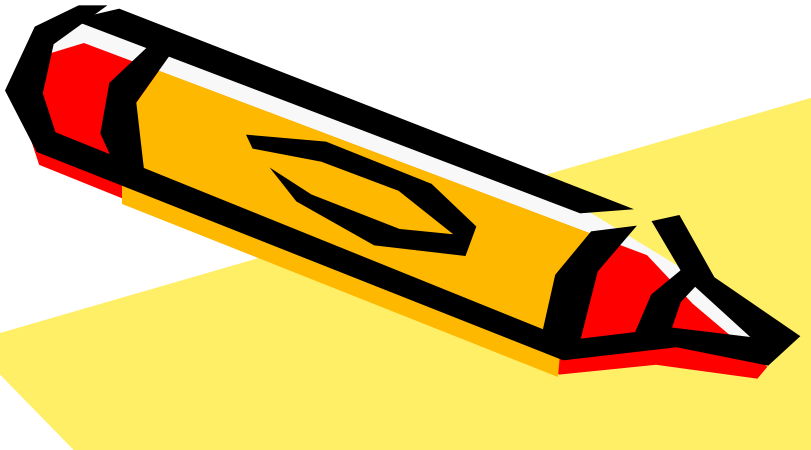
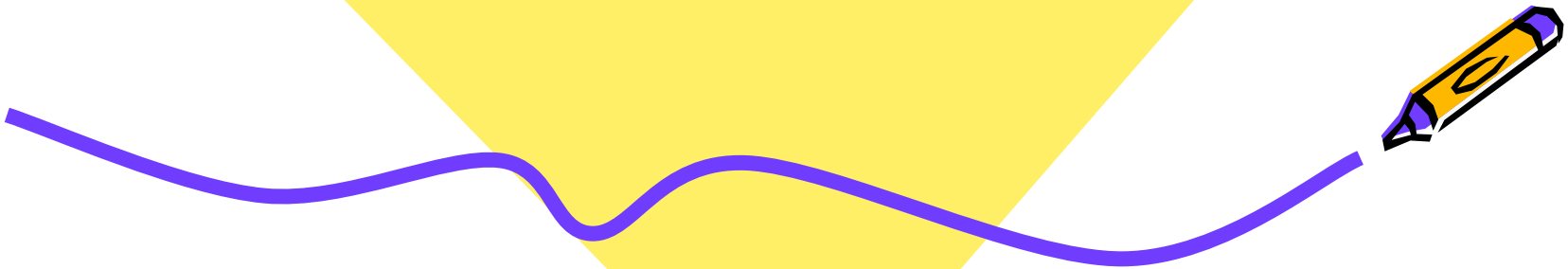
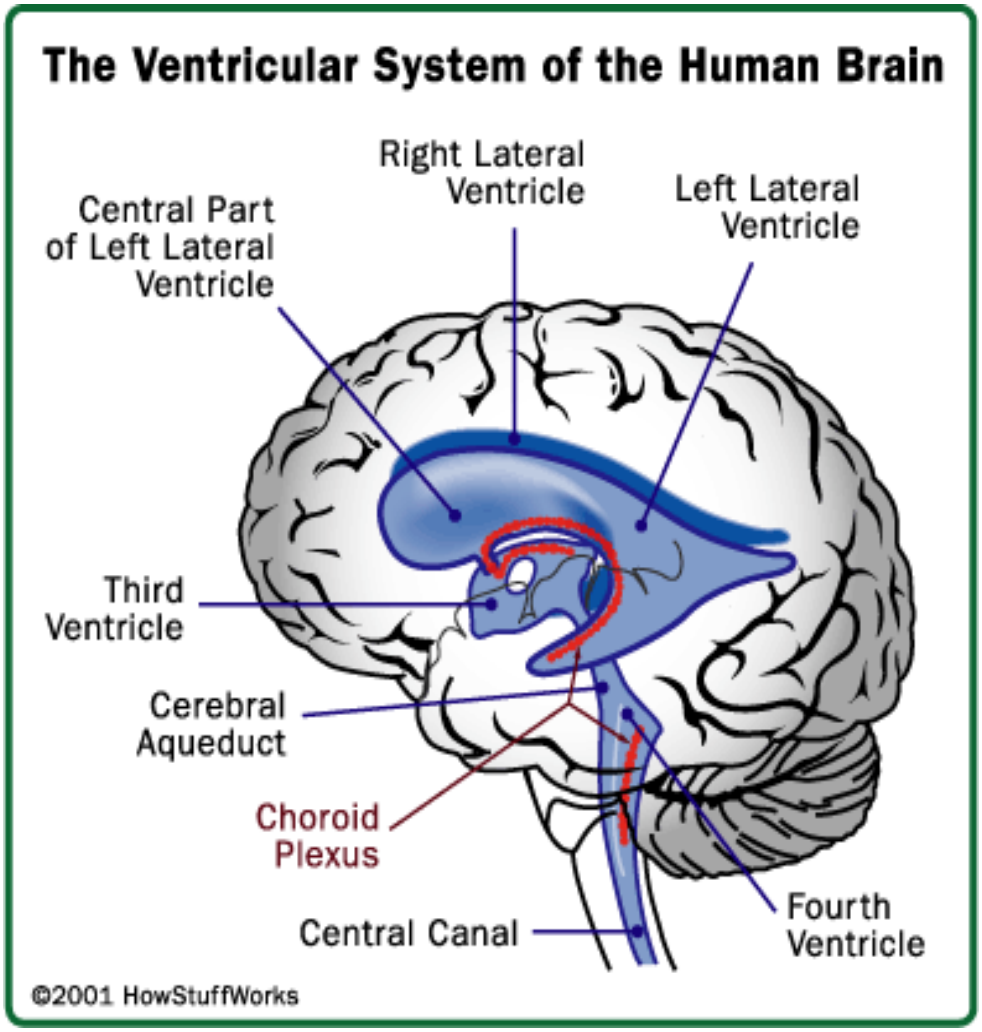


HYDROCEPHALUS



Hydrocephalus

- A syndrome, or sign, resulting from disturbances in the dynamics of cerebrospinal fluid (CSF), which may be caused by several diseases.


The Ventricular System of the Human Brain
Right Lateral Ventricle
Central Part of Left Lateral Ventricle
Left Lateral Ventricle
Third Ventricle
Cerebral Aqueduct
Choroid Plexus
Central Canal
Fourth Ventricle
©2001 HowStuffWorks

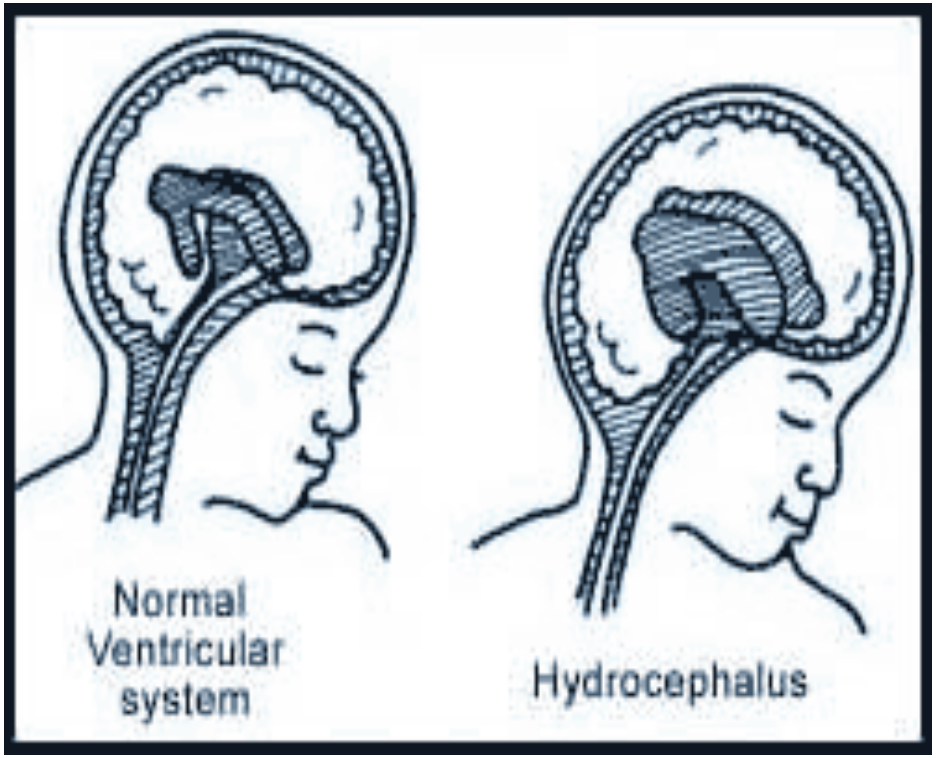
Incidence

- Occurs in 3-4 of every 1000 births.
- Cause may be congenital or acquired.
- Congenital- may be due to maldevelopment or intrauterine infection
- Acquired- may be due to infection, neoplasm or hemorrhage.

Pathophysiology

- CSF is formed by two mechanisms:
  - Secretion by the choroid plexus,
  - Lymphatic-like drainage by the extracellular fluid in brain.

CSF circulates thru ventricular system and is absorbed within subarachnoid spaces by unknown mechanism.


Normal
Ventricular
system
Hydrocephalus

Mechanisms of Fluid Imbalance

- Hydrocephalus results from:
- 1. Impaired absorption of CSF within the subarachnoid space (communicating hydrocephalus), or
- 2. Obstruction to the flow of CSF through the ventricular system (non-communicating hydrocephalus)

Mechanisms of fluid imbalance

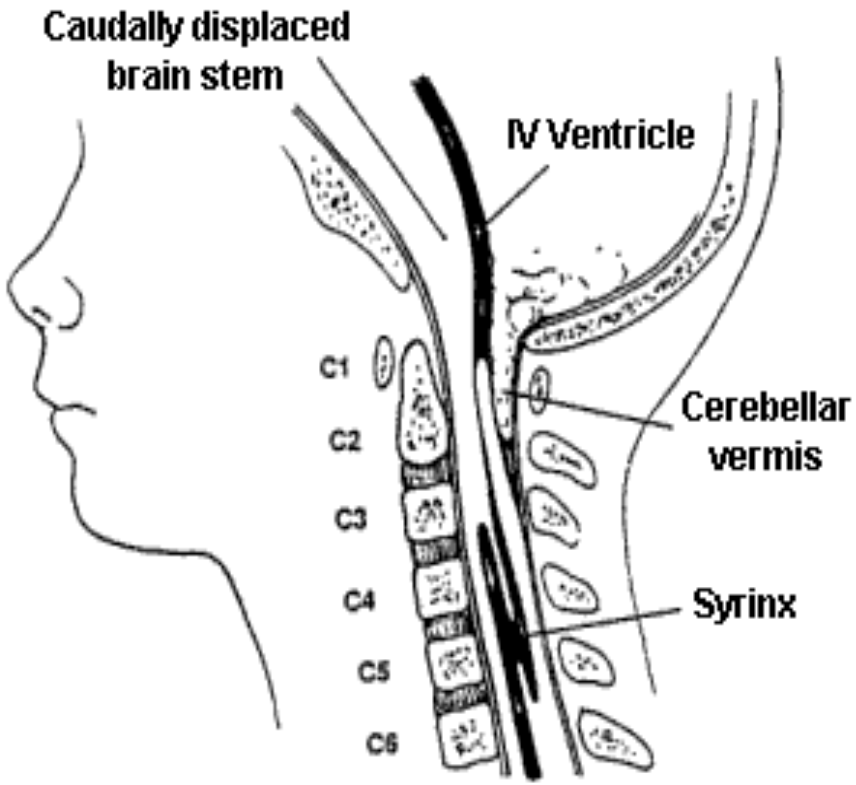
- Both lead to increase accumulation of CSF in the ventricles!
- Ventricles become dilated and compress the brain.
- When this happens before cranial sutures are closed, skull enlarges.
- In children <10-12, previously closed sutures may open.

Hydrocephalus

- Most cases of non-communicating (obstructive) hydrocephalus are a result of developmental malformations.
- Other causes: neoplasms, intrauterine infections, trauma.
- Developmental defects account for most causes of hydrocephalus from birth to 2 years of age.

Common Defects

- Arnold-Chiari Malformation (ACM)
  - Type 2 malformation of brain seen most exclusively with myelomeningocele, is characterized by herniation of a small cerebellum, medulla, pons, and fourth ventricle into the cervical spinal canal through an enlarged foramen magnum.


Caudally displaced
brain stem
IV Ventricle
C1
C2
C3
C4
C5
C6
Cerebellar
vermis
Syrinx

Clinical manifestations

- Clinical picture depends on acuity of onset and presence of preexisting structural lesions.

Infancy

- Head grows at alarming rate with hydrocephalus.
  - First signs- bulging of fontanels without head enlargement.
  - Tense, bulging, non-pulsatile anterior fontanel
  - Dilated scalp veins, esp. when crying
  - Thin skull bones with separated sutures (cracked pot sounds on percussion)

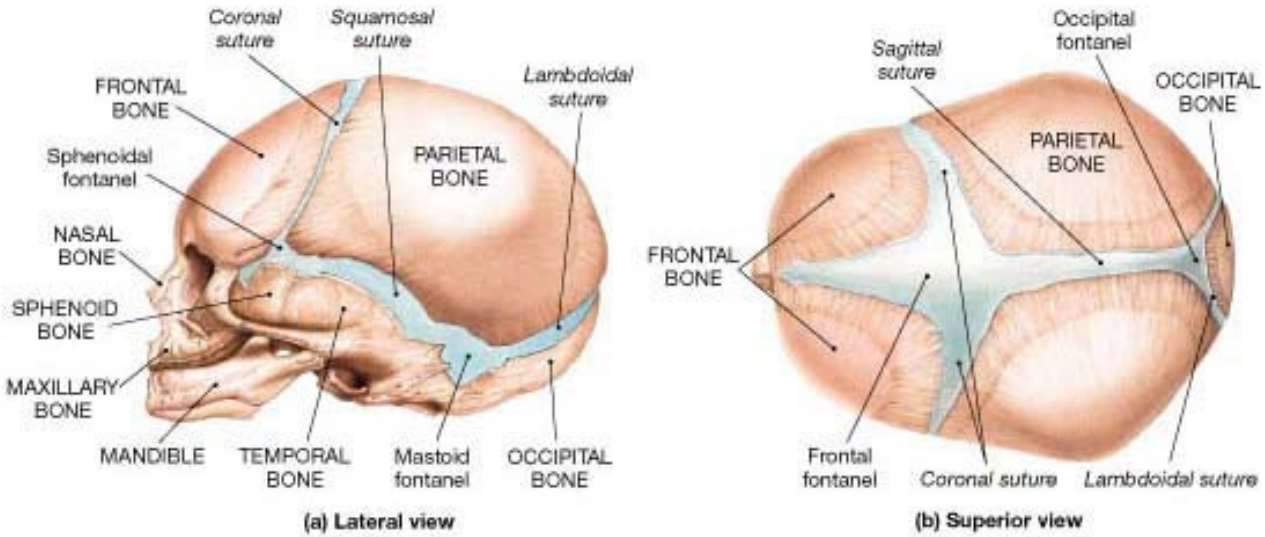
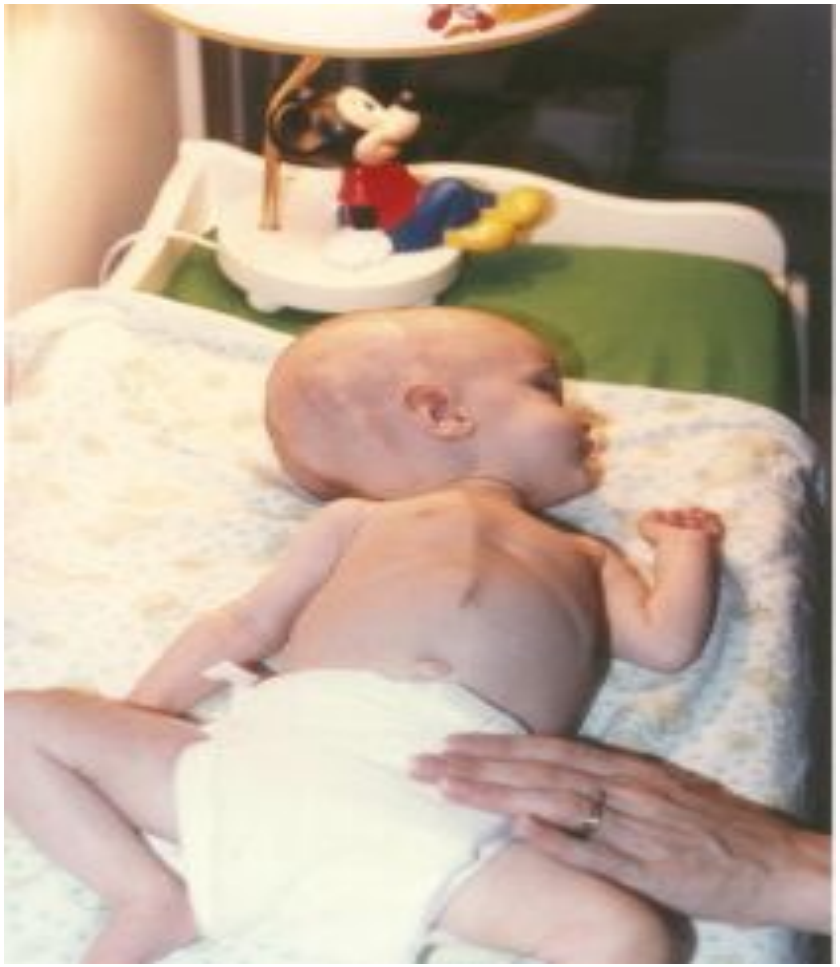


FIGURE 7-15 The Skull of an Infant. **(a)** Lateral view. The skull of an infant contains more individual bones than that of an adult. Many of the bones will eventually fuse; thus the adult skull will have fewer bones. The flat bones of the skull are separated by areas of fibrous connective tissue, allowing for cranial expansion and the distortion of the skull during birth. The large fibrous areas are called fontanels. By about age 4, these areas will disappear. **(b)** Superior view.



Infancy

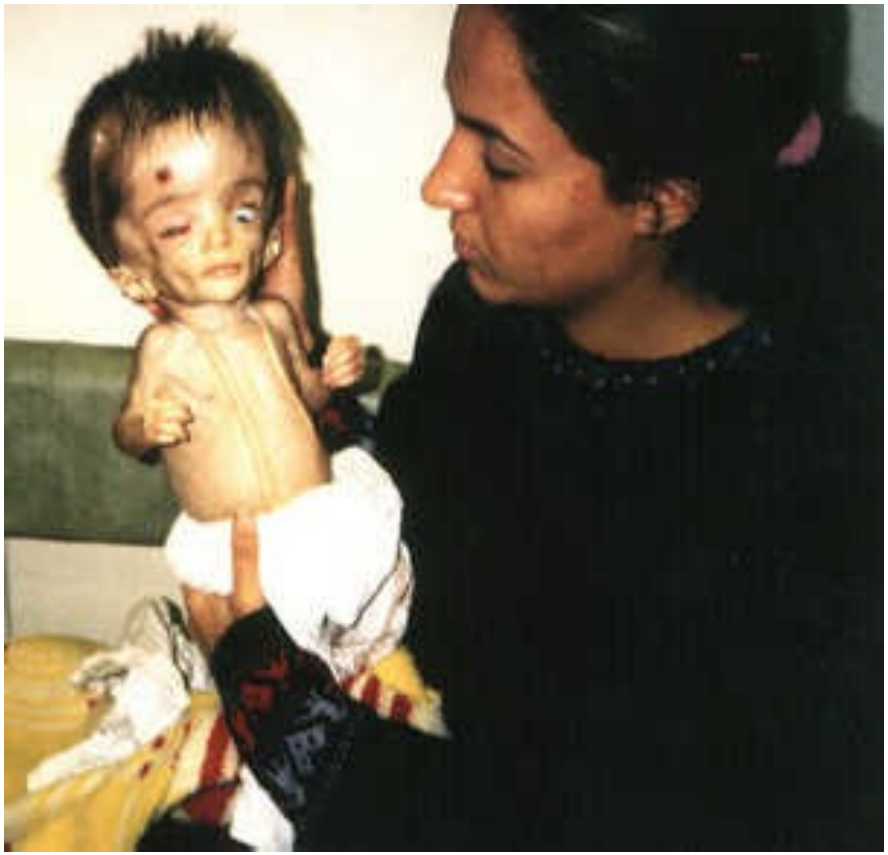
- Protruding forehead or bossing.
- Depressed eyes or setting-sun eyes (eyes rotating or downward with sclera visible above pupil)
- Pupils sluggish with unequal response to light
- Irritability, lethargy, feeds poorly, changes in LOC, arching of back (opisthotonos), lower extremity spasticity.
- May cry when picked up or rocked; quiets when allowed to lay still.

Infancy

- Swallowing difficulties, stridor, apnea, aspiration, respiratory difficulties and arm weakness may indicate brain stem compression.
- If hydrocephalus progresses, difficulty sucking and feeding, and a high-pitched shrill cry results. (lower brain stem dysfunction)

Infancy

- Emesis, somnolence, seizures, and cardiopulmonary distress ensues and hydrocephalus progresses.
- Severely affected infants may not survive neonatal period.

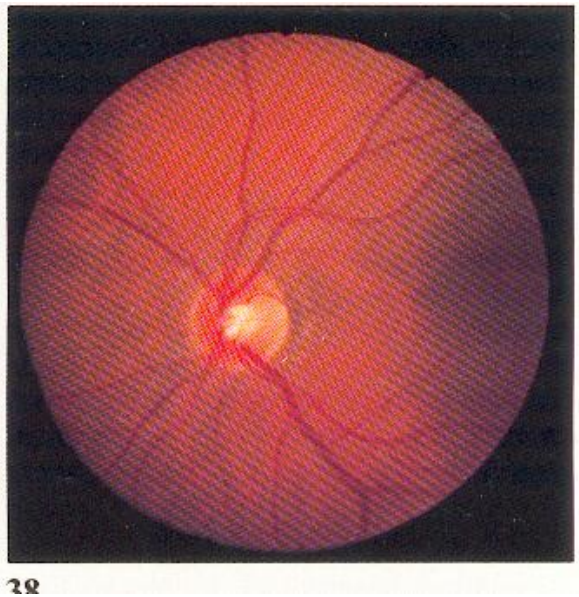


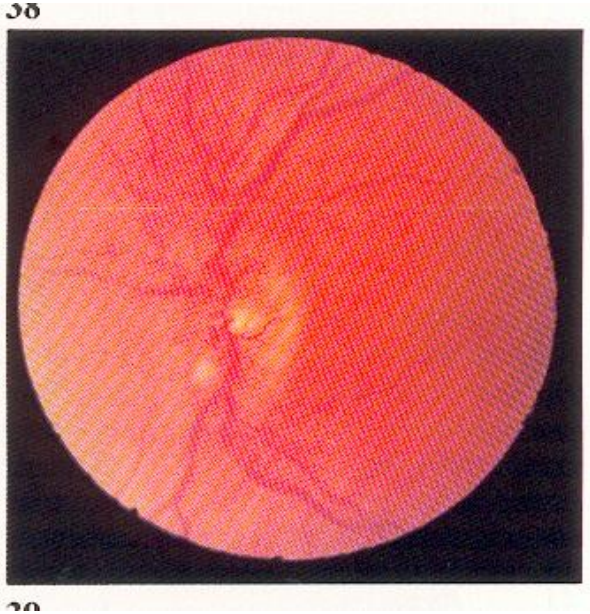
Childhood

- Signs and symptoms caused by increased ICP.
- Manifestations caused by posterior neoplasms and aqueduct stenosis, manifestations associated with space-occupying lesions.

Childhood

- Headache on awakening with improvement following emesis or sitting up.
- Papilledema (swelling of optic disc), strabismus, and extrapyramidal tract signs such as ataxia
- Irritability, lethargy, apathy, confusion, and often incoherent





Childhood

- Dandy-Walker syndrome- congenital defect- late onset.
  - Obstruction of foramen of Lushka and Magendie
  - Bulging occiput, nystagmus, ataxia, cranial nerve palsies
  - Female predominance (3:1)
  - Absence or occlusion of ventricles

Diagnostic Evaluation

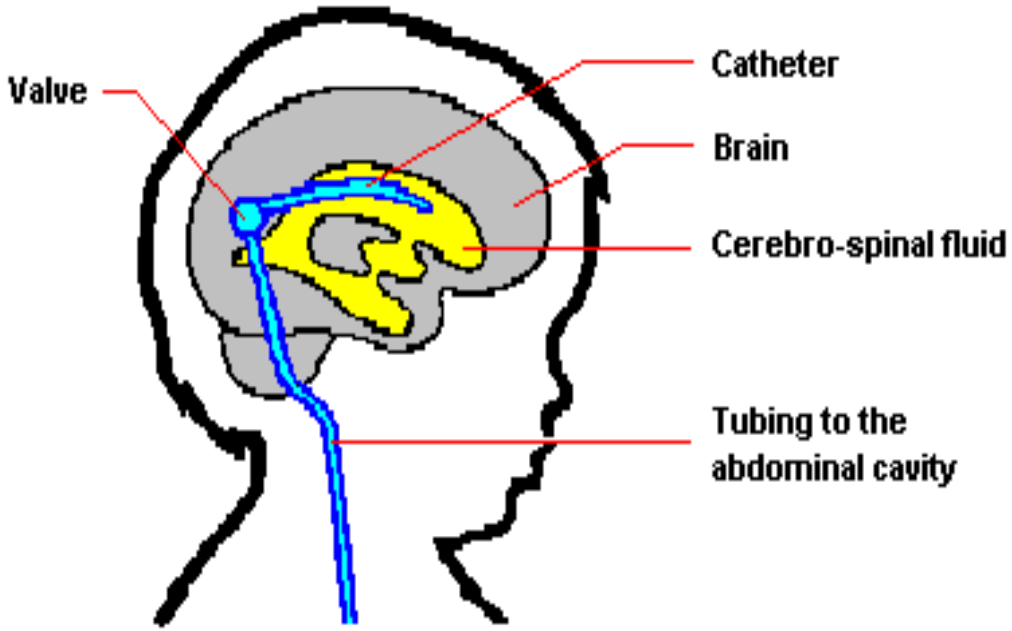
- Antenatal- fetal ultrasound as early as 14 weeks
- Infancy- based on head circumference crosses one or more grid lines on the infant growth chart within a 4 week period and there are progressive neuro signs.
- CT and MRI to localize site of obstruction; reveal large ventricles

Therapeutic management

- Goals:
- Relieve hydrocephaly
- Treat complications
- Manage problem resulting from effects of disorder on psychomotor development
- USUALLY SURGICAL!

Surgical Treatment

- Therapy of choice!
- Direct removal of source of obstruction (neoplasm, cyst, or hematoma)
- Most require shunt procedure to drain CSF from ventricles to extracranial area; usually peritoneum(VP shunt), or right atrium (VA shunt) for absorption.



An example of a shunt in place

VP shunt

- Used in neonates and young infants
- Greater allowance for excess tubing; which minimizes number of revisions needed as child grows

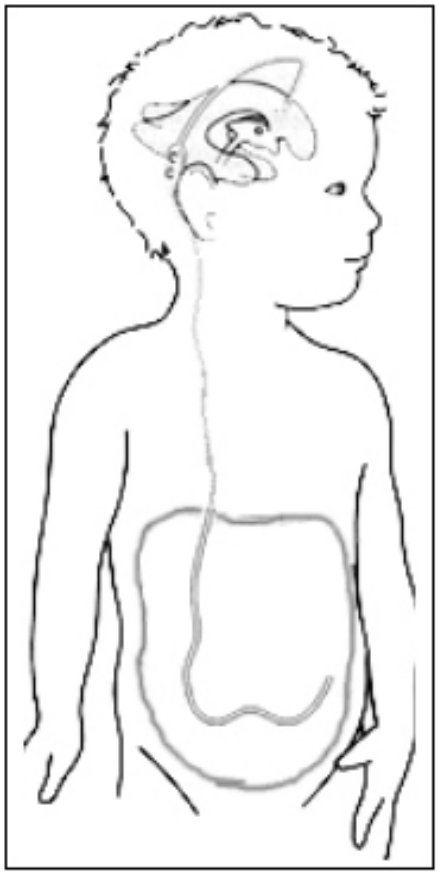
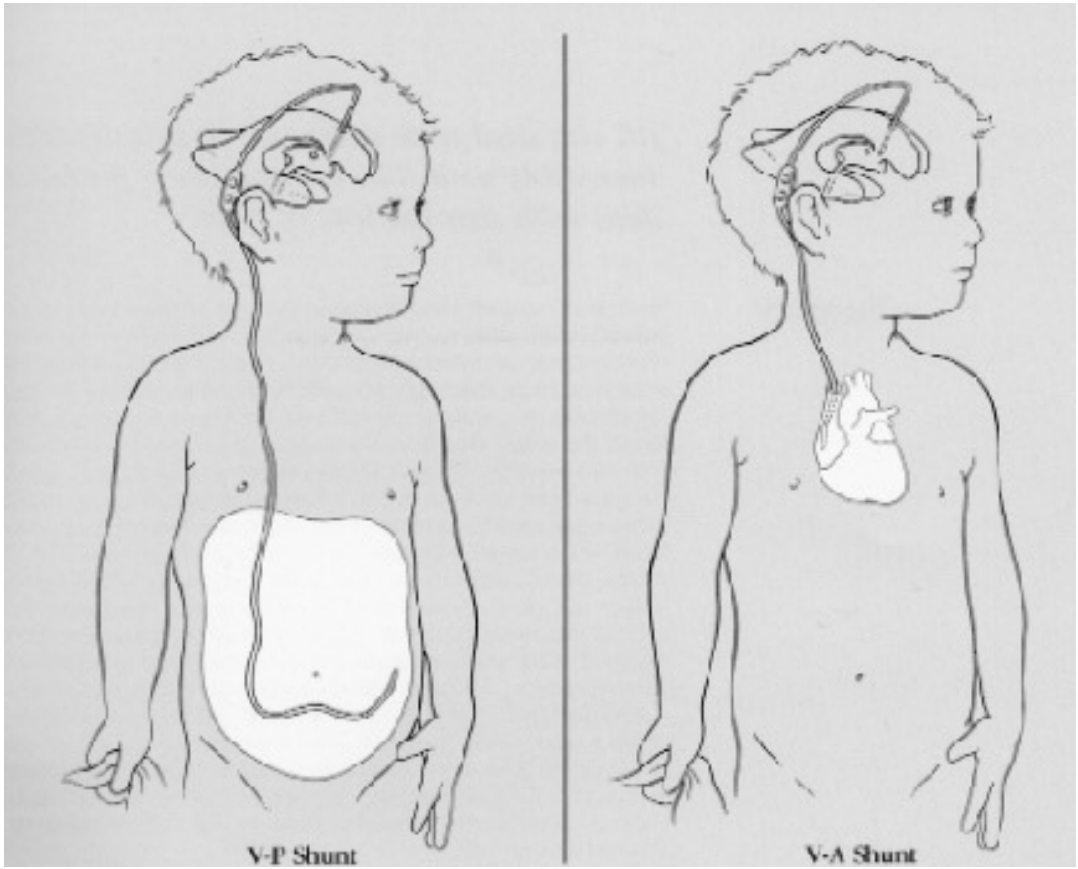
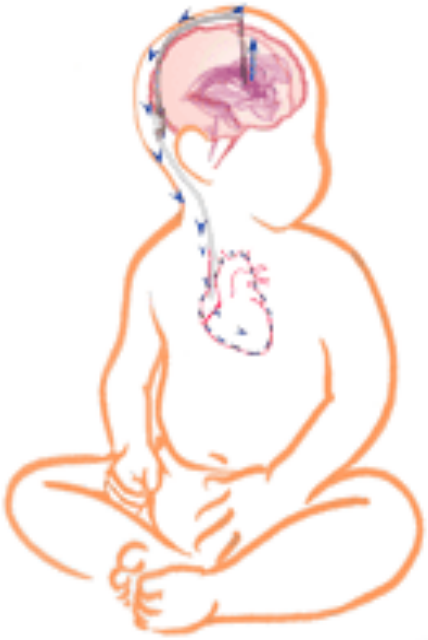


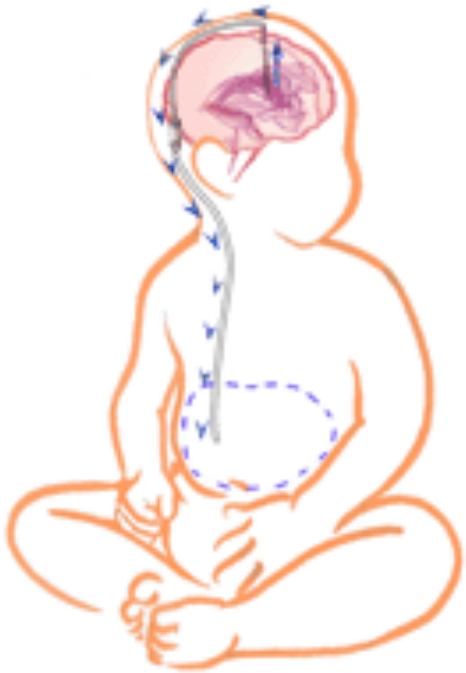
Abb.4 Schematische Darstellung eines Shuntsytems

VA shunt

- Reserved for older children who have attained most of somatic growth, or children with abdominal pathology.
- Contraindicated in children with cardiopulmonary disease or with elevated CSF protein.


V-P Shunt
V-A Shunt





Major Complications

- Shunt infection is most serious complication!
- Period of greatest risk is 1 to 2 months following placement.
- Staph and strep most common organisms

Complications

- Mechanical difficulties

  kinking, plugging, migration of tubing.
- Malfunction is most often by mechanical obstruction!
- Look for signs of increased ICP; fever, inflammation and abdominal pain.

Post-op care

- In addition to routine post-op care:
  - 1. Place on unoperated side to prevent pressure on shunt valve
  - 2. Keep HOB flat; rapid decrease in IC fluid may cause subdural hematoma due to small vein rupture in cerebral cortex.
  - 3. **Do not pump shunt without specific direction from doctor (too many different pump devices)**

Post-op care

- 4. Observe for signs of Increased ICP! May indicate obstruction of shunt!
  - Assess pupil size; as pressure on oculomotor nerve may cause dilation on same side as pressure.
  - Blood pressure may be variable due to hypoxia to brainstem
  - Abdominal distention- due to CSF peritonitis or post-op ileus due to catheter placement.

Post-op

- 5. Monitor I and O- may be on fluid restriction or NPO for 24 hours to prevent fluid overload.
- 6. Monitor VS- increased temp may indicate infection.
- 7. Give good skin care to prevent tissue damage, etc.

Family support

- Fear
- Communication of procedures
- Prepare for discharge.