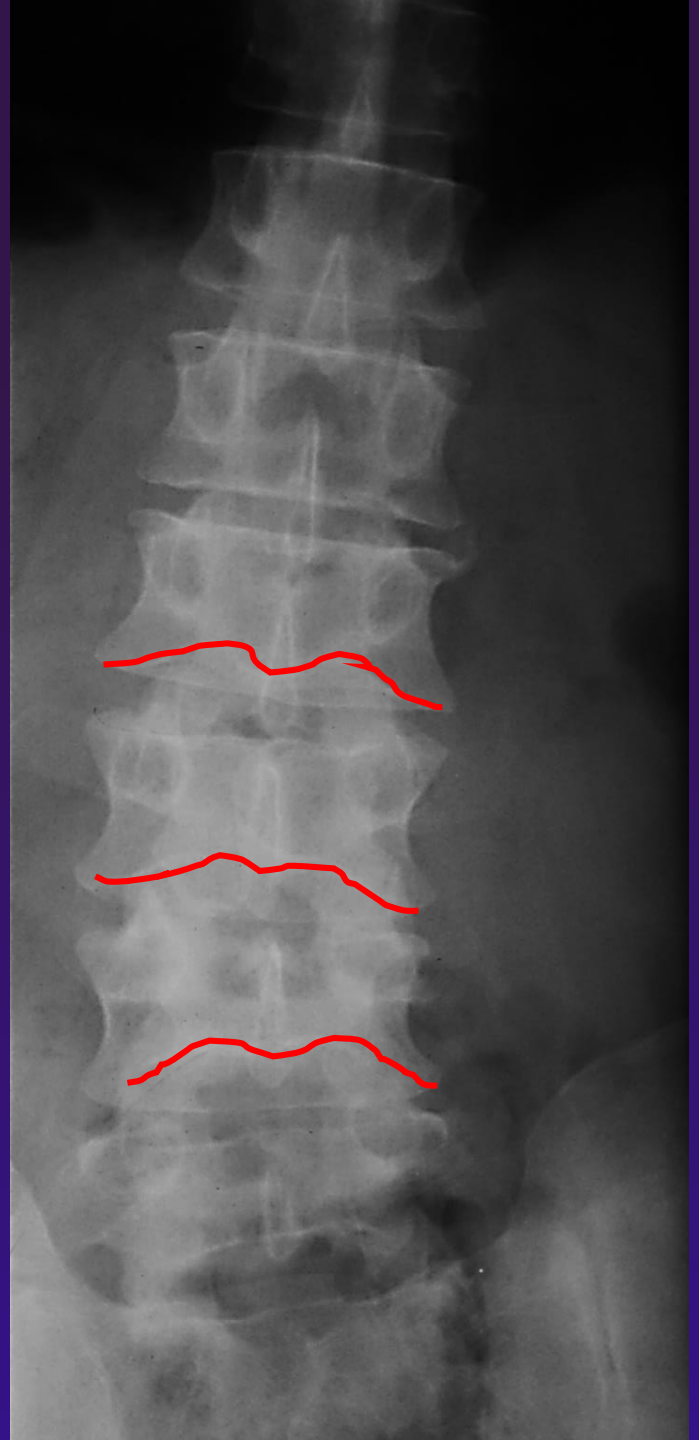




Unfused secondary ossification centers

- Oppenheimer's ossicle
  - Caused by nonunion and **not** fracture.
    - Usually unilateral
    - Most common location is the lumbar spine (L2).
    - Much more common in males
    - Of no clinical significance

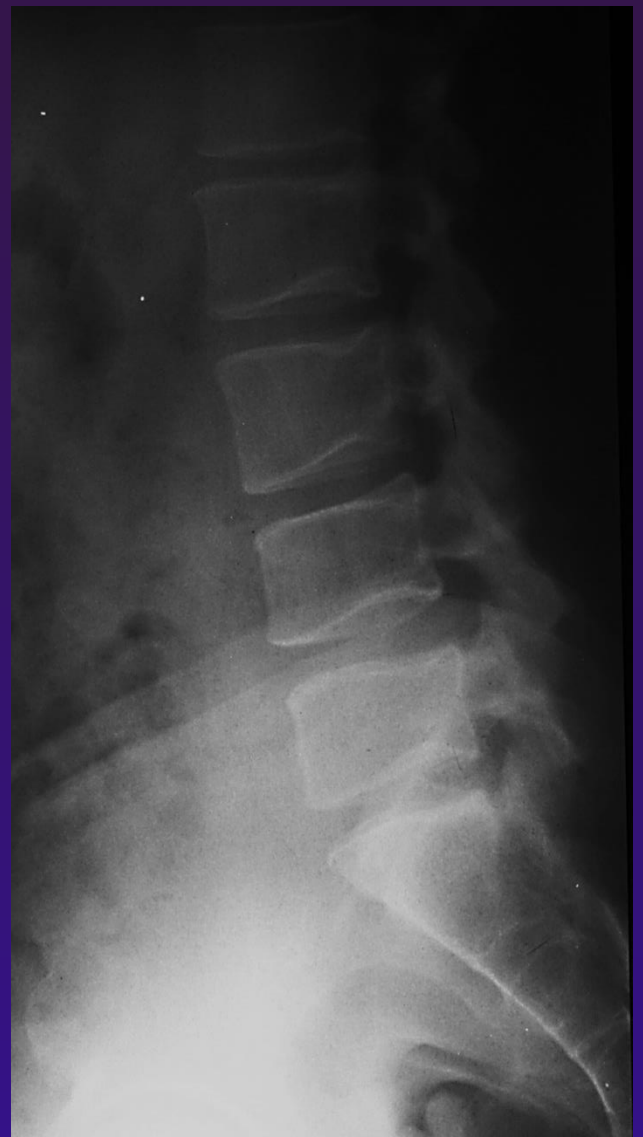


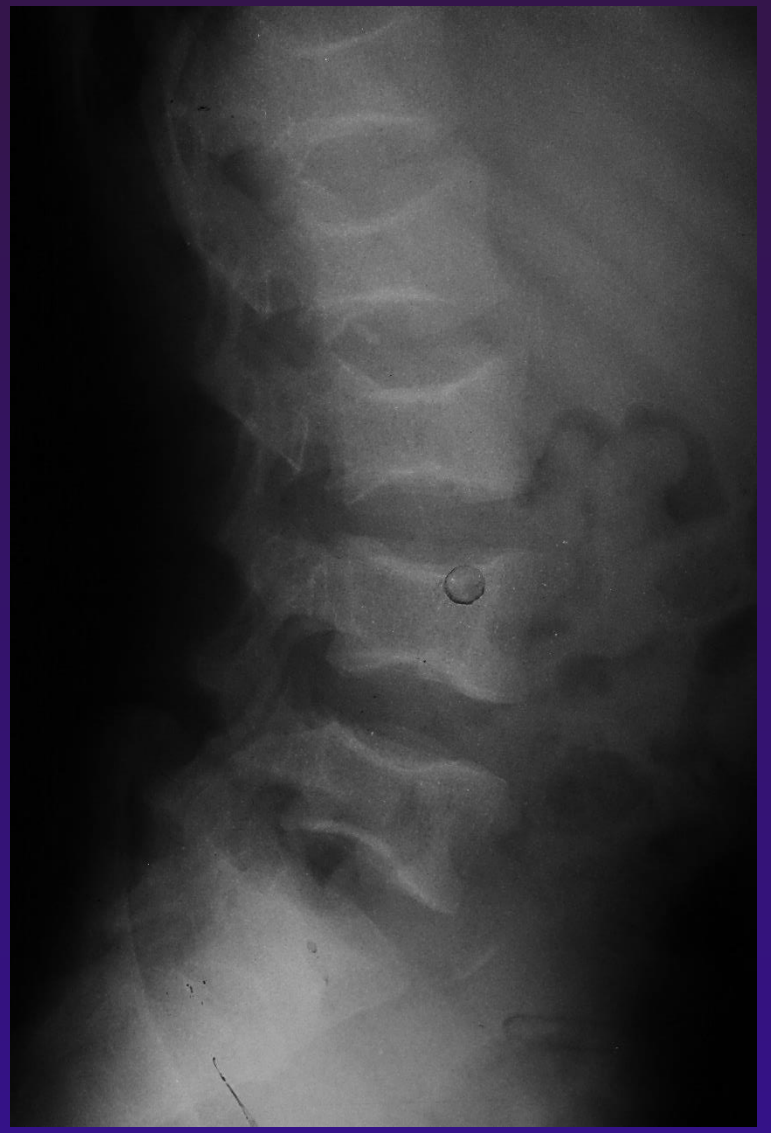


Persistent notochordal defects

- Also called “nuclear impressions”
  - Bilateral, para sagittal depressions giving the “cupids bow” appearance
  - Usually in the posterior 3rd of the endplate, smooth indentation
  - Of no clinical significance

Persistent notochordal defect vs SSA

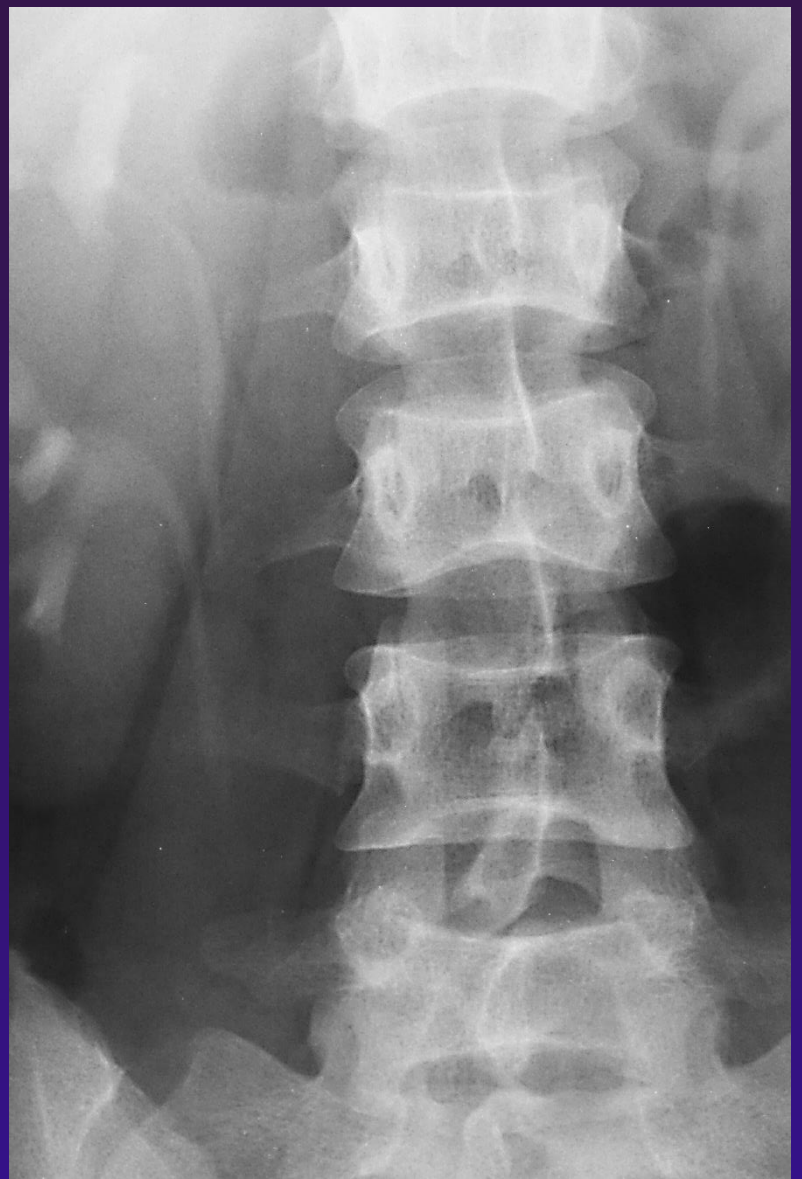


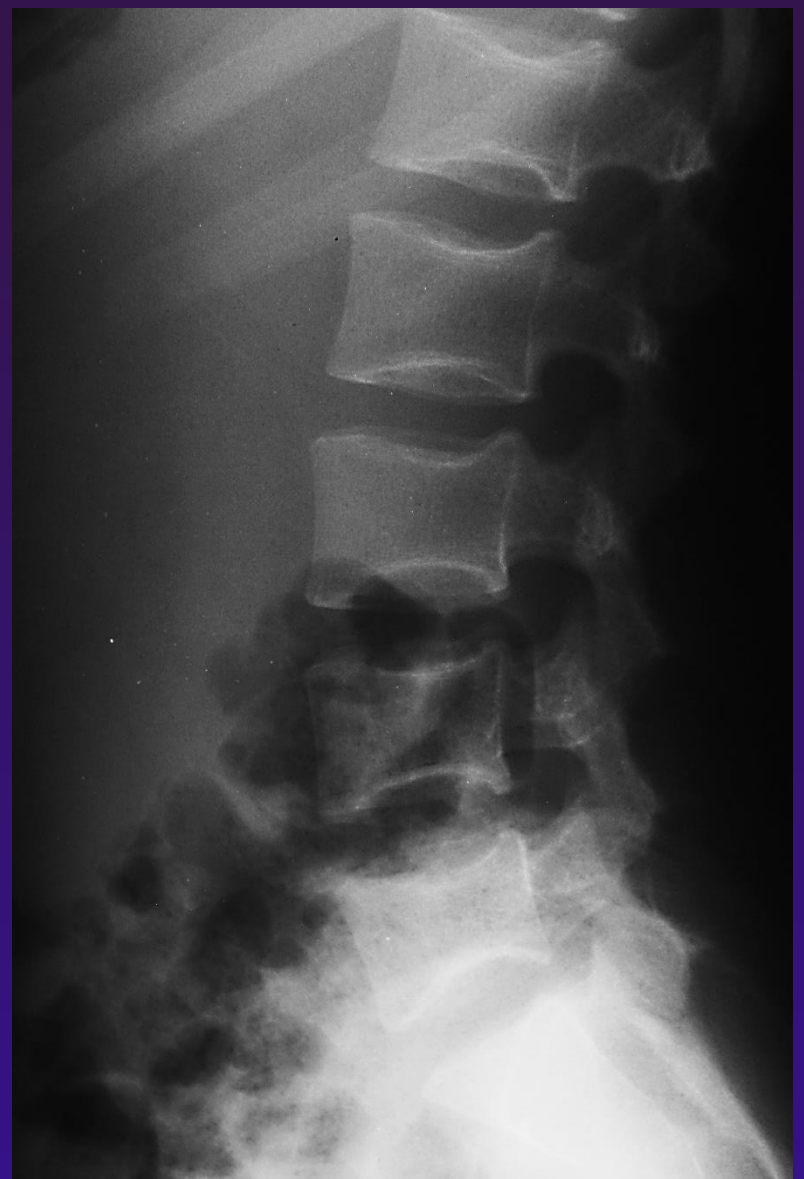


Sickle-cell anemia

- Produces “H-shaped” vertebrae
  - Probably due to infarction of the nutrient artery resulting in central depression of the endplates in height
  - Should be bone infarctions elsewhere
  - Also see osteomyelitis, infarcts within the soft tissues (spleen).

Sickle Cell Anemia





65 y.o. male

- Long history of back pain
- Sx (arthrodesis) 7 yrs ago
- Low back pain coming back