

Understanding and treating raised intracranial pressure

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Learning objectives

- **Understand relevant anatomy and physiology of ICP**
- **Know causes of abnormal ICP**
- **Describe management of increased ICP**

Intracranial pressure

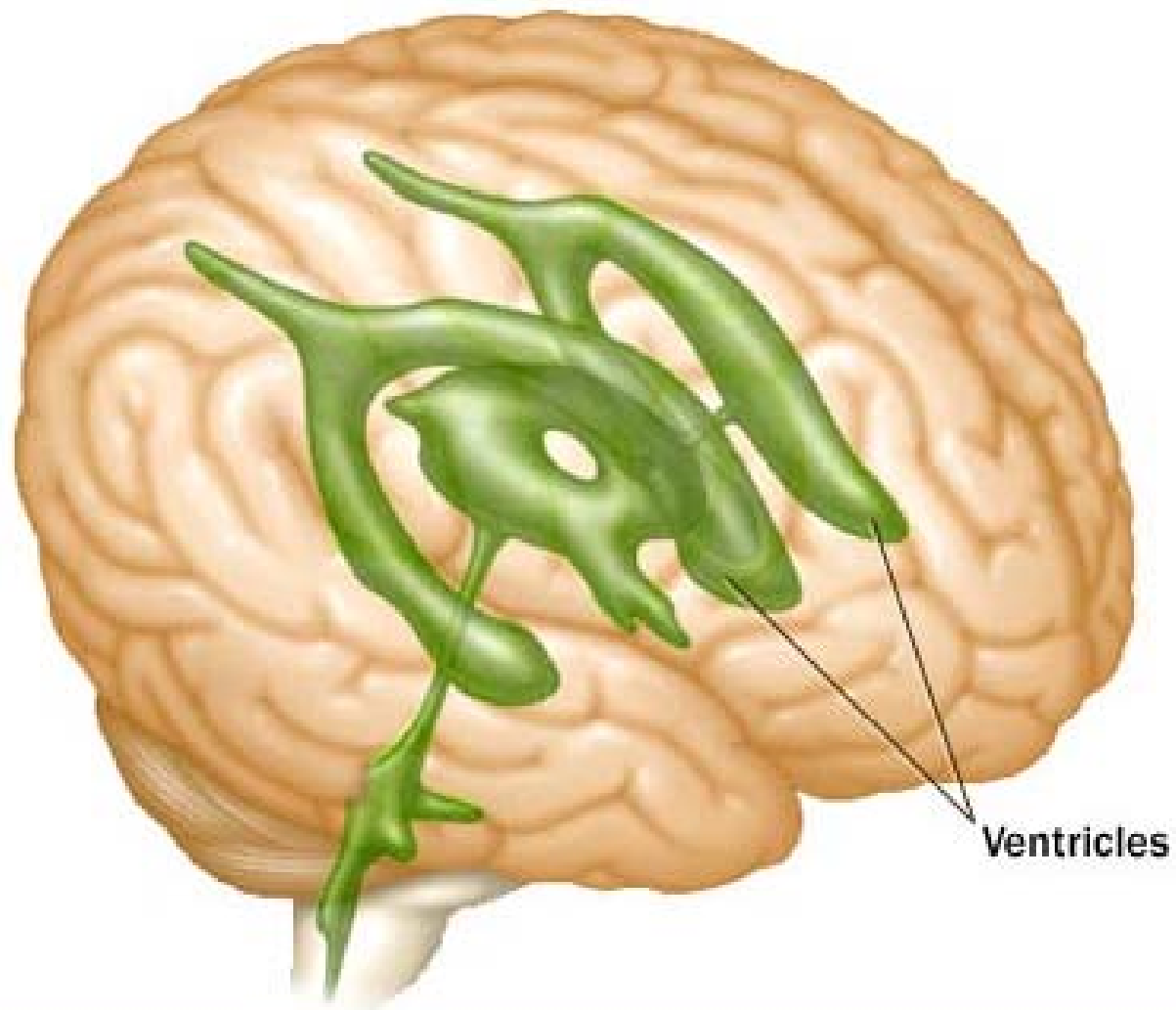
- **Brain and cord suspended in CSF**
- **CSF produced by choroid plexuses**
- **Circulates through the ventricular system and subarachnoid space**
- **Resorbed through the arachnoid villi**
- **Normal pressure 7-15 mm Hg (supine); -10 mm Hg (upright)**

Monro-Kelly hypothesis

- **cranial compartment incompressible (except in infants)**
- **intracranial volume is fixed**
- **any increase in volume of one or more of the blood, CSF, and brain must be compensated by a decrease in volume of another**
- **Monro A (1783). Observations on the structure and function of the nervous system. Edinburgh: Creech & Johnson.**
- **Kelly G (1824). "Appearances observed in the dissection of two individuals; death from cold and congestion of the brain". Trans Med Chir Sci Edinb 1: 84–**

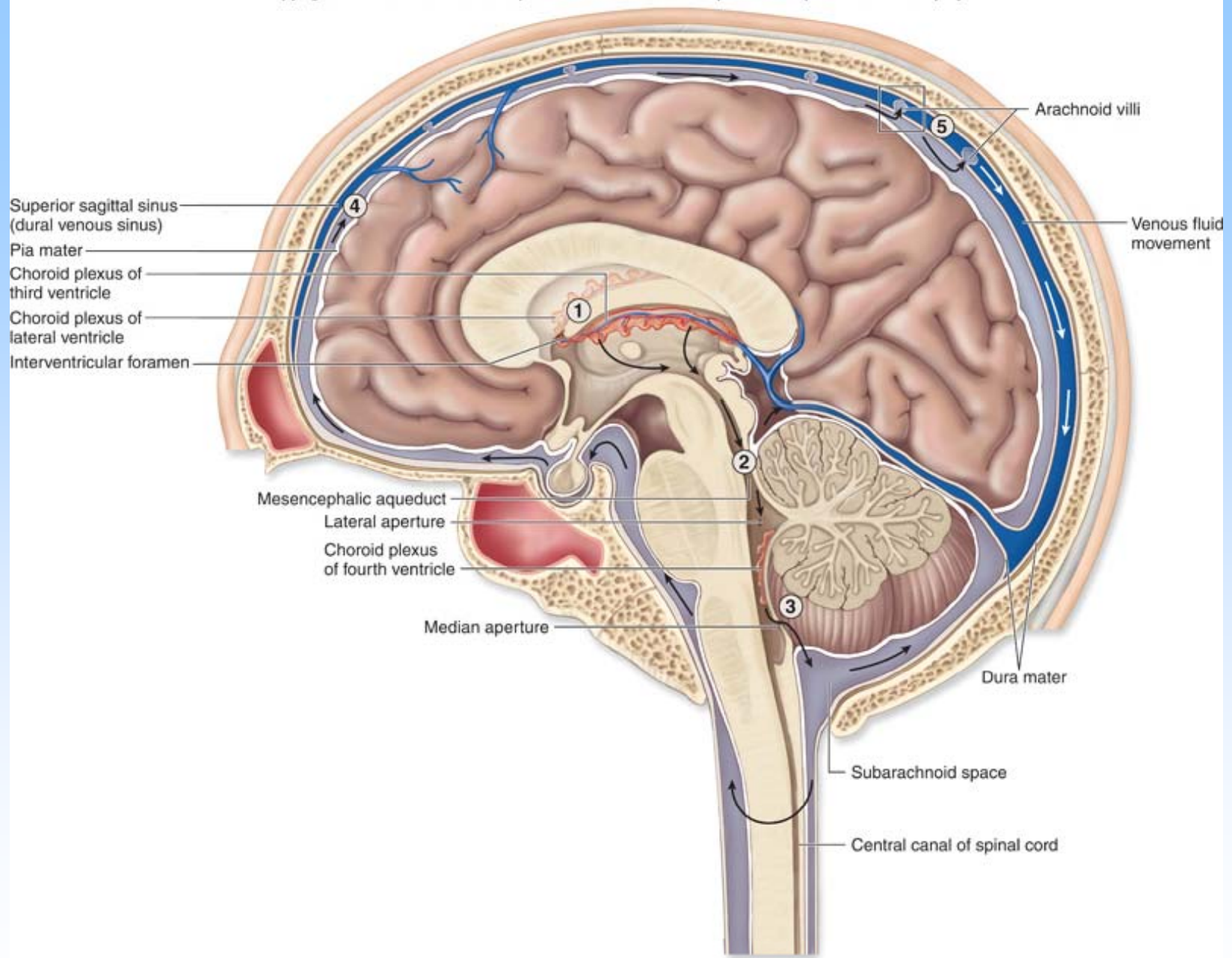
Anatomy

- **CSF pathways**
- **Meninges (membranes)**
 - **Dura mater* = tough mother**
 - **Arachnoid mater = cobweb-like mother**
 - **Pia mater = tender mother**
 - ***Latin translation from Arabic**

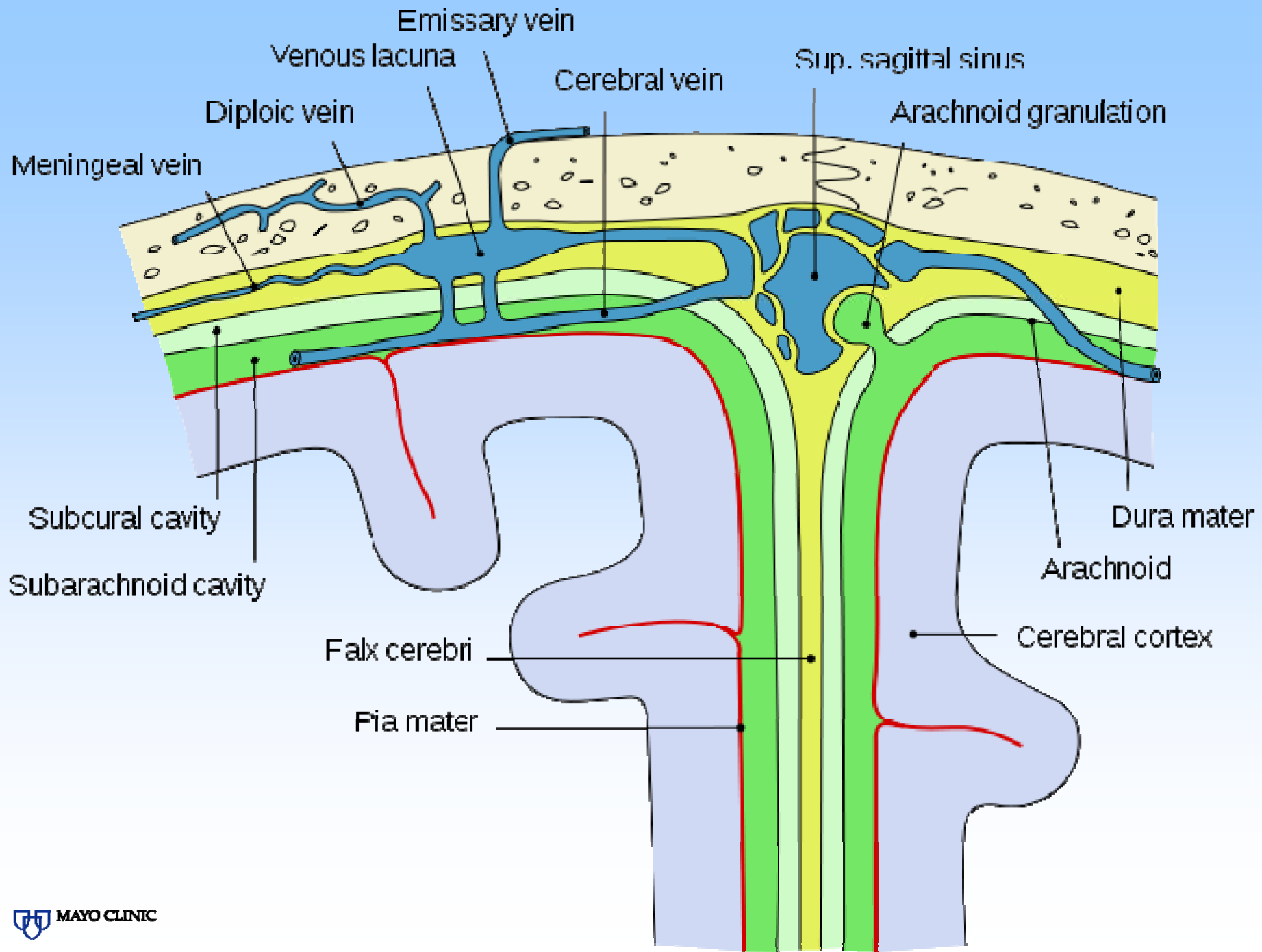


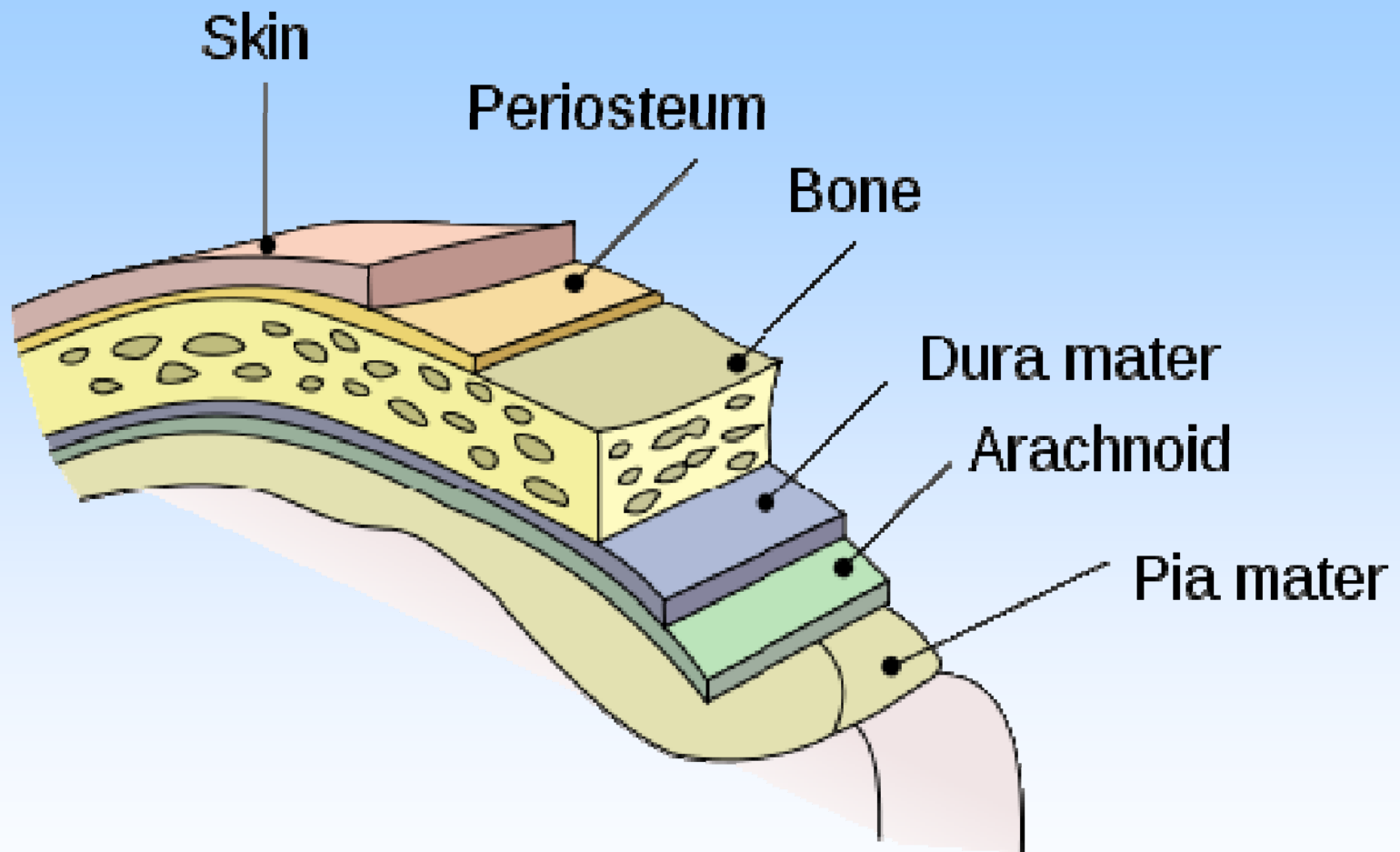
Ventricles

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(a) Midsagittal section





Low ICP

- **Spontaneous**
 - **CSF leaks**
- **Iatrogenic**
 - **Overshunting**
 - **Post – LP leak**

Increased ICP

- **Increased volume of**
- **Brain – tumor, swelling**
- **Blood – hemorrhage, vascular malformation**
- **CSF**
 - **Obstruction**
 - **Increased CSF production**

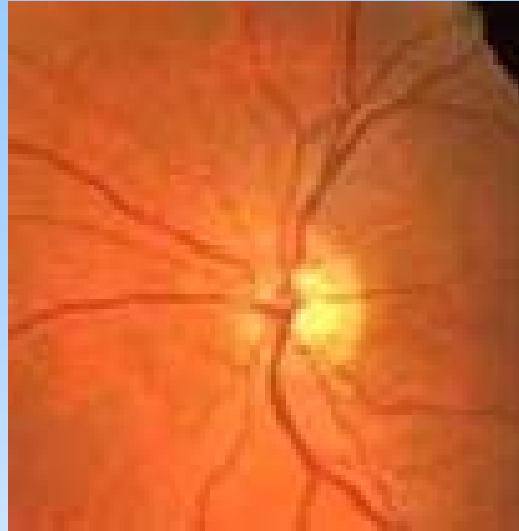
Symptoms and signs of increased ICP

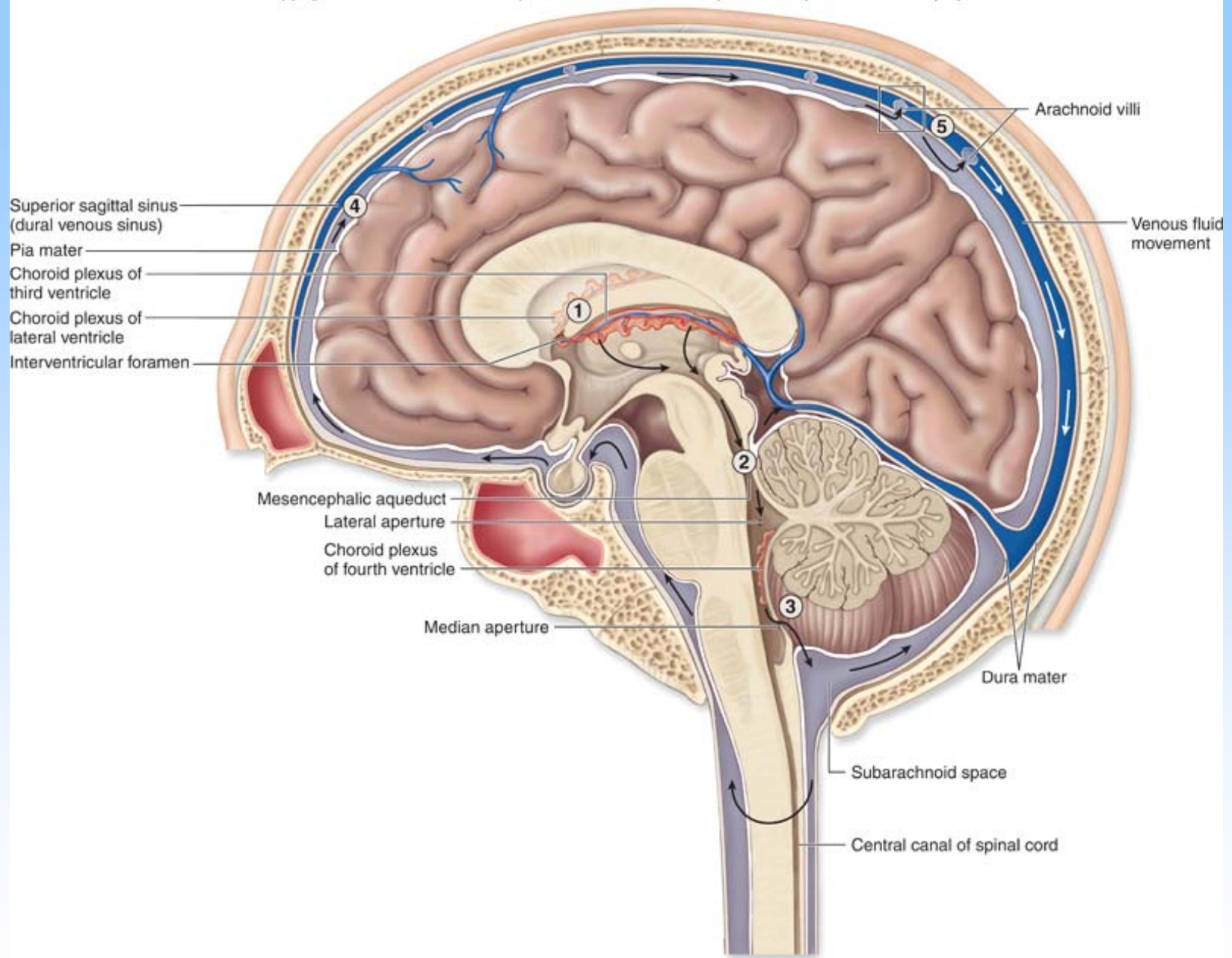
- Symptoms

- Headaches
- Vomiting
- Drowsiness
- Blurred vision
- Double vision

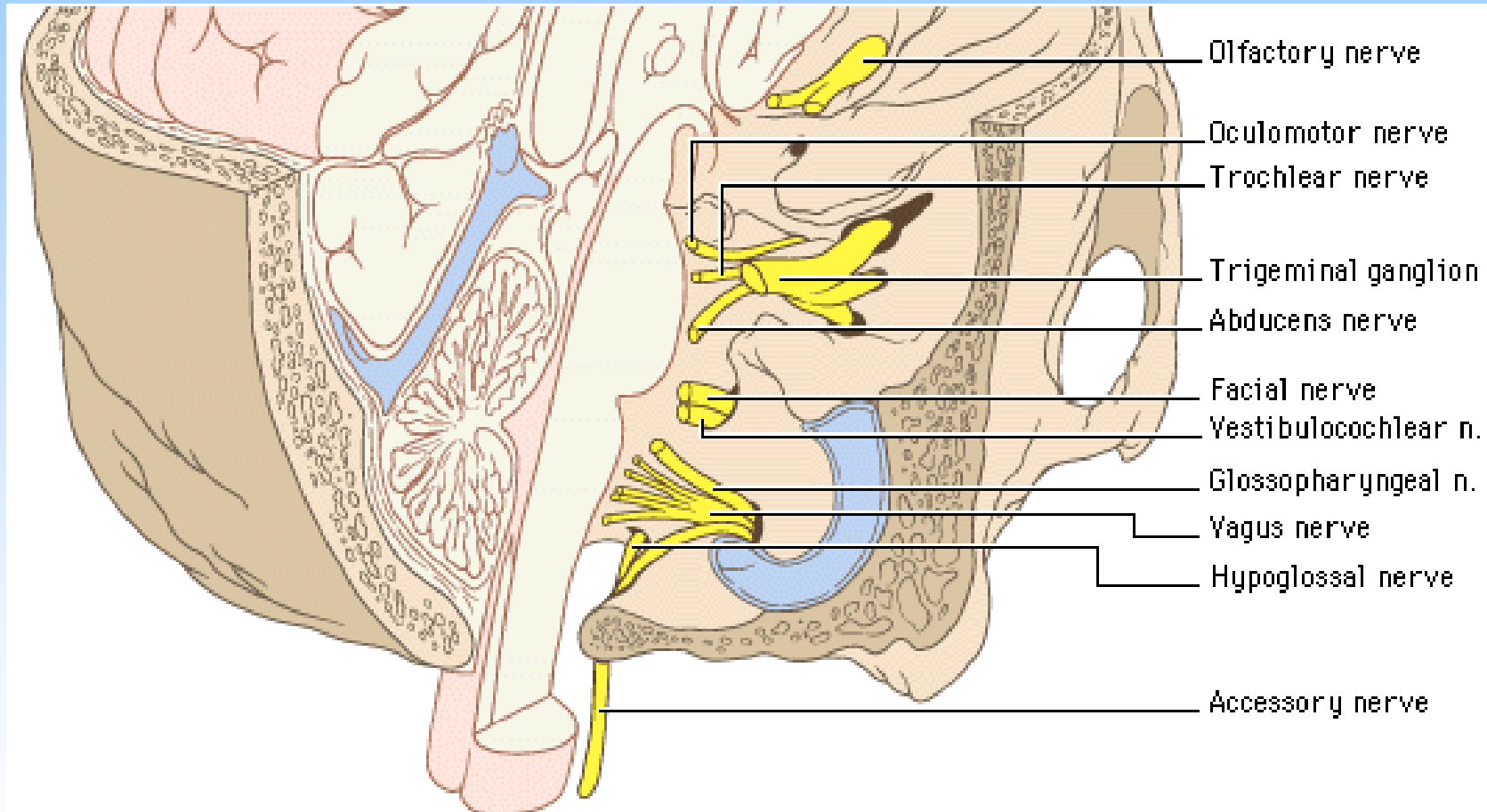
- Signs

- Macrocephaly
- Ataxia
- Upgaze paralysis
- Papilloedema



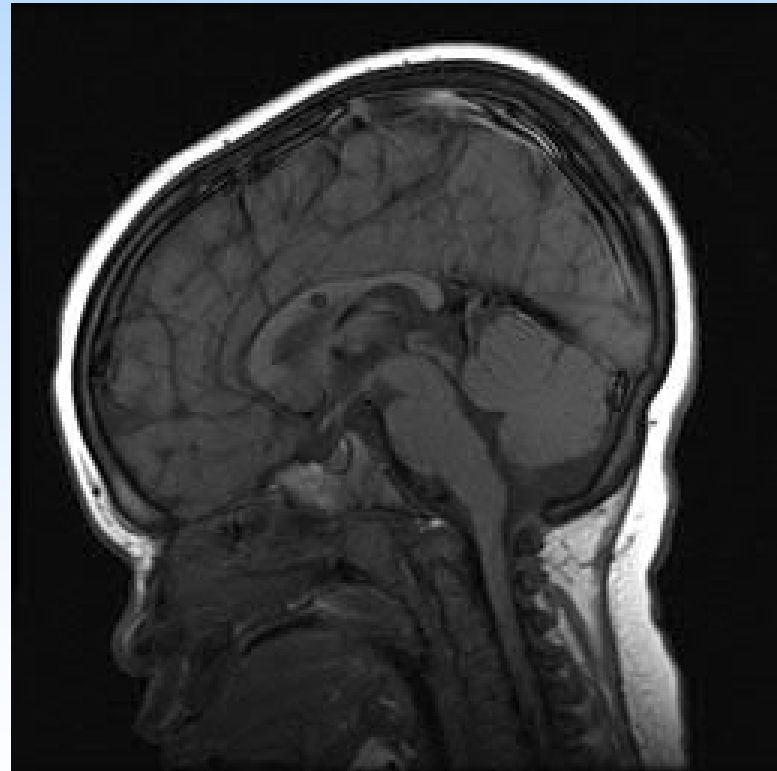
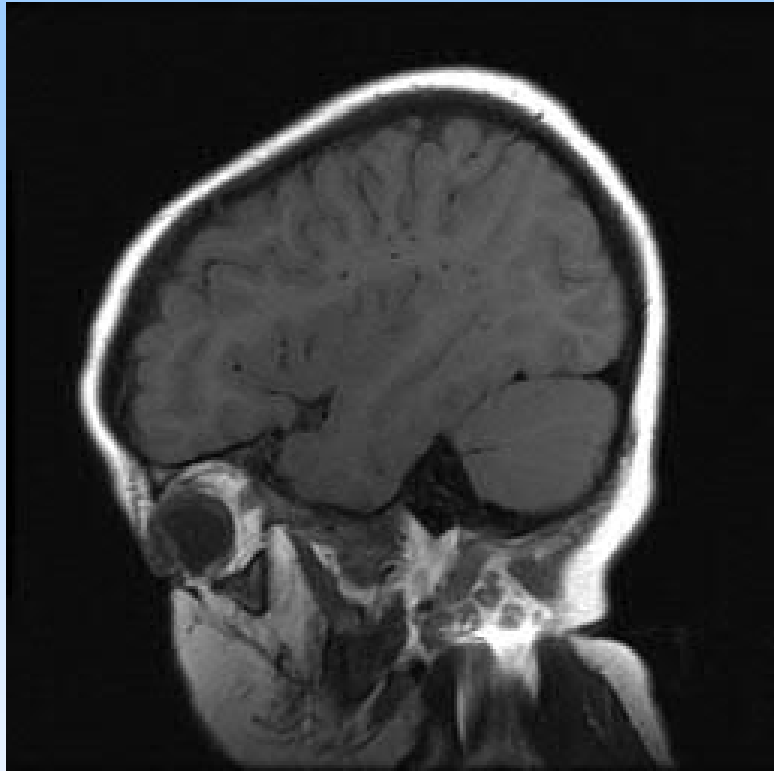


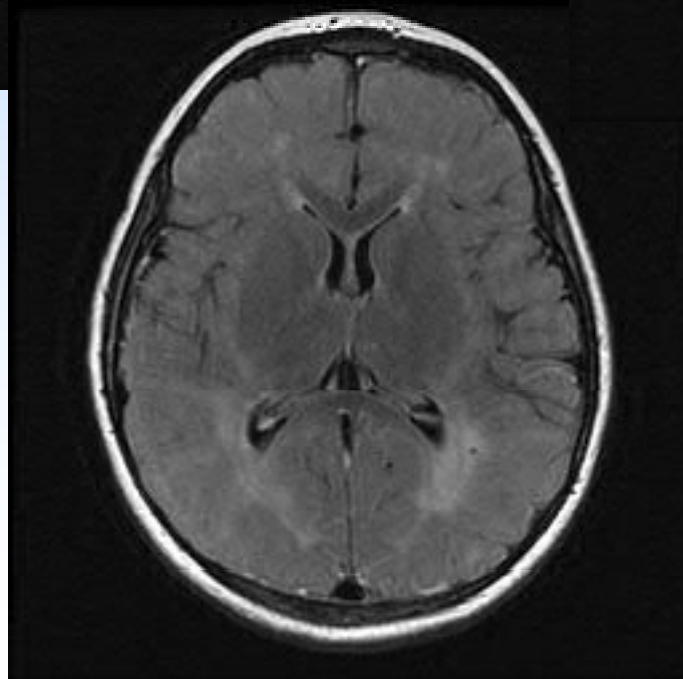
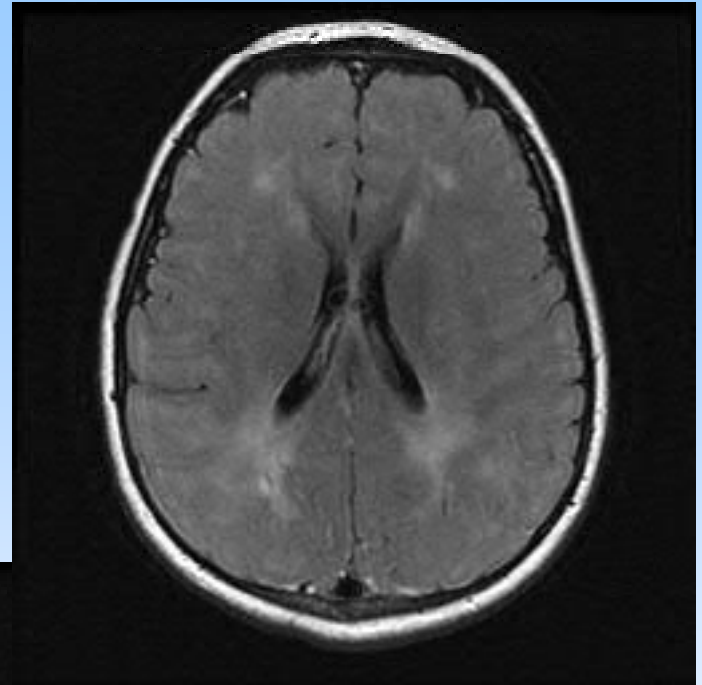
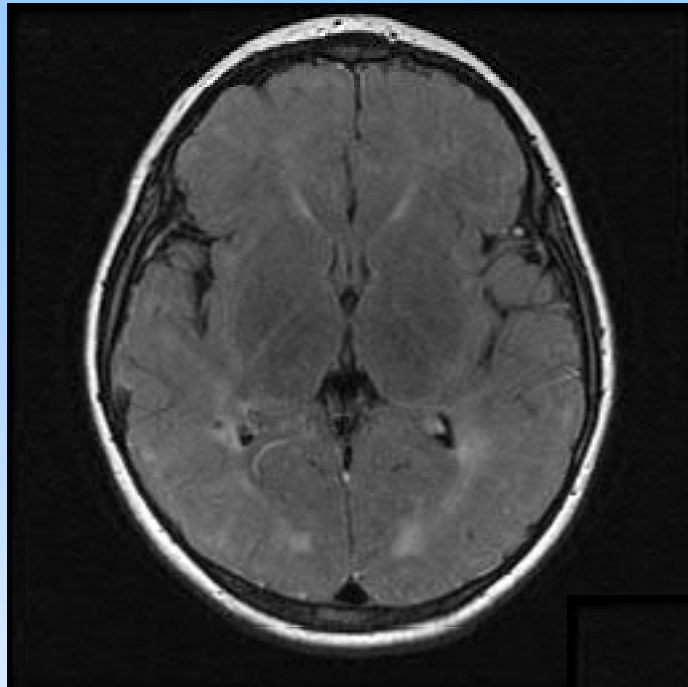
(a) Midsagittal section



Increased ICP in MPS

- **Basic pathology – increased ground substance**
- **Obstruction along CSF pathways**
- **Meningeal thickening**
- **Bony deformity may obstruct CSF pathways**
- **Pseudotumor (benign intracranial hypertension)**
- **Dural sinus thrombosis**

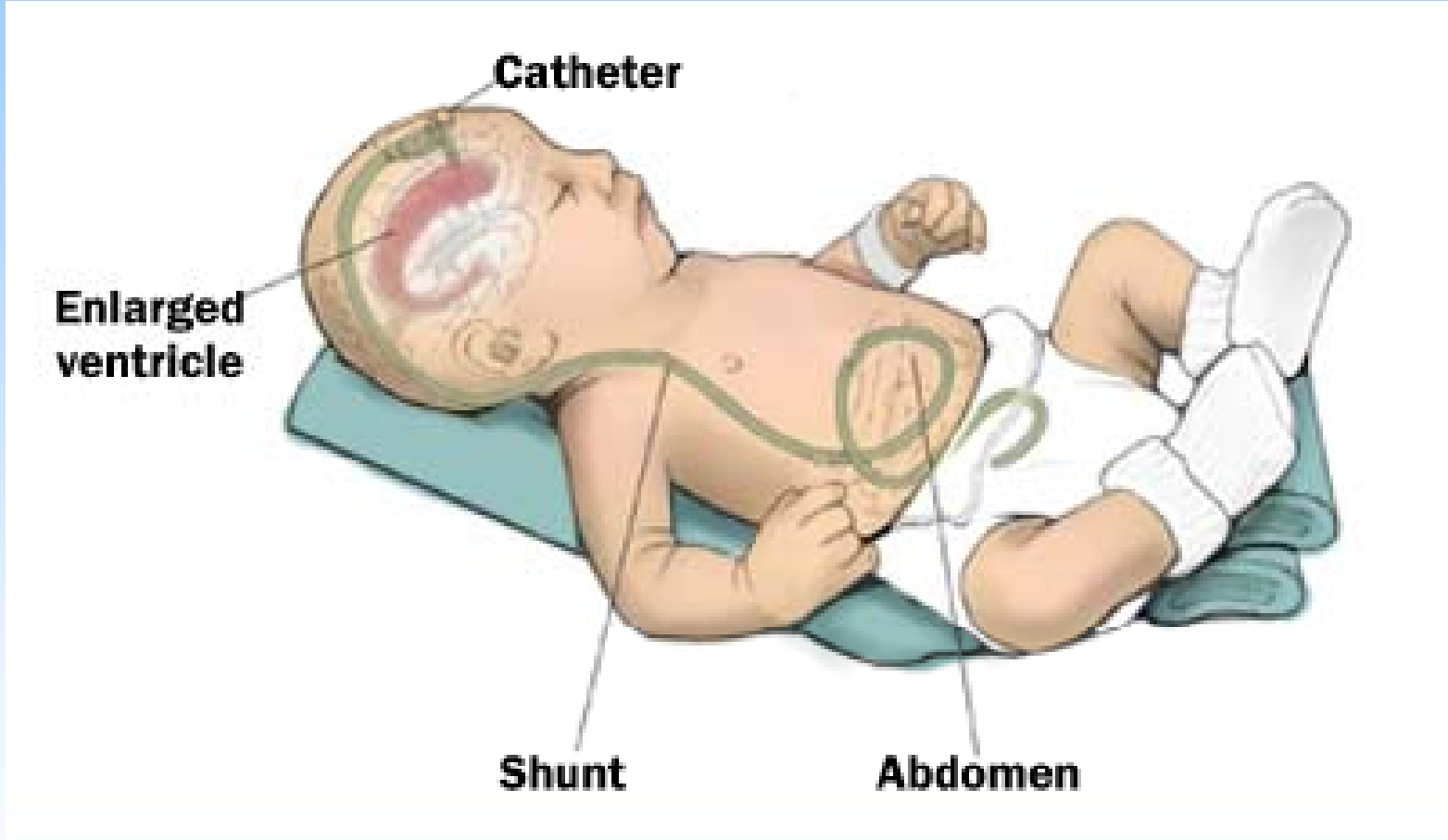






Management

- **Definitive – clear GAGs**
 - **ERT**
 - **HSCT**
- **Symptomatic**
 - **Diminish CSF production**
 - **Remove CSF – repeated LPs**
 - **Reroute CSF**
 - **External Ventricular Drain**
 - **Shunt**
 - **Third ventriculostomy**



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Shunt complications

- **Obstruction**
- **Disconnection**
- **Over- and under-shunting**
- **Infection**
- **Outgrowth**

Summary

- **Increased ICP may complicate MPS and related disorders**
- **Patients with MPS may have unrelated causes of increased ICP**
- **Ideal management treats the underlying cause**
- **Symptomatic treatment may be needed, and is usually effective**

Questions?

