

**Gomel State Medical University**  
**Department of Neurology and neurosurgery**

**Lecture**

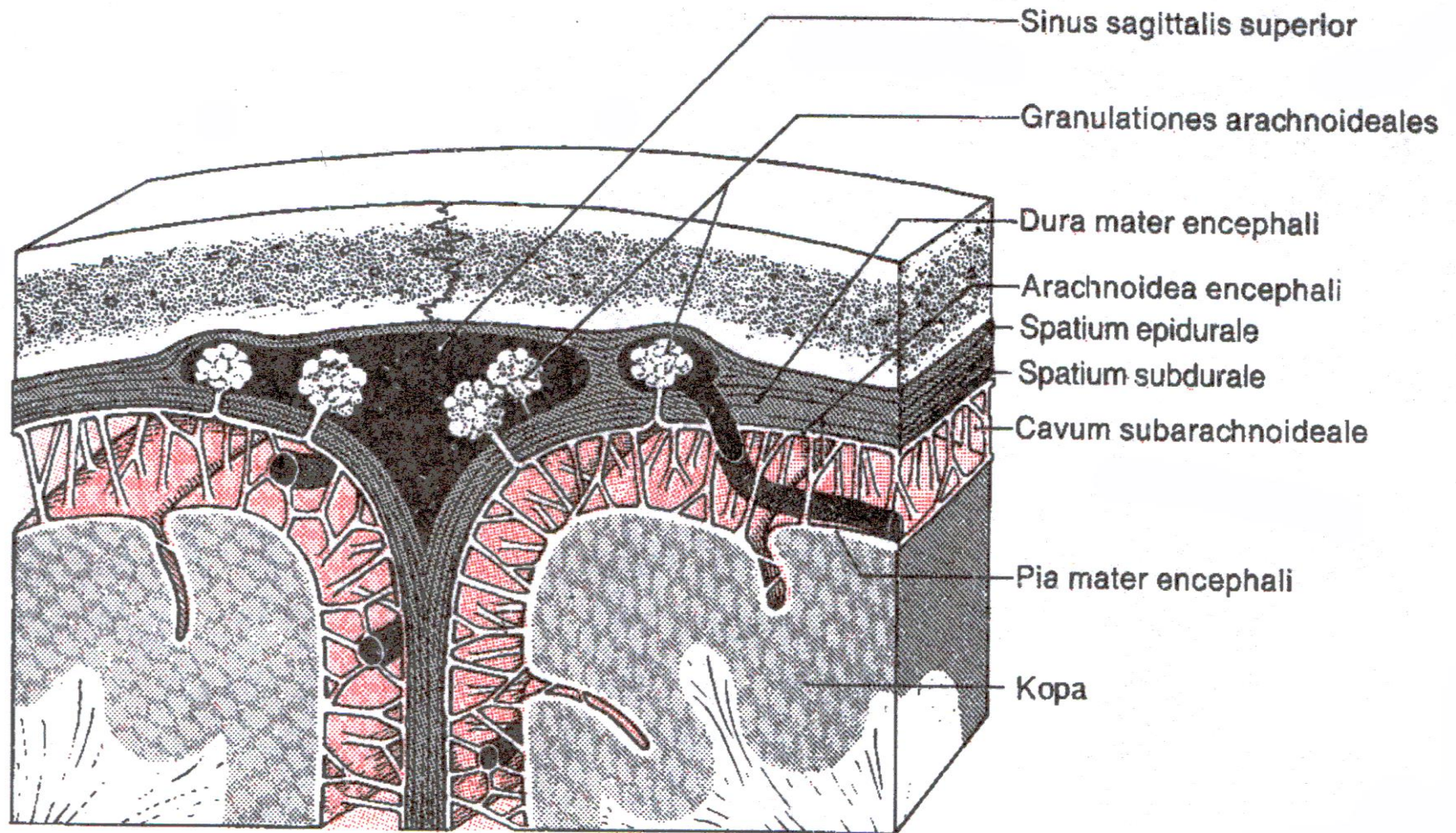
**THEME 6. LINING OF THE BRAIN,  
CEREBROSPINAL FLUID,  
MENINGEAL SYNDROME,  
INTRACRANIAL HYPERTENSION**

***The faculty of general medicine***

# **There are three meninges:**

- **dura mater;**
- **arachnoid membrane;**
- **soft (vascular) shell.**

# Schematic frontal section through the upper longitudinal sinus



**The dura mater consists of two layers of dense connective tissue.**

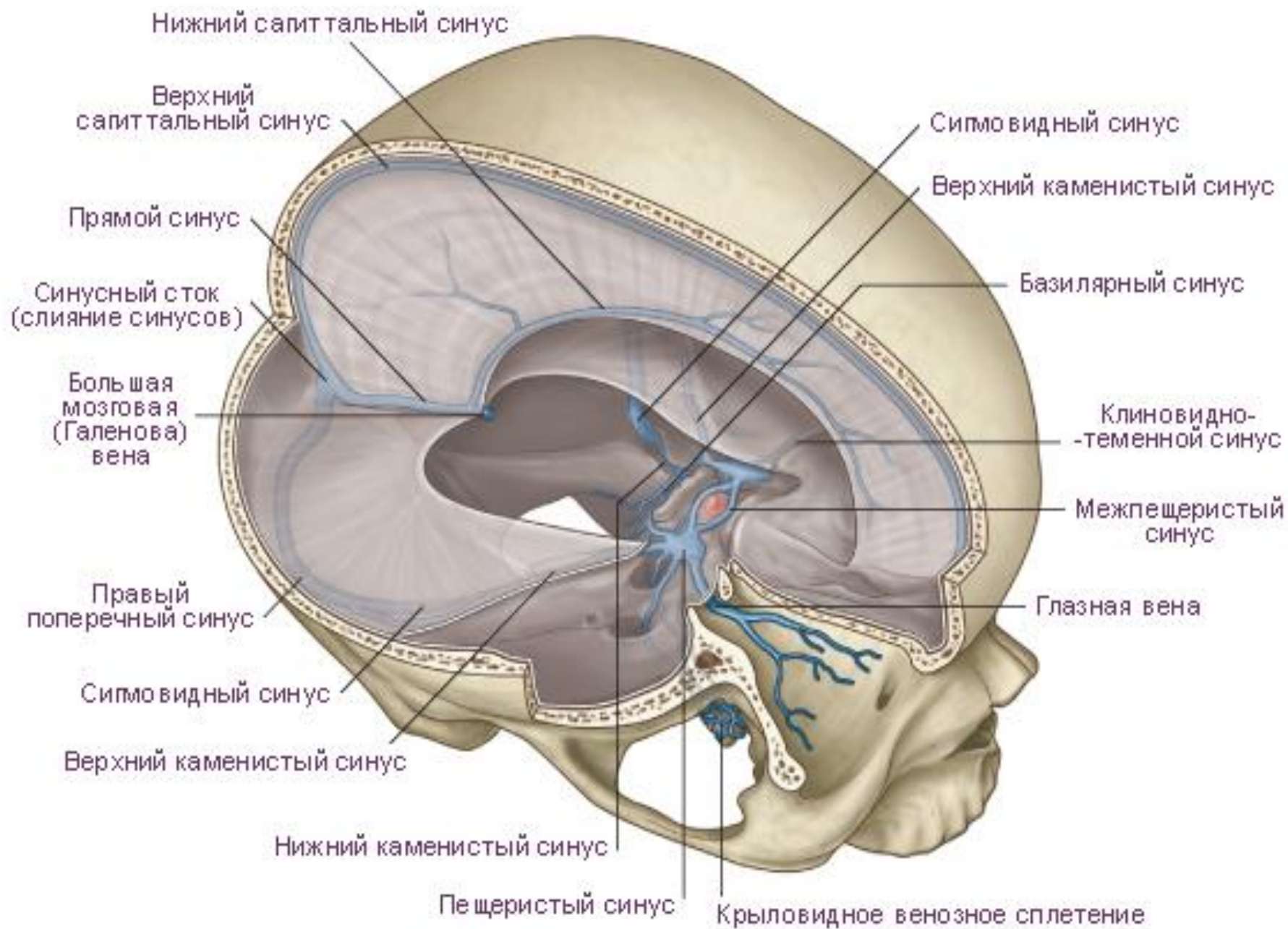
**The outer layer is the periosteum and tight to the bone.**

**Internal — actually meningeal layer, facing the arachnoid membrane.**

**The inner layer of the dura mater in places distant from the outside, forming a dural sinuses.**

**The largest of them: upper sagittal, lower sagittal and transverse sinuses.**





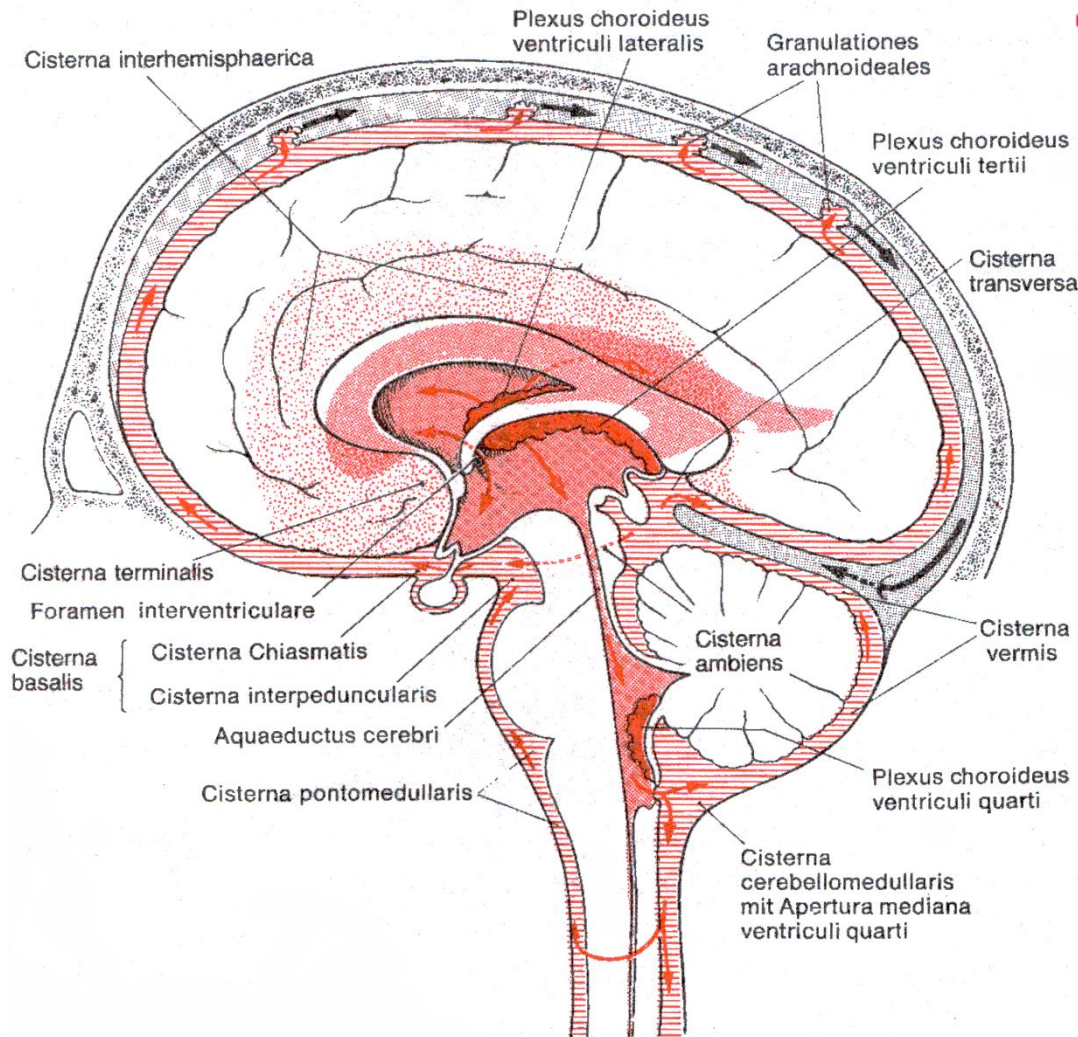
**Pia mater consists of a thin layer of mesodermal cells.**

**Between the arachnoid and soft shell formed the subarachnoid space, which is filled with circulating liquor.**

**Arachnoidea — this is a thin transparent but sturdy formation consisting of the outer cell membrane and the inner layer of connective tissue, which attached loose network of thin trabeculae.**



# Tanks of brain



**Circulation of  
the  
cerebrospinal  
fluid**

**Blood flow in  
the upper  
longitudinal  
sinus**

**Ventricular system of the brain consists of paired lateral and unpaired third and fourth ventricles.**

**Each lateral ventricle there anterior horn, the middle part (body), rear horn and lower (or temporal horn).**

**Both are connected to the third ventricle through the aperture of Monroe.**

**The third and fourth ventricles are connected by the aqueduct of Sylvius.**

**The fourth ventricle is connected to the subarachnoid space through the three holes: two Lushka side holes and a center hole Magendie.**

# Topography of intracerebral ventricular system





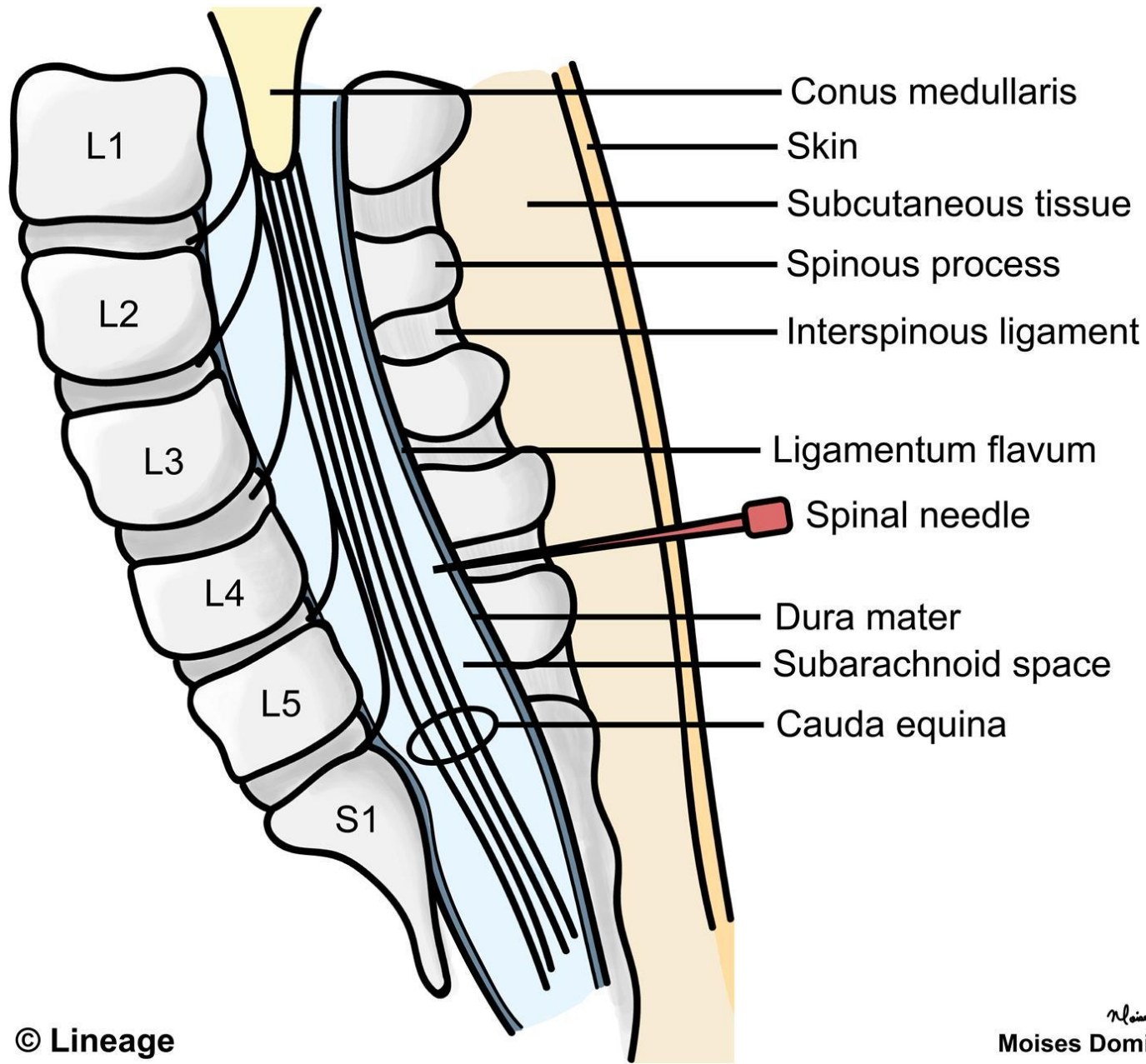
# Lumbar Puncture

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- On December 9, 1890, Heinrich Quincke performed the first lumbar puncture to save a boy dying of meningitis.



# Lumbar Puncture



# ***Normal composition of the cerebrospinal fluid***

- **Colorless, transparent;**
- **Pressure of 100-200 mm of water.lying, 200-300 mm of water.sitting down;**
- **Total protein-0.15-0.45 g / l;**
- **Glucose is half the blood glucose level (average 3.6-3.9 mmol / l);**
- **Cell count – 3-4 lymphocyte**
- **Chlorides-115-130 mmol / l**



## **Clinic of irritation of the meninges (meningeal syndrome):**

- **headache, vomiting, pain on percussion of the skull, increased sensitivity to light, sound and skin irritants;**
- **tonic tension of the muscles (the extensor cervical spine); symptom rigidity neck;**
- **Kernig symptom;**
- **upper, middle and lower symptoms**
- **Brudzinskogo;**
- **«Pose hound dog».**

# Менингеальные симптомы

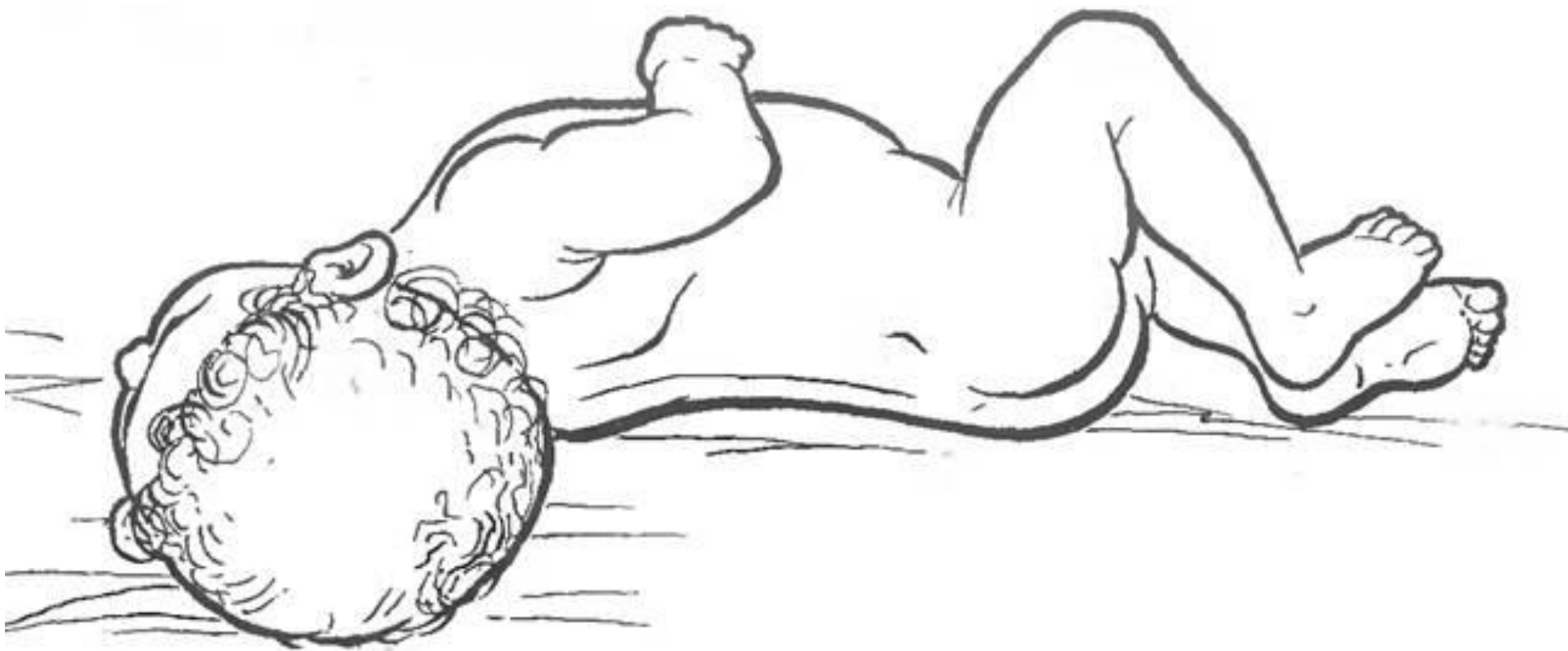


симптомы Брудзинского



ригидность  
задне-шейных мышц

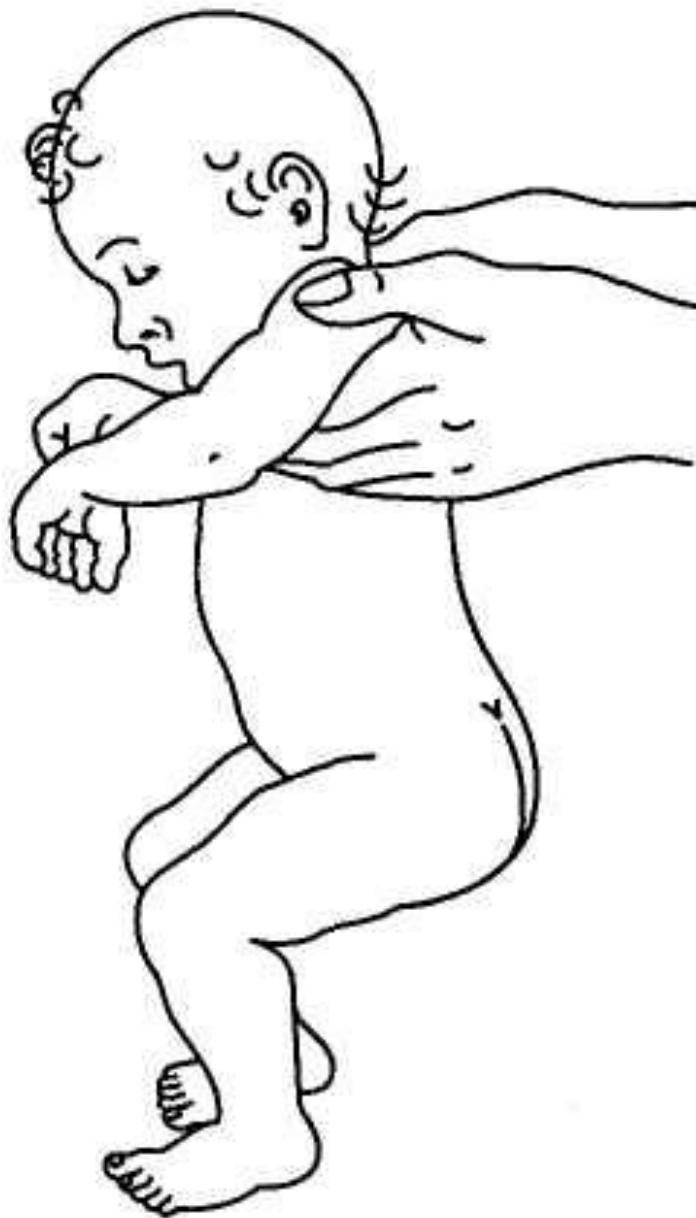
# Поза «легавой собаки»



**Children observed symptom of «hanging» on Lessazhu — raise the child, supporting for axillary area, with legs pulled up to his stomach involuntarily through a double bend.**

**Bechterev symptom: when tapped on the zygomatic arch increased headache and involuntary grimace appears on the corresponding side of the face.**

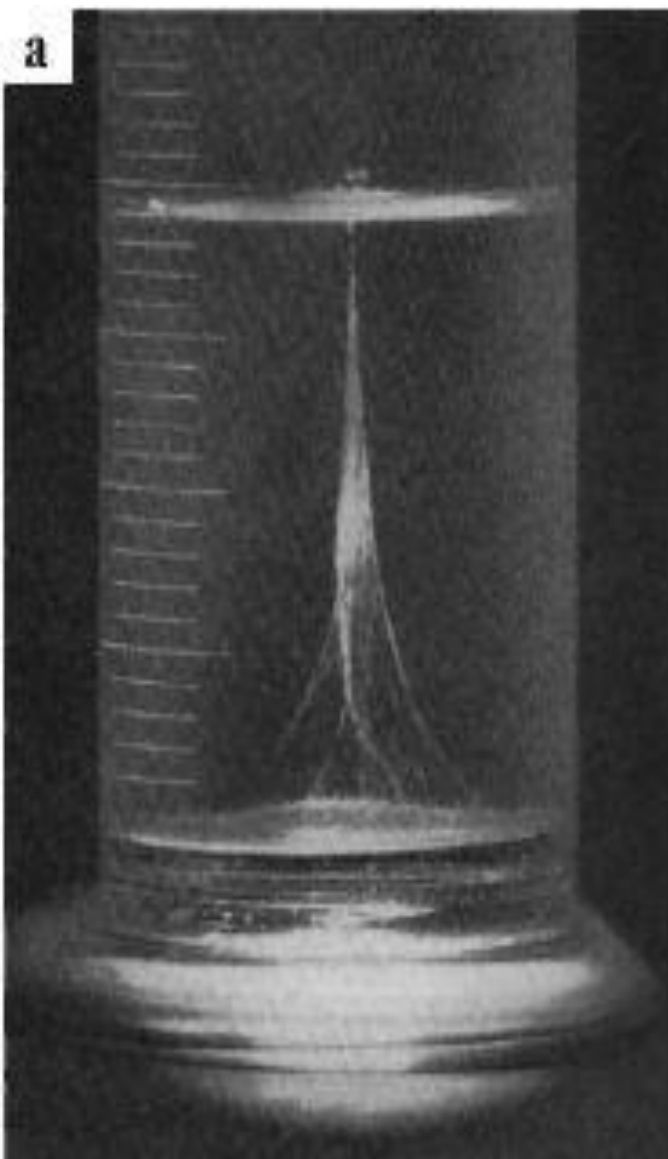
# Симптом подвешивания Лессажа



## **Changes in the color of the CSF:**

- **blood in the cerebrospinal fluid indicates subarachnoid hemorrhage;**
- **with meningitis liquor becomes turbid from the presence of a large number of corpuscles;**
- **yellow-greenish liquor takes after subarachnoid hemorrhage, with meningococcal meningitis, with brain tumors.**

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## ***Pathological changes of cerebrospinal fluid:***

- **Cell-protein dissociation (in meningitis)**  
- cells predominate in the cerebrospinal fluid;
- **Protein-cell dissociation (in brain and spinal cord tumors, Guillain-Barre syndrome)** - protein predominates in the cerebrospinal fluid;
- **Low level of glucose in tuberculous meningitis, purulent bacterial meningitis.**

# ***Meningism syndrome***

***The presence of meningeal symptoms in the normal analysis of cerebrospinal fluid (influenza, SARS)***



# **Inflammatory diseases of the shells of the brain**

- **Meningitis — inflammation of the shells of the brain and spinal cord.**
- **Meningitis — inflammation of the soft and arachnoid meninges.**
- **Pachymeningitis — an inflammation of the dura mater of the brain.**

**Classification provides for the separation of serous meningitis and purulent.**

**When serous meningitis in CSF lymphocit cells predominate, with purulent — mainly neutrophils.**

# **Pathogenetic classification**

**primary;**

**Secondary (there is a primary focus of infection).**

# Etiological classification of meningitis:

bacterial;

Viral;

Fungal;

Caused by protozoa.

On localization:

Generalized;

Delimited.

## **Meningitis is diagnosed with a presence of 3 syndromes:**

- infectious;**
- meningeal;**
- inflammatory changes in the cerebrospinal fluid.**

**General laboratory diagnosis is confirmed, bacteriological, virological studies of blood and cerebrospinal fluid. Lumbar puncture is performed in all patients with signs of meningeal irritation.**



## **General symptoms of meningitis:**

- **fever, chills;**
- **headache;**
- **increased sensitivity to sound and visual stimuli;**
- **sometimes skin rashes;**
- **stiff neck, a symptom of Kernig, Brudzinskogo (upper, middle and lower);**
- **zygomatic symptom of Bechterev, lockjaw;**
- **symptom of «hanging» Lessazha;**

- **meningeal «pose hound dog»;**
- **pain when pressing the eyeballs;**
- **agitation, delirium, stupor, coma;**
- **heart rate slowed in the early stages, then tachycardia;**
- **respiratory failure;**
- **venous congestion in the fundus, swelling of the optic nerve;**
- **sometimes strabismus, double vision, difficulty swallowing.**

## **Purulent meningitis**

**Epidemic cerebrospinal meningitis caused by Gram-negative diplococci — *Neisseria meningitidis*. The infection is spread by droplets from an infected person or a healthy carrier. Sick more often young children, mostly in the winter-spring period, sporadic cases can occur at any time of year.**

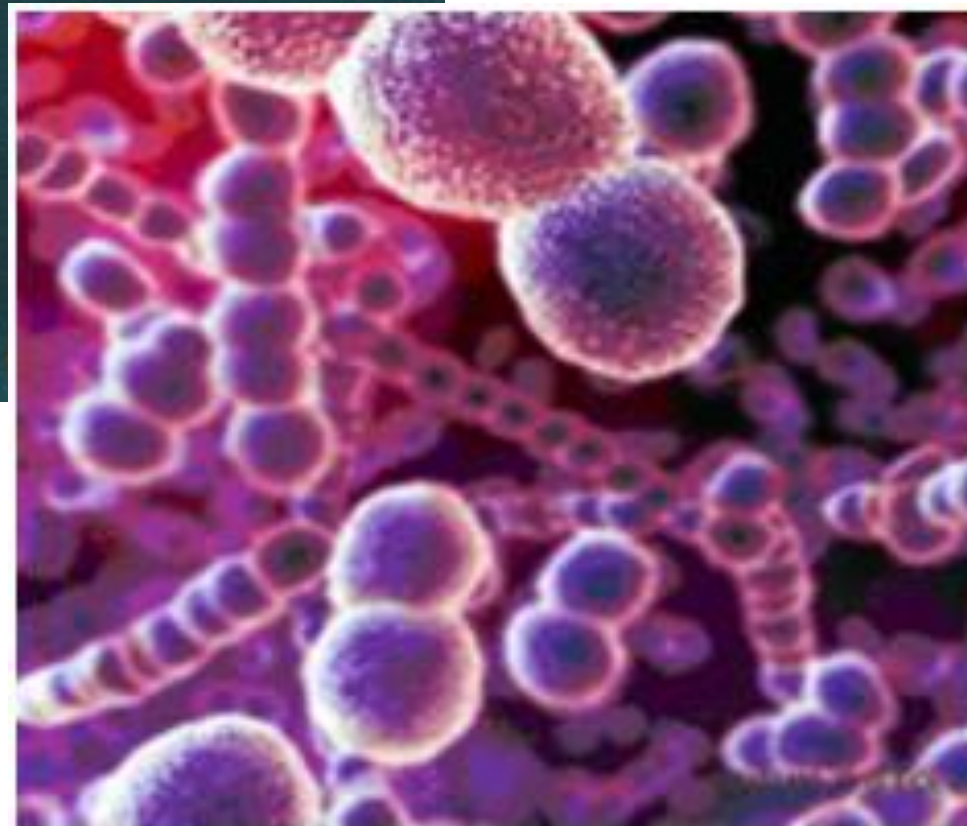
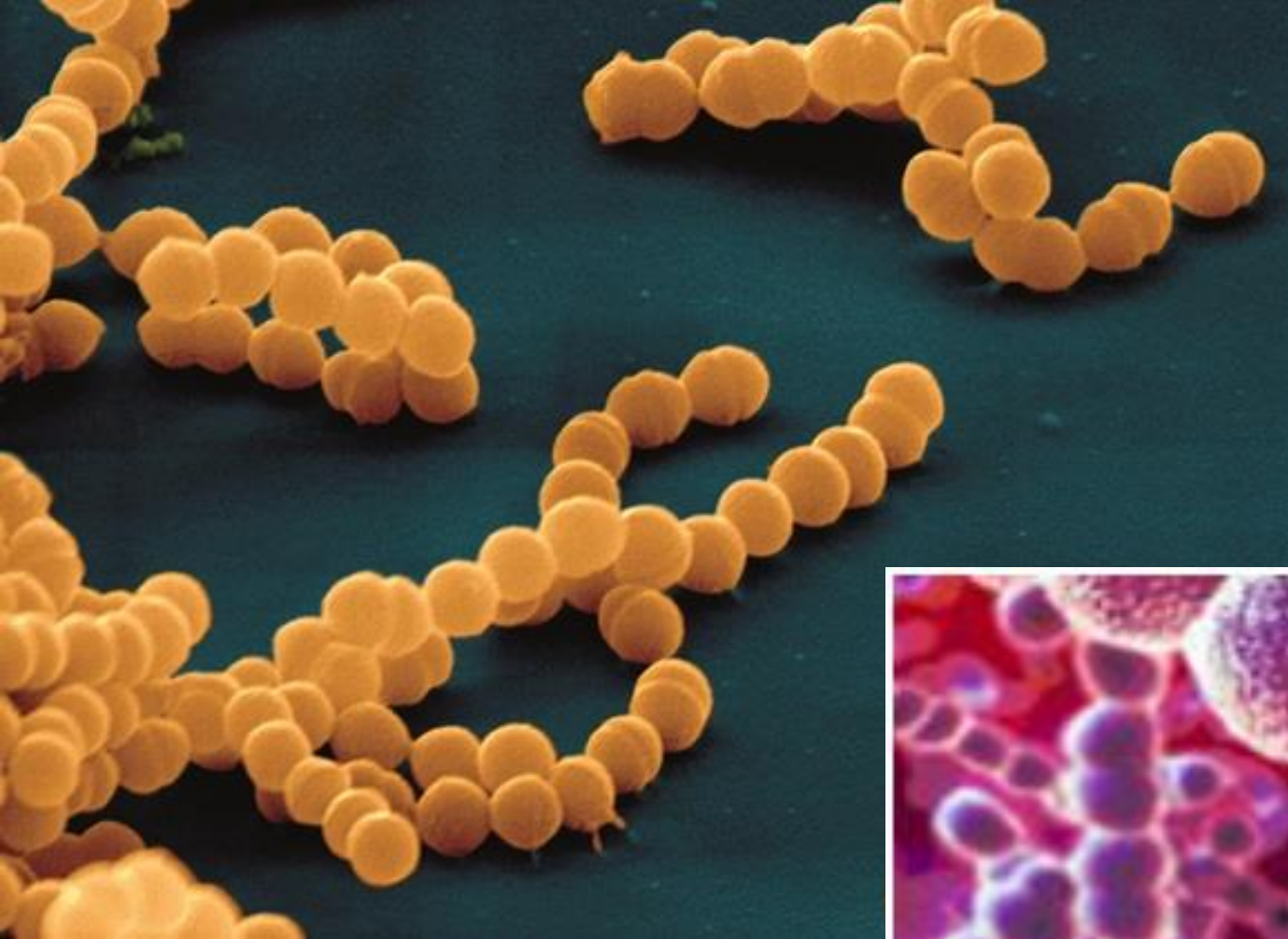
- Сыпь при менингококкемии



- Характерная поза больного при менингите



**Secondary purulent meningitis. Infection (usually pneumococci, bacillus Pfeiffer, at least — staphylococci, streptococci) gets contact, hematogenous, lymphatic, perineural by infections from various sources (blood, ears, sinuses, tonsils, wound opening).**



**The disease begins with a high fever (40-40,5°C). A detailed picture of meningitis detected in 12-24 hours. Liquor muddy, green, its pressure is increased, determined neutrophilic pleocytosis (tens of thousands), the protein content of more than 2-3 g/l. When microscopy detected pathogen (Streptococcus pneumoniae, Streptococcus).**

**In the blood — leukocytosis with a left shift, accelerated ESR.**



# **Serous meningitis**

**characterized by serous inflammatory changes in the meninges.**

**Enteroviral meningitis  
ECHO and Coxsackie viruses  
are highly contagious, so the  
disease often occurs in the  
form of epidemic outbreaks.**

**Tuberculous meningitis**  
**is a manifestation**  
**hematogenic-**  
**dissemination of**  
**tuberculosis. sick more**  
**often children with**  
**tuberculosis lung, bronchial**  
**lymphcal and choroidal**  
**plexus.**

**Clinic.** Against the background of subfebrile temperature display fatigue, headache, changes in the nature.

**In children, there is crying, drowsiness, and irritability.**

**Patients lose weight, increasing headache, vomiting, disturbed sleep, there are mental health problems, the temperature rises to 38-39°C, there is a stiff neck, a sharp increase in headache patients clutching his head, sharp scream («hydrocephalic cry»).**

**Gradually increasing strabismus, diplopia, anisocoria, ptosis, reflexes are reduced or disappear, grow stupor, impaired consciousness, convulsions appear, then developed decerebrate rigidity, violated vital functions.**

# **General principles of treatment of meningitis**

- **Causal treatment:**
- **In bacterial meningitis-antibiotics (must penetrate the blood-brain barrier, have no neurotoxic effect, act on the pathogen) - Cephalosporins of the third generation, Penicillins, Vancomycin**

# **General principles of treatment of meningitis**

- **Pathogenetic therapy**
- **Decongestant therapy;**
- **Adequate oxygenation;**
- **Glucocorticoid;**
- **Detoxification and infusion therapy;**
- **Neuroprotection**
- **Symptomatic therapy (analgesics, antipyretics, anticonvulsants, etc. )**

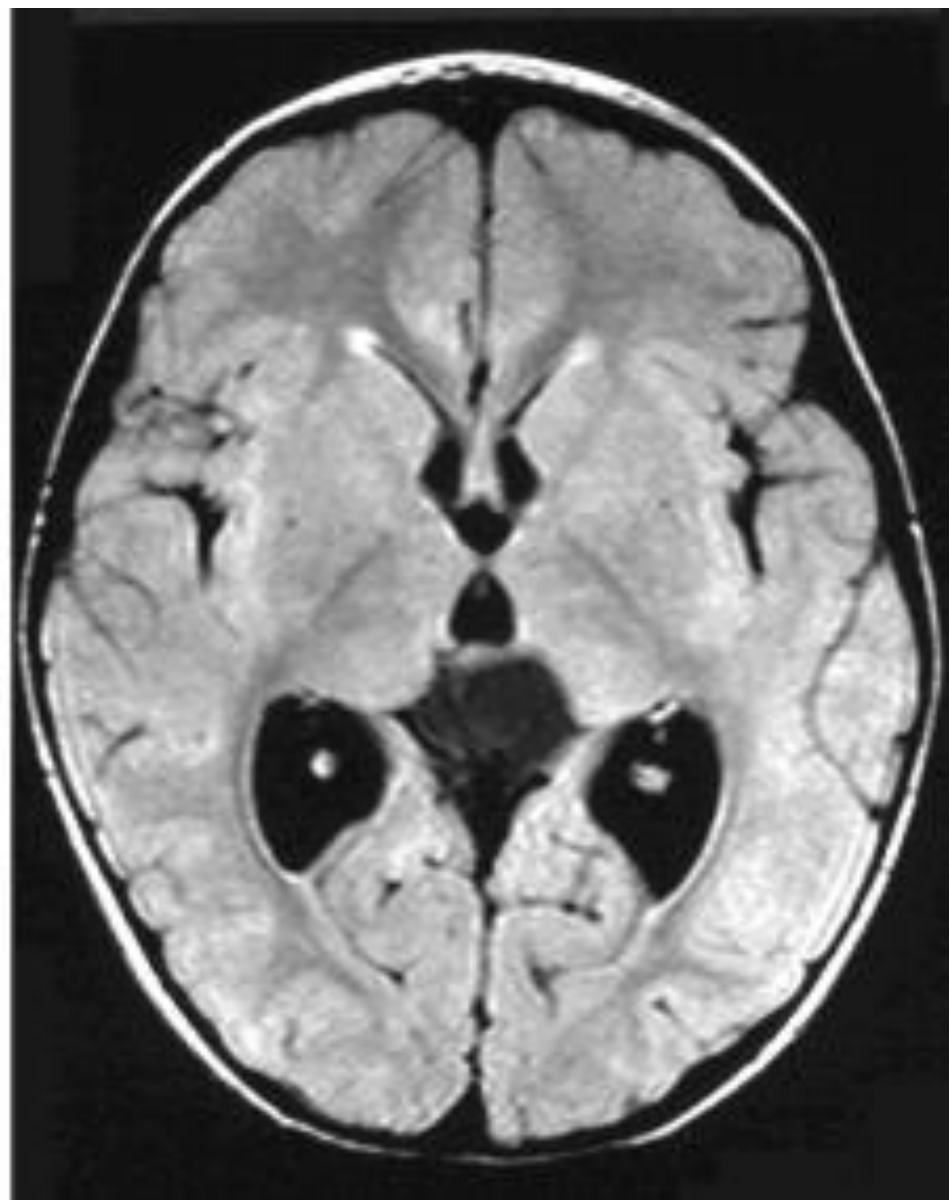
## **Intracranial hypertension**

- **Intracranial pressure is normal, in case the lumbar puncture in the supine position are equal 150-180 mm water column (11-13 mm Hg).**
- **It consists of three components: the pressure of cerebrospinal, interstitial and intracellular fluids.**
- **Increased intracranial pressure with brain tumors develop due to:**
  - 1) increasing the mass of the tumor;**

- 2) occlusion of liquor in violation of the outflow tract cerebrospinal liquid;**
- 3) swelling of the brain;**
- 4) imbalance «products — suction» cerebrospinal fluid;**
- 5) violation of the venous outflow or «local» origin, or due to increased central venous pressure at the inadequacy of breath and constant vomiting.**



**The clinical signs of intracranial hypertension slow its rise appears uncertain, often «morning» headaches, often at the height of headache marked vomiting.**



# **Dislocations and herniation of the brain**

- **The most common temporal-occipital and axial tentorial wedging.**
- **Starting wedging is characterized by pain in the back of the head and neck, stiff neck, forced position of the head. The growth of herniation leads to disturbances of consciousness and vital bulbar disorders ending apnea, if not received emergency assistance.**

