Hydrocephalus

Hydrocephalus is the abnormal accumulation of CSF within the ventricles and subarachnoid spaces. It is often associated with dilatation of the ventricular system and increased intracranial pressure.

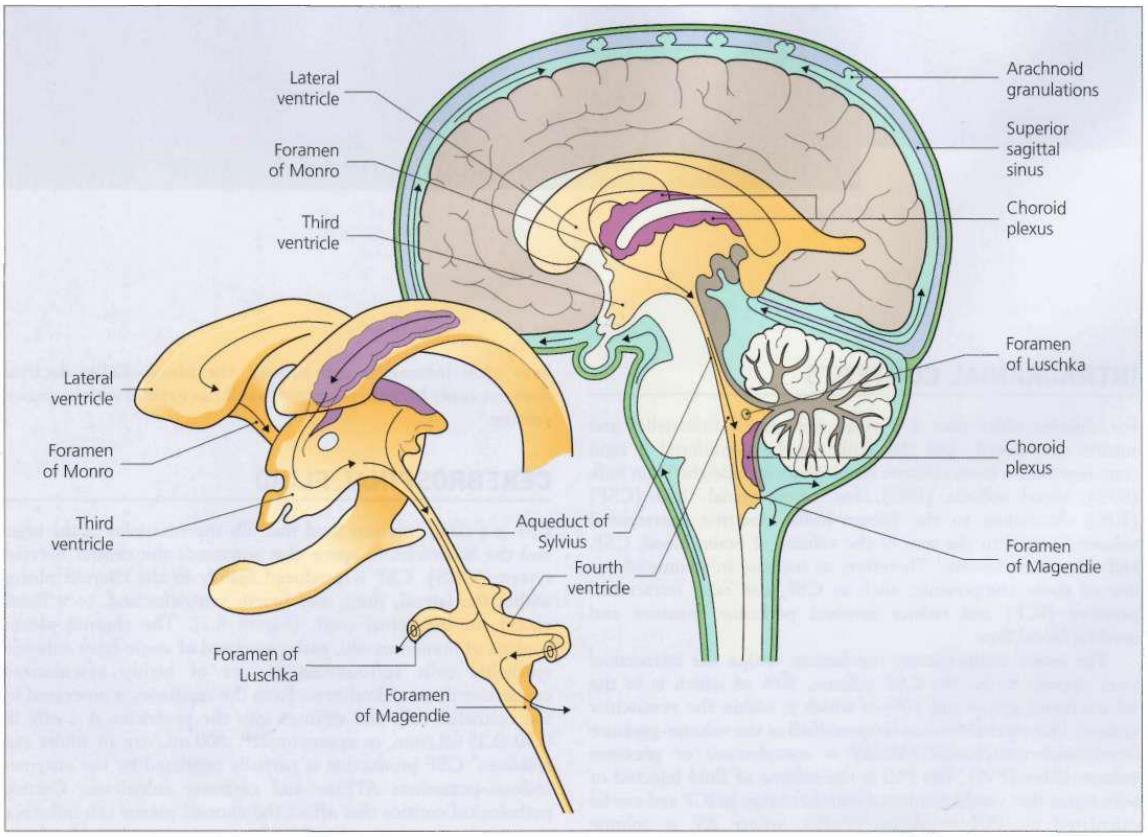
CSF pathway

CSF is produced at a rate of about 0.4 ml. /minute by two distinct processes; **(1)** Energy- requiring process performed by the choroid plexuses in the lateral, third and forth ventricles. This process depends on the enzyme **carbonic anhydrase** and can be blocked by the carbonic anhydrase inhibitor; **acetazolamide** (Diamox). **(2)** As by-product of cerebral and white matter metabolism. After its production, the ventricular CSF flows through a series of narrowing from one compartment to the next. The compartments begin with the lateral ventricles through the foramina of monro to the third ventricle. From there it flows through the cerebral **aqueduct of** Sylvius in to the forth ventricle. From there it flows into cisterna magna through 3 foramina [two lateral foramina **(Luschka)** and one median foramen **(Magendie)],** where it mixes with the CSF from the spinal subarachnoid space. Finally, the CSF flows through the cortical subarachnoid space to be absorbed through specialized organs; the **arachnoid villi,** into the sagittal sinus.

Etiology and classification of hydrocephalus

(a) Obstruction of CSF pathways this includes:

(1) Non- communicating hydrocephalus: in which obstruction localized at level of ventricular system (lateral and 4rth ventricle). This means that the ventricular system doesn't communicate with subarachnoid


Lateral ventricle
Foramen of Monro
Third ventricle
Arachnoid granulations
Superior sagittal sinus
Choroid plexus
Foramen of Luschka
Choroid plexus
Foramen of Magendie
Aqueduct of Sylvius
Fourth ventricle
Lateral ventricle
Foramen of Monro
Third ventricle
Foramen of Luschka
Foramen of Magendie

Communicating hydrocephalus: in which the obstruction localized at level outside the ventricular system (subarachnoid space and arachnoid villi). [this mean that the ventricular system does communicate with subarachnoid space].

Communicating	Non-Communicating	
Absence of arachnoid granulations	Aqueduct stenosis	Congenital
Arnold-Chiari malformation	Atresia of 4th. ventricle foramina	
Meningoencephalocele	Benign intracranial cyst	
Hemorrhage	Aqueduct stenosis	Acquired
Infection	Infection	
Tumor	Tumor	

(B)CSF oversecretion: (choroids plexi"; papilloma).

Clinical features of hydrocephalus

(A) Infantile hydrocephalus: (1) Enlar$_D$jd head (Craniofacial disproportion) (2) Distended
scalp veins (3) Tense and bulgin" of anterior fontanel (4) Unilateral or bilateral abducent palsy (5) weakness of up,, ard gaze (Sun-setting sign).
(B) Adult-type hydrocephah:;: (1) cli ' -al Features of raised intracranial pressure and/or clinical features of brain herniation. <*T.)* weakness of upward gaze (Parinaud's syndrome)

Imaging

By CT scan or MRI, Hydrocephalus is suggested when either:

A- The size of both temporal horns (TH) is more or equal to 2 mm. in width (in the absence of hydrocephalus the temporal horn should be barely visible), **and** the sylvian & interhemispheric fissures and cerebral' sulci are not visible (this is known as **effacement)**
OR

B- Both **TH** are more or equal to 2 mm. in width **and** the ratio of the largest width . of frontal]horns(FH) to the Internal diameter from inner table to inner-table of skull (ID) at this level is more than 0.5
These finding may or may not associated with interstitial edema which present as periventricular low density density on CT scan or periventricular high intensity signal on T2 MRI.
Hydrocephalus should be differentiated from **cerebral atrophy** in which there is enlargement of the ventricles due to loss of cerebral tissue. In this case the sylvian and interhemispheric fissures and cerebral sulci are vesible and enlarged to a proportion of almost equal to that of ventricular system enlargement.

Treatment of hydrocephalus

Hydrocephalus remains a surgically treated condition. Acetazolamide may be helpful in temporizing. Normal sized ventricles are not the goal of therapy. Goals are optimum neurologic function and good cosmetic result.

Surgical options include:

1. Eliminating the cause of hydrocephalus (tumor removal or opening a stenosed Sylvain aqueduct).

2. Third ventriculostomy (opening of the 3rd ventricle to the basal cisterna that communicates with subarachnoid space to by-pass the obstruction).

3. Shunting: this is a method for CSF diversion to a place where it could be absorbed. This is usually done using special tube system containing valve.

Shunt system are classified according to the sites of CSF diversion into:

(I) Ventriculo-Atrial shunt (divert CSF from ventricular system to the heart).

(II) Peritoneal shunt (divert CSF from ventricular system to the peritoneal cavity).