Pediatric Neurological Alterations

- HYDROCEPHALUS
- SEIZURES
- SPINA BIFIDAS
- MENINGITIS
- CEREBRAL PALSY

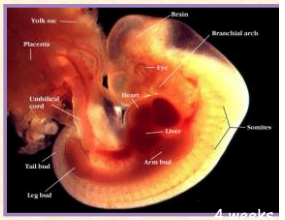
N124
L. Thompson MSN, RN

EMBRYOLOGY OF THE Central Nervous System

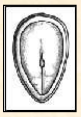
PRE-EMBRYONIC PERIOD
- *1ST 2 weeks
- *3 layers

EMBRYONIC PERIOD
- * 3th- 8th week
- * Neural tube

FETAL PERIOD
- * 9th- 40th week
- *Myelination



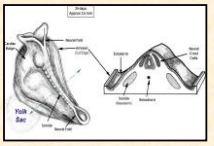
Central Nervous System Neural Tube Disorders



16 days

20 days

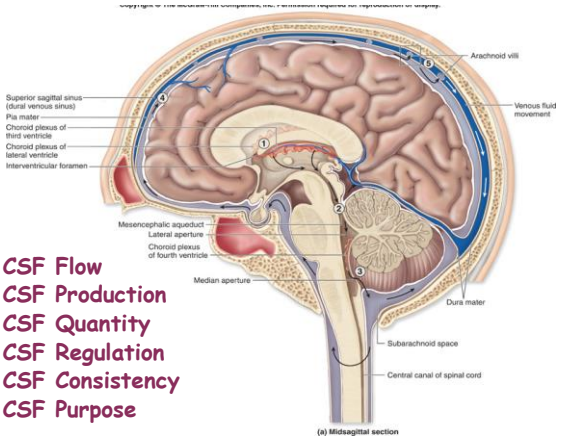
22 days



24 days

- Incidence decreased in recent years
- Conditions that increase the risk

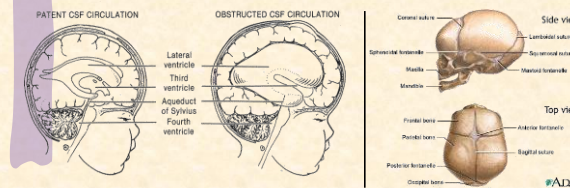
Hydrocephalus



CSF Flow
CSF Production
CSF Quantity
CSF Regulation
CSF Consistency
CSF Purpose

HYDROCEPHALUS

- DEFINITION: *Abnormal Accumulation caused by?*
  - S/S if sutures/fontanelles are open
  - S/S if sutures/fontanelles are closed



Incidence and Forms of Hydrocephalus

- 1-2 in 1000 live births
- 3-4 in 1000 hydrocephalus w/Spina Bifida
- Outcome: Varies with complications
  - Normal Lifespan & Intelligence
  - Learning Disabilities

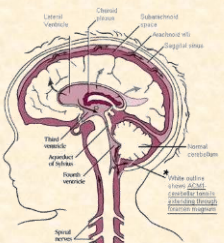
FORMS

- COMMUNICATING
  - IMPAIRED ABSORPTION
  - OVERPRODUCTION (rare)
- NONCOMMUNICATING
  - OBSTRUCTION (99%)

HYDROCEPHALUS
ETIOLOGY

Causes of Imbalance:

- **Congenital**
  - Arnold-Chiari Malformations
  - Dandy Walker Cyst
  - Arachnoid cysts or tumors
  - Aqueductal stenosis
- **Acquired**
  - Neoplasm
  - Hemorrhage
  - Infection
- **Unknown Etiology**



HYDROCEPHALUS
Clinical Manisfestations

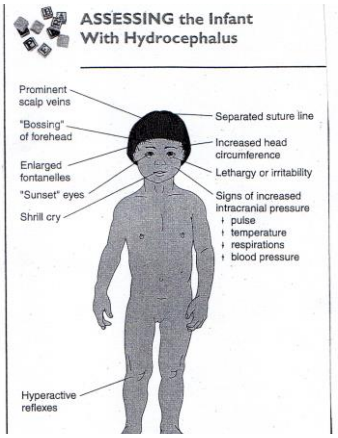
Infant to 2 yrs

Early Signs

- Irritability
- Poor feeding
- Bulging fontanels
- Widened sutures
- Rapid head growth
- Incr. Tone (hyperreflexia)

Late Signs

- Bossing
- Setting-sun sign
- Vomiting, lethargy
- Shrill, high pitched cry
- Vital Signs
- Sluggish or unequal pupils



HYDROCEPHALUS
Clinical Manisfestations

- **Children >2 yrs.**

Early Signs
- S/S of Incr. ICP
  - Headache (frontal)
  - Vomiting, ataxia, irritability
- Altered LOC
- Strabismus

Late Signs
- Seizures
- Vital Signs
- Decerebrate rigidity
- Blindness from herniation

HYDROCEPHALUS
Diagnostic Evaluation

- Serial Measurements
- Serial Transilluminations
- CT Scan
- MRI
- Lumbar Puncture
- EEG (electroencephalography)
- Glasgow Coma Scale
- Labs:
  - ABG, lytes, CBC

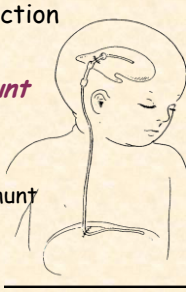
HYDROCEPHALUS
Therapeutic Management

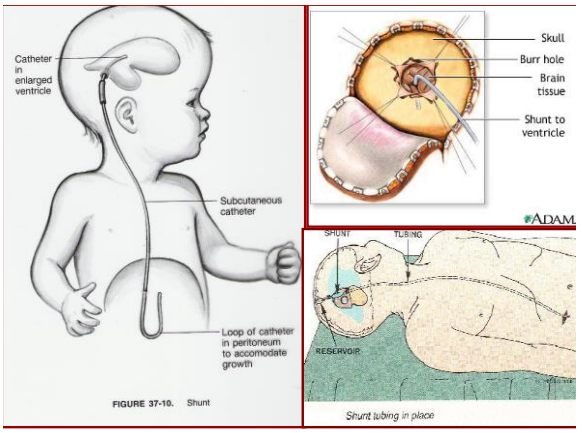
- Surgical removal of obstruction

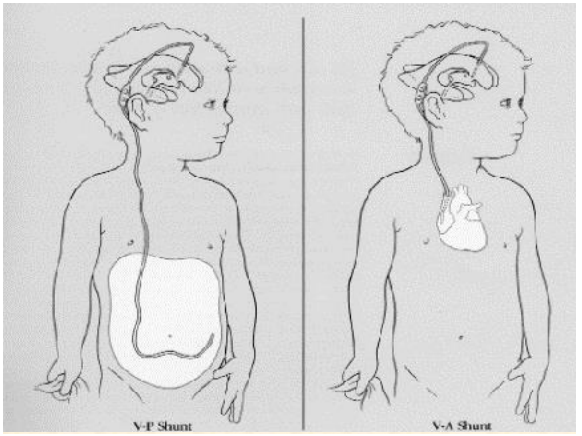
OR

- Create a new pathway: ***Shunt***

- SHUNTS
  - Ventriculoperitoneal (VP) Shunt
  - Ventriculoatrial (VA) Shunt







Nursing Management
Pre-op Shunt Placement

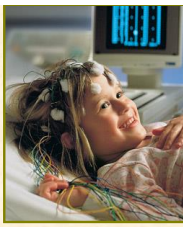
- **Assessment & Management**
  - Measure head circumference
  - VS, assess resp. pattern
  - Seizure Precautions
  - Support heavy head
  - Skin care

Nursing Management
Post-op Shunt Placement

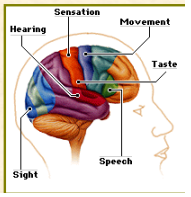
- **Positioning**
  - Flat initially, or as ordered
  - On unaffected side
- **Monitor for:**
  - Infection
  - Pain
  - Increased ICP
    - VS
    - Head Circumference
    - LOC
    - Fontanels & Sutures
    - Feedings

Seizures

- Excessive abnormal discharge of neurons
- Classifications
  - **Generalized**
    - Entire brain
    - Alters consciousness
  - **Partial (focal)**
    - Occurs in a focal area
    - May or may not alter consciousness
    - Simple Partial
    - Complex Partial



EEG



Nursing Management
Seizures

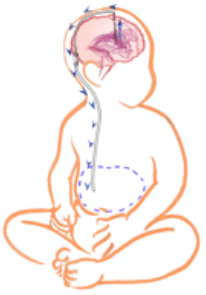
- **Protect from Injury**
- **Keep airway open**
  - O2 if necessary
- **Observe and record**
  - Preictal, Ictal, Postictal
- **Provide client and family teaching**
  - Care during seizure
  - Drug Therapy
  - Medic-Alert ID

HYDROCEPHALUS
Parent Teaching

- Assess current knowledge
- Shunt Revision
- Expected Development
- Infection
  - Post-Op
    - Wound Care
    - Pump Site
  - S/S of ?
- Obstruction
  - S/S of ?

HYDROCEPHALUS
Parent Teaching

- Diet
  - fruit, vegetables, cereals, fluids
- Position
  - HOB slightly elevated
- Safety
  - Use of helmet for tricycle riding
- Support Groups



The End

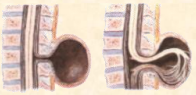
Pediatric Neurologic Alterations

Spina Bifida

Spina Bifida

- SPINA BIFIDA OCCULTA

- MENINGOCELE



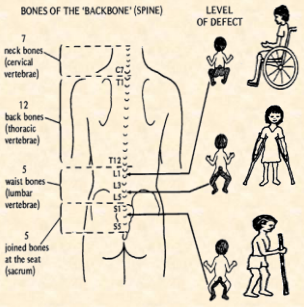
- MYELOMENINGOCELE

Spina Bifida
Etiology & Incidence

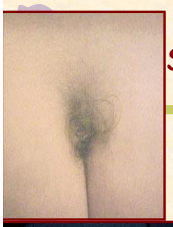
Discovering Spina Bifida

- 1 in 4,000 (myelomeningocele)
- Actual etiology unknown
- Increased incidence
  - Maternal folic acid deficiency
  - Sibling w/neural tube defect
  - Environmental factors
    - Chemicals
    - Medications

Spina Bifida
Pathophysiology



- CNS Defect @ 4th wk
- Degree of Impairment
  - ≥T12: Flaccid LE
    - ↓Sensation
    - Incontinence
  - ≤L2: 90% of cases
    - Varying ortho problems
  - ≤S3: No motor impairment



SPINA BIFIDA OCCULTA

- L5-S1 w/ failure to fully close
- No sensory/motor involvement possible
- Clinical Manifestations
  - Dimple
  - Hair tuft
  - Hemangioma
  - Lipoma

Spina Bifida Cystica
Meningocele / Myelomeningocele

- Meningocele
  - Sac like protusion
  - Meninges & CSF
  - Translucent or Membranous
  - Least common

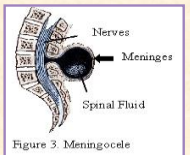
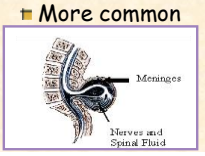


Figure 3. Meningocele

- Myelomeningocele
  - Herniation
  - Meninges, CSF, Spinal Nerves
  - Poorly covered
  - More common



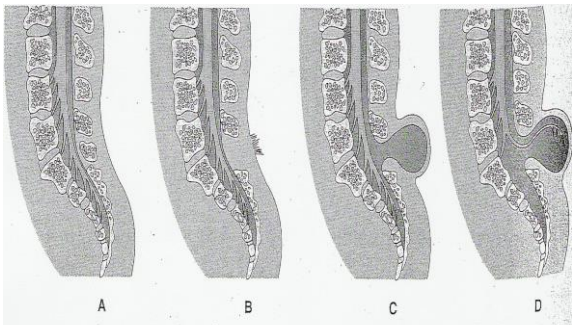


FIGURE 39.12 Degrees of spinal cord anomalies. (A) Normal spinal cord. (B) Spina bifida occulta. (C) Meningocele. (D) Myelomeningocele.

Other Neural Tube Defects

- Anencephaly
  - Upper end of neural tube fails to close
  - Absence of cerebral hemispheres
  - Will not survive

Spina Bifida
DIAGNOSTIC EVALUATION

- **PRENATAL EVALUATION:**
  - AFP (alpha-fetoprotein)
    - 16-18 weeks of gestation
- **If AFP screen is elevated:**
  - Amniocentesis
  - Fetal ultrasound
- **POSTNATAL EVALUATION:**
  - CT scan
  - Myelography
  - Neurological evaluation

Spina Bifida
Therapeutic Management

- **Surgical Repair**
  - Perinatal
    - 19-25 wks gestation
  - Postnatal
    - 24-48 hrs following birth
  - Benefits vs. Risks
- **Lifelong Management…Collaboration!**
  - Neurologic
    - Shunt revisions
  - Orthopedic
    - Braces, surgery, PT
  - Urinary
    - Bladder emptying program

Spina Bifida
Major Problems of Myelomeningocele

- Infection of Sac (at birth)
- Hydrocephalus
- Bowel and Bladder Dysfunction
- Risk for latex allergy- 18-40%
- Paralysis / Sensory Loss

Spina Bifida
Nursing Management

- **Protect the Sac (pre-op & post-op)**
  - Positioning
  - Dressings
- **Provide adequate nutrition**
- **Prevent Complications**
  - Observe for S/S of ?
- **Promote Mobility**

Spina Bifida
Nursing Management

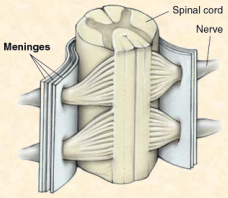
- **Teaching and Discharge Planning**
  - Wound Care
  - S/S of Complications
  - Medication Regimen
  - Physical Therapy
  - Weight control
  - Elimination
  - Sensory stimulation
- **Emotional Support**
  - Support Groups

Spina Bifida
Nursing Diagnoses

- **Risk for Infection**
  - r/t rupture or bacterial invasion of the neural tube sac
- **Constipation**
  - r/t sensory deficit or immobility
- **Risk for Imbalanced Nutrition, less than body requirements**
  - r/t difficulty assuming feeding position

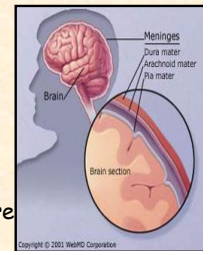
Neurological Alterations

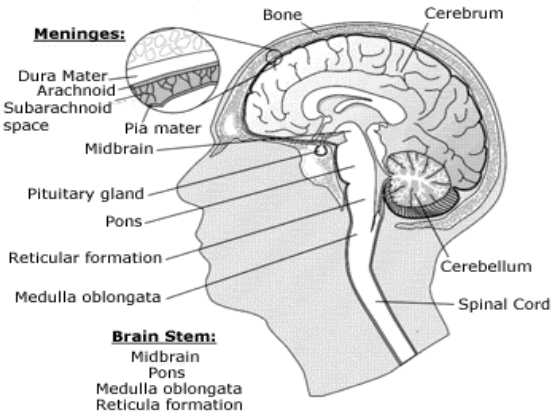
Meningitis



Meningitis

- Inflammation of the meninges caused by:
  - **Primary disease**
    - Bacterial
    - Viral
  - **Secondary complication**
    - Trauma to brain
    - Systemic Infection
    - After surgery / procedure





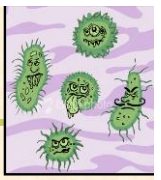
Meningitis Pathophysiology

- **Pathogen enters the CNS**
- **Causes inflammatory response**
  - ↑Intracranial pressure
  - Subdural empyema
  - Potential spread to ventricles
- ***Remember* CSF contains glucose & protein**
  - Leukocytes ineffective
  - Bacteria can multiply quickly!

Meningitis Incidence

- 1 month - 5 yrs.
- Immunosuppressed
- VP shunt
- Crowded living conditions
  - Day Care
  - College Dormitories
- Boys > Girls
- Decrease incidence since HIB vaccine

Meningitis Etiology



- **Bacterial**
  - **AGES 2-12 YEARS**
    - Haemophilus influenzae type B (Hib)
    - Neisseria meningitidis (meningococcal)
    - Streptococcus pneumoniae
  - **NEWBORNS**
    - Group B Strep
    - Escherichia coli
- **Viral (aseptic)**
  - Enterovirus (80%)
  - Herpes virus
  - Mumps
  - Paramyxoviruses

Meningitis
Etiology

- **Secondary to other infections**
  - Otitis Media
  - Pharyngitis
  - Pneumonia
  - Tuberculosis
  - Septic arthritis
- **Secondary to brain trauma** (penetrating)
- **Secondary to a neurosurgical procedure**
  - VP shunts
  - LP
  - Cochlear Implants

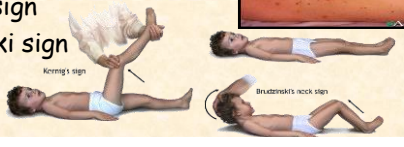
Meningitis
Clinical Manifestations

Symptoms vary & depend on:
***age *pathogen *length of illness**

- **Infant**
  - Poor feeding
  - Fever
  - Vomiting/diarrhea
  - Irritability
  - Lethargy
  - Seizures
  - S/S of ↑ ICP
    - High-pitched cry
    - Bulging fontanels
- **Child/Adolescent**
  - Severe Headache
  - Photophobia
  - Fever
  - Vomiting/diarrhea
  - Altered LOC (headache)
  - Joint pain
  - Seizures (rare in viral)
  - Other symptoms r/t Meningeal irritation →

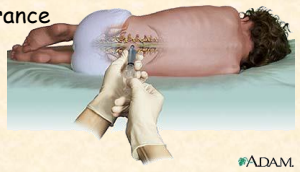
Bacterial Meningitis
Other Clinical Manifestations r/t Meningeal irritation

- Nuchal rigidity
- Opisthotonic position
- Hemorrhagic Rash
- Kernig's sign
- Brudzinski sign



Meningitis
Diagnostic Evaluation

- **History & Clinical Presentation**
- **Lumbar Puncture to evaluate for:**
  - ↑ Pressure
  - Cloudy appearance
  - Culture
    - ↑ Protein
    - ↓Glucose
    - WBC
- **Labs**
  - Culture blood, pharynx, urine



Bacterial Meningitis
Therapeutic Management

- **Bacterial Meningitis** (Medical Emergency!)
  - **Isolation** until 24 hrs of antibiotic tx (*droplet*)
  - **IV Antibiotics**
    - Initiate before pathogen identified
    - IM injection if unable to gain IV access
    - Antibiotics may change after pathogen ID
  - **Corticosteroids**
    - Reduce risk of neurologic sequelae
  - **If increased ICP is present**
    - Mannitol
    - High-dose barbiturates

Viral Meningitis
Therapeutic Management

- **Symptomatic and supportive**
  - Acetaminophen
  - Keep room dark and quiet
  - Ensure hydration (PO or IV)
  - Keep parents informed and educated
  - Teaching for home care

Meningitis
Nursing Interventions

- **Prevention**
  - Immunization
  - Risk evaluation
- **Early Recognition**
  - *Assessment*
    - Physiologic status, VS
    - Neurological assessment
    - Head circumference
- **Treatment**
  - During treatment, be alert to changes

Meningitis
Nursing Diagnosis

- **Risk for Aspiration** r/t ?
- **Risk for Fluid Volume Deficit** r/t ?
- **Knowledge deficit** r/t ?
- **Caregiver role strain** r/t hospitalized child and other family responsibilites

Pediatric Neurologic Alterations

Cerebral Palsy

Neurologic Alterations
Cerebral Palsy

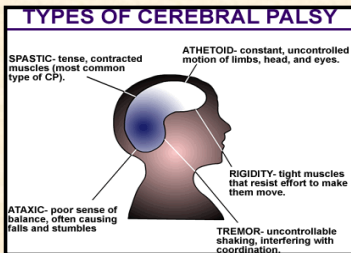
- Nonprogressive, chronic disorder of the upper motor neurons of the developing brain occurring:
  - Prenatal
  - Perinatal
  - Postnatal

Cerebral Palsy
Etiology & Incidence

- Unknown
- Associated with low birth weight & preterm infants.
- Theory:
  - Caused by congenital anoxia
  - Caused by intrauterine infection
- Most common chronic pediatric disorder (2-3/1000 births)

Types of Cerebral Palsy

- Type relates to location of brain injury
  - Dyskinetic or athetoid
  - Spastic
  - Ataxic
  - Mixed



Types of Cerebral Palsy

- **Dyskinetic or Athetoid**
  - Early hypotonicity
  - Later involuntary movement
    - choreoid (jerking)
    - dyskinetic
      (slow, writhing, purposeless weaving motions)

Types of Cerebral Palsy

- **Spastic (most common)**
  - Hypertonicity, abnormal clonus & reflexes

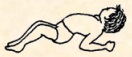
Types of Cerebral Palsy

- **Ataxic** mimics cerebellar disorders
  - Early hypotonicity
  - Coordination problems

To keep her balance the child with ataxia walks bent forward with feet wide apart. She takes irregular steps, like a sailor on a rough sea or someone who is drunk.

Types of Cerebral Palsy

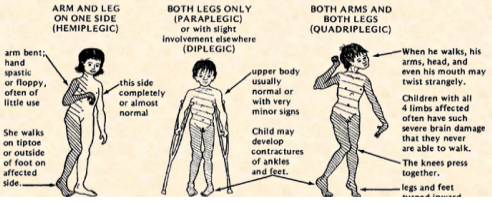
- **Mixed**
  - Spastic & Athetoid symptoms



Stiffness, with the knees bent or with legs separated, occurs more commonly in the child with spasticity and athetosis combined (see below).

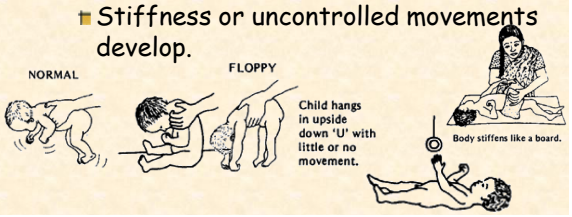
Types of Cerebral Palsy

- **Parts of the Body Affected**
  - Hemiplegia
  - Paraplegia or diplegia
  - Quadriplegia



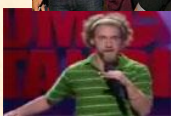
Cerebral Palsy
Assessment

- **Great variance in problems**
  - Assess motor behaviors
  - Babies are often limp or floppy
  - Stiffness or uncontrolled movements develop.



Cerebral Palsy
Assessment

- Seizures
- Intellectual function
- Sensory deficits
- Swallowing
- Nutrition
- Joint injuries



Cerebral Palsy
Diagnostic Evaluation

- History
- Signs & Symptoms
  - Developmental milestones
  - Abnormal positions
- EEG, CT, MRI
- Labs: Electrolytes
- Neurological exam

Cerebral Palsy
Treatment

By standing on her knees as she paints sign, this girl is improving her balance help her (possibly) stand and walk.

- **Maximize abilities**
- **Medication:**
  - Anticonvulsants
  - Control spasms - Skeletal muscle relaxants
    - Baclofen (PO or Intrathecal Pump) for severe spasticity in children
    - Benzodiazepines
  - Antiulcer (to minimize GI side effects)
    - Rantidine or cimetidine
  - Botox Treatment

Cerebral Palsy
Surgical Interventions

- G-tube placement
- Orthopedic surgery for hip & joint problems
- Dental work
- Foot surgery

Cerebral Palsy
It takes a Collaborative Team!

- Speech Therapy
- Special Education
- Occupational Therapy
- Physical Therapy
- Recreational Therapy
- Nutritional Management
- Gastroenterologist
- Pulmonologist
- Ophthalmologist

Success Story

- **Preemie** (33 weeks gest)
- **Hydrocephalus** (r/t grade 4 IVH)
- **Major Heart surgery** (2 days on ECMO)
- **Cerebral Palsy w/rt-sided hemiparesis (mild)**
- **Epilepsy**
- **VP Shunt** placed at 8 mo. (pic taken 6 mo. later)
- **Attends regular school** (ballet & swim lessons)
- **No cognitive impairment**

The End