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
  • Diastematomyelia
  • Meningocele/myelomeningocele
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 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
Cervical Rib

Case courtesy of Dr Gagandeep Singh, Radiopaedia.org, rID: 7262
Case courtesy of Dr Ruslan Esedov, Radiopaedia.org, rID: 7518
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