Problem 6.02

Spina Bifida

- ↓Folate
- Teratogenic Drugs
- Congenital

Embryonic Neural Tube Fails to Close
- 1st 4 Weeks

Neural Tube Defect

Anterior Neuropore
- Closes day 24
- Brainstem, Cortex

Posterior Neuropore
- Closes day 28
- Lumbosacral

Anencephaly
- 1:1000
- Absence of calvaria, meninges, brain
- May survice for short time as brainstem intact (breathe, heart)

Spina Bifida
- Defect of Vertebrae
- Usually Lumbusacral

Spina Bifada Occulta
- Open vertebral arch
- Asymptomatic
- Usually L5 or S1

Lumbar X-Ray
- "Scottie Dog"
- Oblique view

At Site May Have
- Dimple
- Mole (Naevus)
- Hair

Spina Bifada Cystica

Meningocoele
- Dura & arachnoid protrude
- Spinal cord intact
- >1 vertebrae effected
- Fluid Ffilled sac
- 1 per 50,000 births
- Usually occurs @ weeks 5-12

Myelomenongocoele
- Meninges, & spinal cord protrude
- 1:2,000 births
- Usually occurs @ week 4

Malformation of vertebral column from Mesoderm

Spinal cord fused to vertebrae at site of lesion (Tethering)

Spinal Cord Growth Slower than Vertebral Column

Spinal cord "Pulled Caudally"

Lesion Exposed to Exterior of body

Infections
- Meningitis
- Encephalitis

CNS Damage From
- Amniotic Fluid
- Movement in Utero
- Birth

Neurological defecit

LMN Lesion
- Lower Limb
- Bladder
- Bowel

CSF Leaks into Amniotic Sac

Serum α Fetoprotein

↓ CSF Pressure

↓ Skull Growth
↓ CNS development

Posterior Fossa doesn't Develop Fully
- Requires pressure to shape

Compression of Brainstem through Foramen Magnum

CNS changes

4th Ventricle Compressed

CSF Flow Out of 4th Ventricle Blocked
- Lateral Aperture (foramen of Lushka)
- Median Aperture (foramen of Magendi)

↑ICP

Dilated Ventricles

Communicating Hydrocephalus
- CSF can move through ventricles
- CSF cannot get to subarachnoid space
- Caused by CSF production or viscosity or thickened meninges w arachnoid granulations involved

Obstructive Hydrocephalus
- Blocked ventricles

- Tumours
- Aqueduct stenosis
- Chiari malformation
- Dandy Walker (atresis of formamina of Lushka & Magendie)

- "Full" fontanelles
- Seperation of cranial sutures

DEATH

Head Expansion
- Non fused Sutures

Thinned Cerebral Cortex

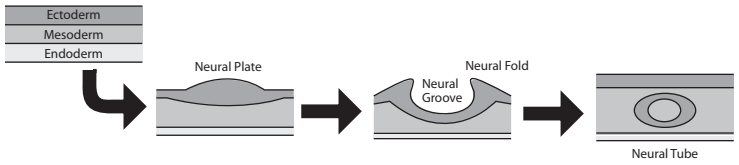
↑ Head Circumference

Morula

Gastrulation
- Produces 3 germ layers
  - Mesoderm
  - Endoderm
  - Ectoderm

1° Neuralation
- Elevation, folding & fusion of the neural folds into Neural tube
- From the cerbral cortex to S2

2° Neuralation
- Neural tissue below S2 grows as a solid mass
- Neural tube extends into this mass



Holoprosencephaly
- "Face predicts the brain"

Brain Embryology
- Neural tube has 5 divisions
1. Telencehoalon → cerbreal hemishperes
2. Diencephalon → thalaums, hypothalamus, epithalamus
3. Mesencephalon → midbrain
4. Metencehpalon → pons & cerebellum
5. Myelencephalon → medulla

- 2 weeks neural tube forms
- 4 weeks fully closed
- 5-12 weeks vertebral column formed

CSF Circulation

Choroid Plexus
- Modified epididymal cells
- 80% of CSF production
- Located in all ventricles

Non-Choroidal Capillaries (CNS)
- 20% CSF production

CSF
- Clear, colorless
- Plasma ultrafiltrate
  - Same osmolarity
  - ↑ Mg, Cl
  - ↓ glucose, Ca, protein
- 500 ml/day
- Production constant over a range of pressures (autoregulation)

Lateral Ventricles

Foramen of Munro

3rd Ventricle

Cerebral Aqueduct

4th Ventricle

Foramen of Lushka/Magendie

Subarachnoid Space

Cisterns

Arachnoid Granulations
- Arachnoid vili accumulations
- Unilateral valves

Venous System

Arnold Chiari Malformation
- 4 types exist (I, II, III, IV)
- Type II
  - Hindbrain anomaly
  - Usually associated w myelomeningocoele
  - Downward displacement of medulla, 4th ventricle & cerebellum into cervical canal
  - Elongation of the pons & 4th ventricle probably due to small posterior cranial fossa
  - Normal sized cerebellum trying to grow in small posterior cranial fossa