Pediatric Spinal Anomalies

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1. Primitive streak
2. Proliferation of cells at primitive pit (Hensen's node)
3. Cells enter pit & migrate cephalad to form notochordal process
4. Notochord induces overlying neural plate
Formation of the Spinal Cord

- Neurulation
- Canalization & retrogressive differentiation
Formation of the Vertebral Column

- Membrane development
- Chondrification
- Ossification
Normal Pediatric Spine
Stage I: Birth to 1 Month

Cartilage
Ossified vertebra
Disk

Vertebra
Disk

T1-weighted image
T2-weighted image
Normal Pediatric Spine
Stage II: 1 Month to 6 Months

- Disk
- Vertebra

T1-weighted image

Vertebra

Disk

T2-weighted image
Spine Anomalies

Embryogenesis

Split Notochord from endoderm-ectoderm adhesion

Premature Dysjunction

Non-Dysjunction

Neural plate

Neural crest
Cutaneous ectoderm
Neural ectoderm
Notochord

Formation of neural folds & groove

Neurulation

Dysjunction
Anomalies of Notochord Formation

Adhesion between endoderm & ectoderm splits notochord

- Diastematomyelia
- Split notochord syndrome
  - Dorsal enteric anomalies
    - (fistula, sinus, cyst)
Dorsal Enteric Cyst
Spine Development

Premature Dysjunction

Lipomyelo-meningocele

Lipomyelocele

Intradural lipoma
Anomalies of Premature Dysjunction

Intradural Lipoma

Lipomyelocele
Spine Development

Non-Dysjunction

- Myeloele
- Myelomeningocele
- Dorsal dermal sinus
- Hemimyelocele
- Chiari II
History: Newborn male with a mass on the lower back
Myelomeningocele
Postoperative myelomeningocele with clinical deterioration

- Postop hematoma
- Postop infection
- Residual or recurrent tumor
- Cord ischemia/infarction
- Myelomalacia
- Arachnoid cyst
- Diastematomyelia
- Syringohydromyelia
- Cord retethering
Dorsal Dermal Sinus

- A disorder of nondysjunction
- Dorsal opening in a hyperpigmented patch or a hairy nevus
- Terminates in spinal canal
  - (extradural or intradural)
- Associated with epidermoid or dermoid in 50%
- May have spina bifida
- History of meningitis
Dorsal dermal sinus with dermoid/epidermoid tumor
History: 9 y/o boy with a lumbar nevus & brisk leg reflexes
Lumbar nevus
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Dx: Dorsal dermal sinus with an intradural epidermoid
Hemimyelocele
History: One day old boy born with an occipital mass
Dx: Chiari III - occipital meningoencephalocele - small posterior fossa - low tonsils, culpocephaly - scalloped clivus, beaked tectum - stenogyria
Lower Spine Development

- **Canalization**
  - Caudal cell mass forms
  - Microcysts coalesce to form neural tube

- **Retrogressive Differentiation**
  - Neural tube decreases in size
  - Neural tube forms caudal conus medullaris & filum terminale
Spine Development
Caudal Cell Mass Anomalies

- Fibrolipomas of filum terminale
- Tight filum terminale syndrome
- Caudal regression
- Anterior sacral meningoceles
- Sacrococcygeal teratomas
Fibrolipoma of the Filum Terminale
Congenital scoliosis secondary to tethered cord
Spinal Dysraphism

Critical Neural Features

- Position of conus
- Location of neural placode
- Fibromuscular tethering bands
- Ventral & dorsal nerve roots
- Hydrosyringomyelia
Tethered Spinal Cord

Associated Anomalies

- Myelomeningocele
- Lipomyeloschisis
- Diastematomyelia
- Dorsal dermal sinus
- Caudal regression
Caudal Regression Syndrome
Sacrococcygeal Teratoma
Spinal Anomalies of Unknown Origin

- Myelocystocele
- Simple meningoceles
- Lateral meningoceles
- Syringohydromyelia
Myelocystocele
History: 67 y/o male with NF1
Dx: Meningocele
Postoperative Myelocystocele
Syringohydromyelia

Etiology

Chiari I: 42%
Post-Traumatic: 28%
Neoplastic: 15%
Idiopathic: 15%
Chiari I with Syringohydromyelia
History: 22 y/o male with brain stem dysfunction

Dx: Chiari I malformation with syringohydromyelia
History: 45 y.o. male with a progressive myelopathy
Spinal Cord Cysts

Evidence for Benign Syrinx

- Fluid isointense to CSF
- Smooth, well-defined internal margins
- Thinned adjacent parenchyma
- Cord atrophy
- No contrast enhancement
- Presence of Chiari malformation