

# PERIOPERATIVE BLOCK

## ACADEMIC YEAR 2023 -2024

### Hydrocephalus

#### **Block staff: (Neurosurgery).**

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**References:**

**essential neurosurgery.**



## Objective:

1. Define hydrocephalus. Rate of CSF production and its pathway.
2. Classify hydrocephalus.
3. Identify causes.
4. Feature of hydrocephalus in infant and adult.
5. What image is appropriate ?
6. Treatment of hydrocephalus.



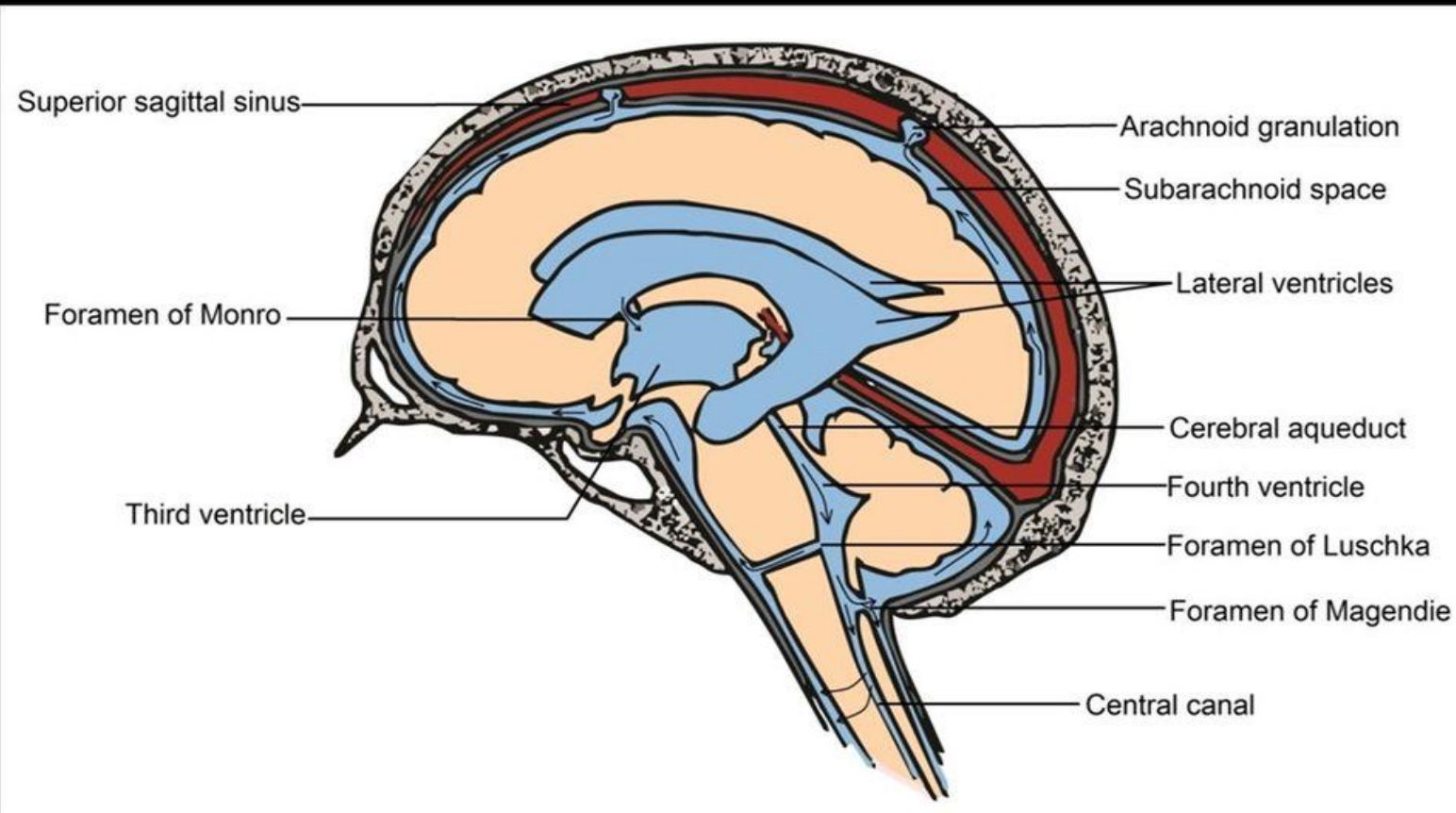
# Hydrocephalus

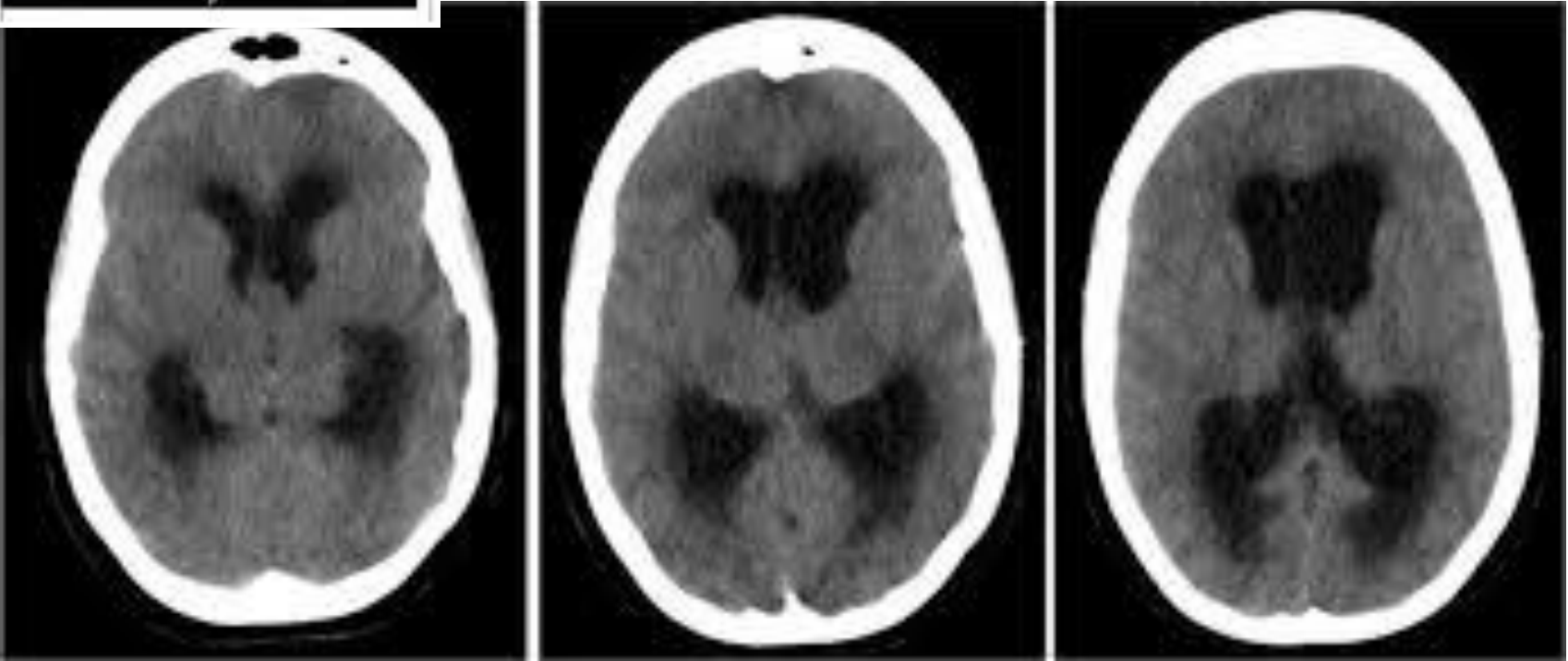
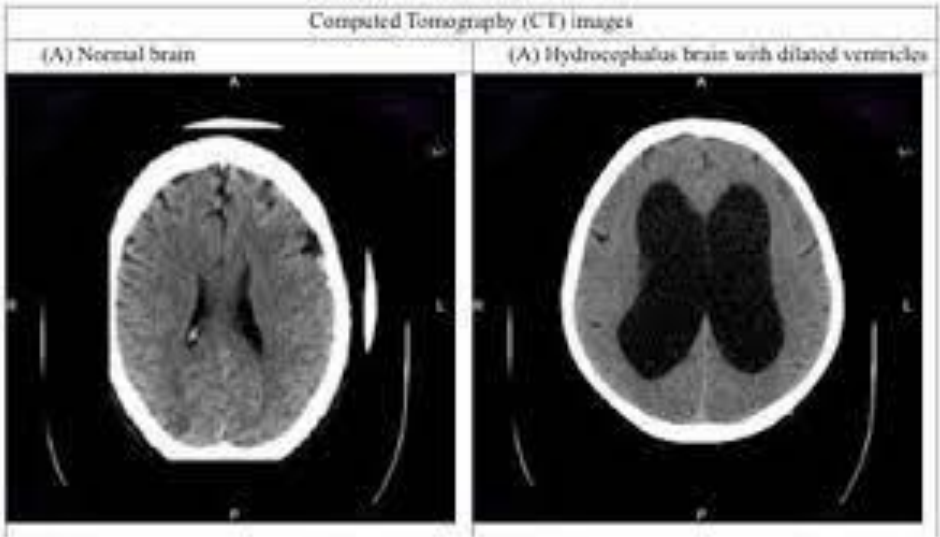
Hydrocephalus is an abnormal enlargement of the ventricles due to an excessive accumulation of CSF resulting from a disturbance of its flow, absorption or, uncommonly, secretion.

- ❖ The **normal volume of CSF is 140 ml**. CSF is produced by the choroid plexus in the ventricles at a rate of **0.35 ml per minute** (or about **500 ml in 24 hours**).
- ❖ The CSF flows from the lateral ventricles through the foramen of Monro into the 3rd ventricle, via the aqueduct of Sylvius into the 4th ventricle and then through the foramina of Magendie and Luschka into the subarachnoid space and basal cisterns. The CSF circulates throughout the spinal subarachnoid space and the basal cisterns up through the tentorial hiatus. It flows over the cerebral hemispheres and is largely absorbed by the arachnoid villi of the dural sinuses.



# CSF CIRCULATION





# Classification of hydrocephalus

There are a number of ways of classifying hydrocephalus but the most useful classification system is:

- 1• **obstructive hydrocephalus**—when there is an obstruction to the flow of CSF through the ventricular system.
- 2• **communicating hydrocephalus**—when there is **no** obstruction to the flow of CSF within the ventricular system but the hydrocephalus is due either to obstruction to CSF flow outside the ventricular system or to failure of absorption of CSF by the arachnoid granulations.



# Causes of hydrocephalus

The most common causes of hydrocephalus are:

## 1 Obstructive hydrocephalus:

- (a) lateral ventricle obstruction by tumors, e.g. basal ganglia glioma, thalamic glioma.
- (b) 3rd ventricular obstruction, due to colloid cyst of the 3rd ventricle or glioma of the 3rd ventricle.
- (c) occlusion of the aqueduct of Sylvius (either primary stenosis or secondary to a tumor).
- (d) 4th ventricular obstruction due to posterior fossa tumor, e.g. medulloblastoma, ependymoma, acoustic neuroma.

## 2 Communicating hydrocephalus:

- (a) obstruction to flow of CSF through the basal cisterns.
- (b) failure of absorption of CSF through the arachnoid granulations over the cerebral hemispheres , caused by infection or hemorrhage.



- ❖ The most common causes of communicating hydrocephalus are infection (especially bacterial and tuberculous) and subarachnoid hemorrhage (either spontaneous, traumatic or postoperative). Other uncommon causes are carcinomatous meningitis, increased CSF viscosity from a high protein content and excessive secretion of CSF due to a choroid plexus papilloma.
  
- ❖ **Post infectious** is the most common cause of communicating HCP.
- ❖ **Post hemorrhagic** is the 2nd most common cause of communicating HCP
  - **IVH**
  - **SAH**
  
- ❖ Aqueduct stenosis is the most common cause of congenital hydrocephalus.





## Presenting features

### Hydrocephalus in infants

The incidence of infantile hydrocephalus is approximately 3–4 per 1000 births and most cases are due to congenital abnormalities. The most common congenital cause is stenosis of the aqueduct of Sylvius. This is a major cause of hydrocephalus in children with spina bifida and myelomeningocele. The acquired forms of hydrocephalus occur most frequently after infections and after intracranial bleeding, particularly in premature infants.

Hydrocephalus can present as acute raised intracranial pressure but because of the relative distensibility of the infant skull the presentation can be more subtle.



## The major clinical features in infants are:

- failure to thrive
- failure to achieve milestones.
- increased skull circumference (compared with normal growth curves)
- tense anterior fontanelle.
- 'cracked pot' sound on skull percussion.
- transillumination of cranial cavity with strong light.
- when severe, impaired conscious level and vomiting
- 'setting sun' appearance due to lid retraction and impaired upward gaze from 3rd ventricular pressure on the midbrain tectum.
- thin scalp with dilated veins.



## Adult hydrocephalus

Adult patients with hydrocephalus may present with either:

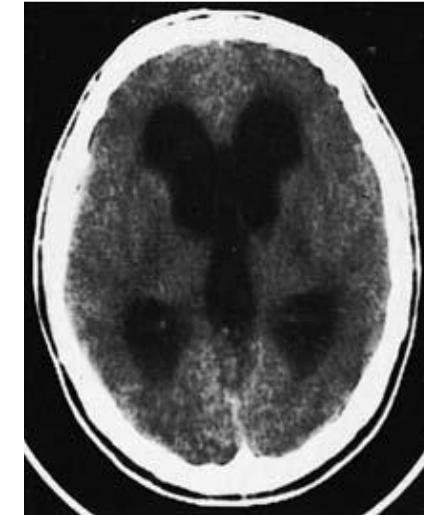
- acute onset and deterioration or
- gradual onset and slowly progressive deterioration.

### *Acute-onset adult hydrocephalus*

The major presenting features are due to the signs and symptoms of raised intracranial pressure :-

- headache
- vomiting
- papilledema
- deterioration of conscious state.

Upgaze will often be impaired due to pressure of the dilated 3rd ventricle on the superior colliculus of the tectum.



## ***Gradual-onset adult hydrocephalus***

This type of onset occurs less frequently than the previous type in patients with obstructive hydrocephalus due to a tumor. The symptoms of raised intracranial pressure are only very gradually progressive and late diagnosis is common. Early features in the adolescent involve deteriorating school performance as a result of headaches, failing mental function, memory loss and behavioral disturbances. Endocrine abnormalities such as infantilism and precocious puberty can occur in association with chronic hydrocephalus in older children and adolescents due to disturbance of the hypothalamus and possible compression of the pituitary gland. If the condition is unrecognized progressive visual failure will occur, secondary to papilledema and optic atrophy. As mentioned earlier, acute decompensation may occur and the patient may suddenly develop a rapid deterioration of conscious state. In elderly patients a chronic form of hydrocephalus is called 'normal-pressure hydrocephalus'; which include triad of dementia, ataxia and urinary incontinence.



## Radiological investigation

The most important investigation is either a **CT scan** or **MRI of the brain**) which will show which ventricles are dilated. If the lateral ventricles and 3rd ventricle are all very dilated, and the 4th ventricle is small, it is likely that the obstruction is at the level of the aqueduct of Sylvius. An **enhanced CT scan or MRI** will help determine the cause, as it will better define the presence of an obstructing tumor. In a communicating hydrocephalus all the ventricles are dilated.

*Magnetic resonance imaging.* In the sagittal plane MRI is particularly helpful in showing aqueduct stenosis and lesions around the 3rd ventricle causing obstructive hydrocephalus.

**Ultrasonography.** Ultrasonography through the open anterior fontanelle is useful in assessing ventricular size in infants and may obviate the need for repeated CT scans.

**Plain skull X-ray.** May demonstrate splayed sutures, erosion of the bony buttresses around the tuberculum sellae or a 'copper beaten' appearance to the inside of the calvarium.

❖ Records of the head circumference and its comparison with body weight and length centile charts are an integral part of postnatal follow-up of any child.



## Treatment

In general, the treatment of hydrocephalus is a CSF shunt or a 3rd ventriculostomy. If there has been rapid neurological deterioration this will need to be performed as an emergency.

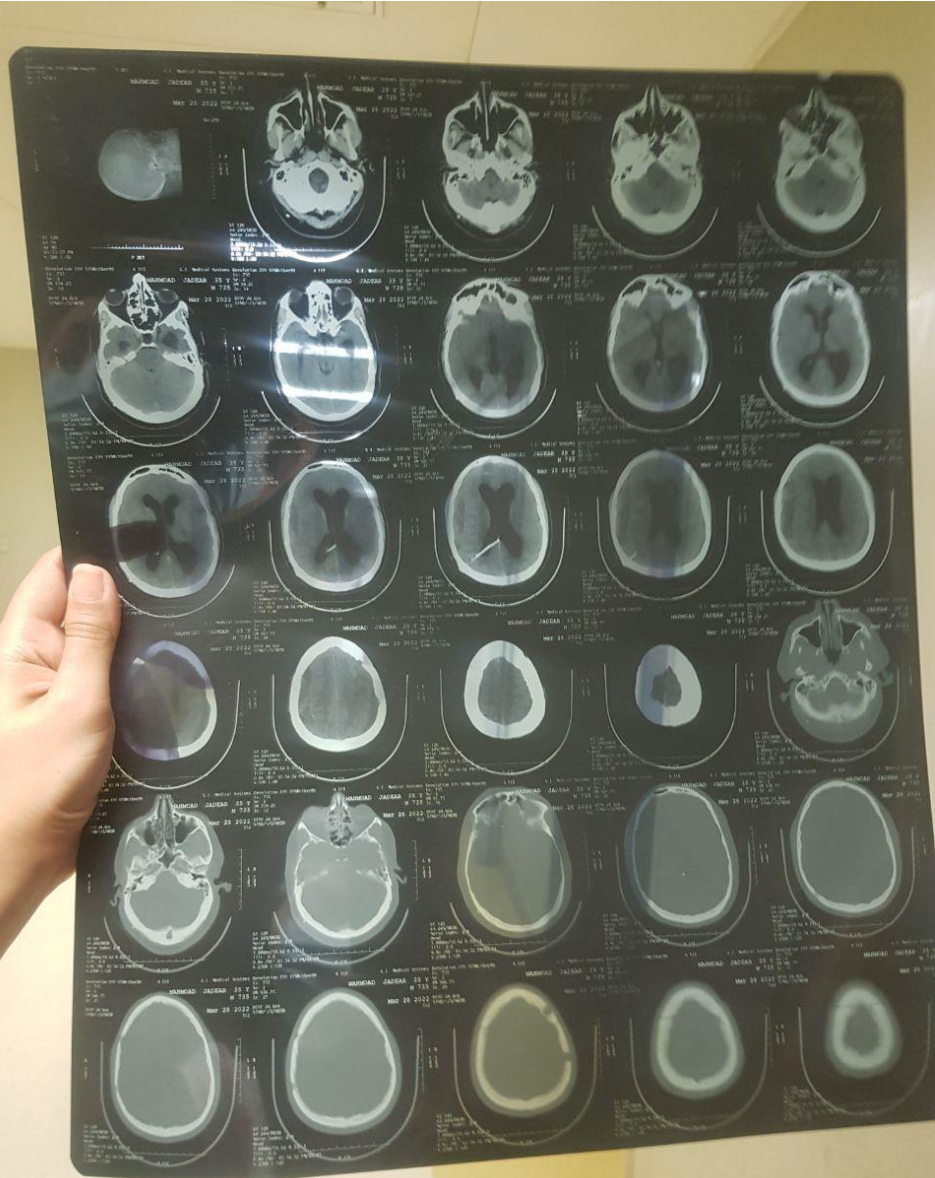
If the hydrocephalus is due to an obstructing tumor that is surgically accessible, resection of the mass may lead to resolution of the hydrocephalus and a shunt might not be necessary.

### Postoperative care

The postoperative management is similar for any intracranial procedure. Initially the patient is nursed flat, to avoid rapid decompression of the ventricular system.

Deterioration of neurological state or failure to improve will require an urgent CT scan to confirm that the catheter has been placed accurately into the ventricular system and to exclude the possibility of intracranial complications such as intracerebral hematoma.





Thanks

