Hydrocephalus in children

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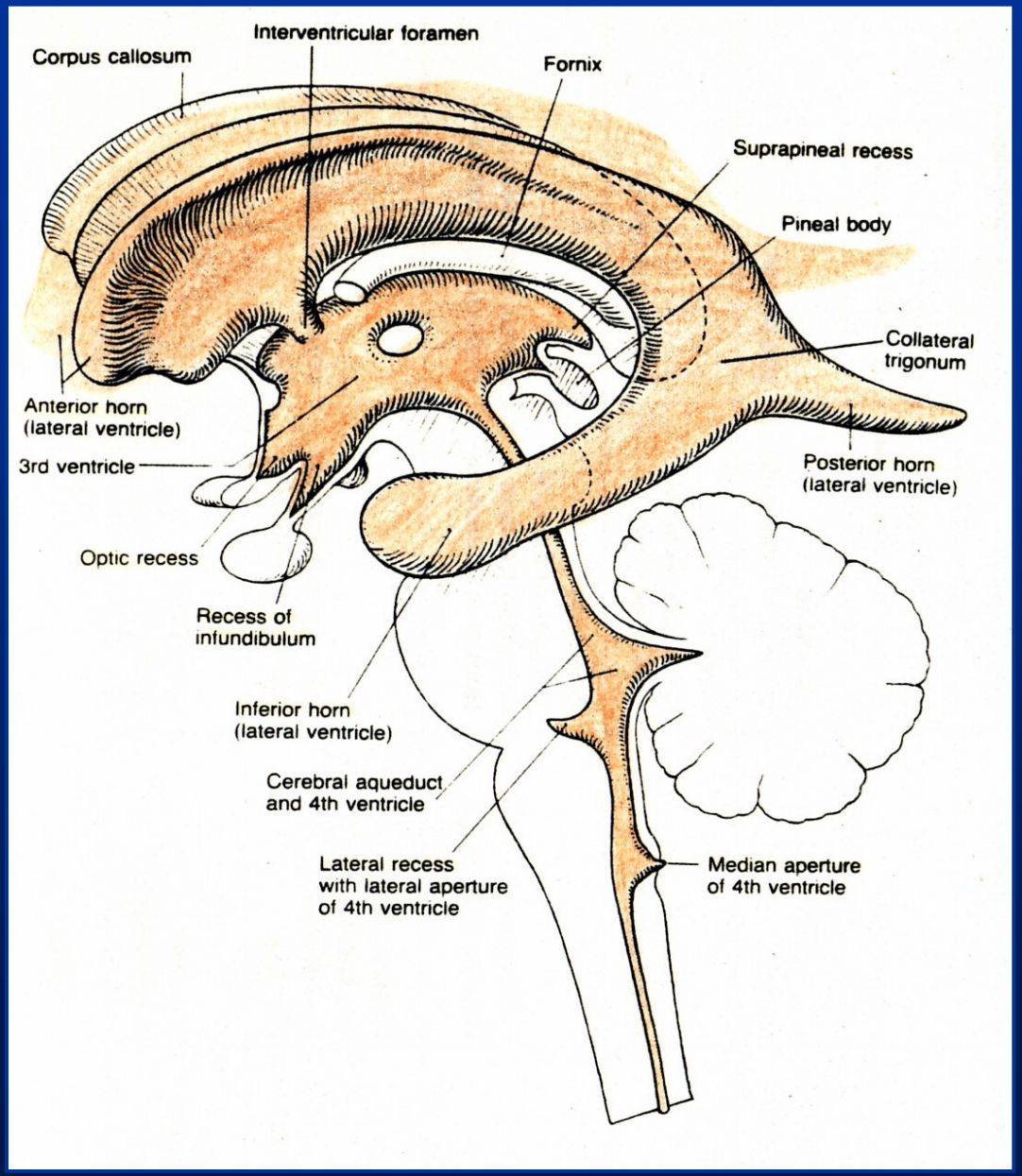
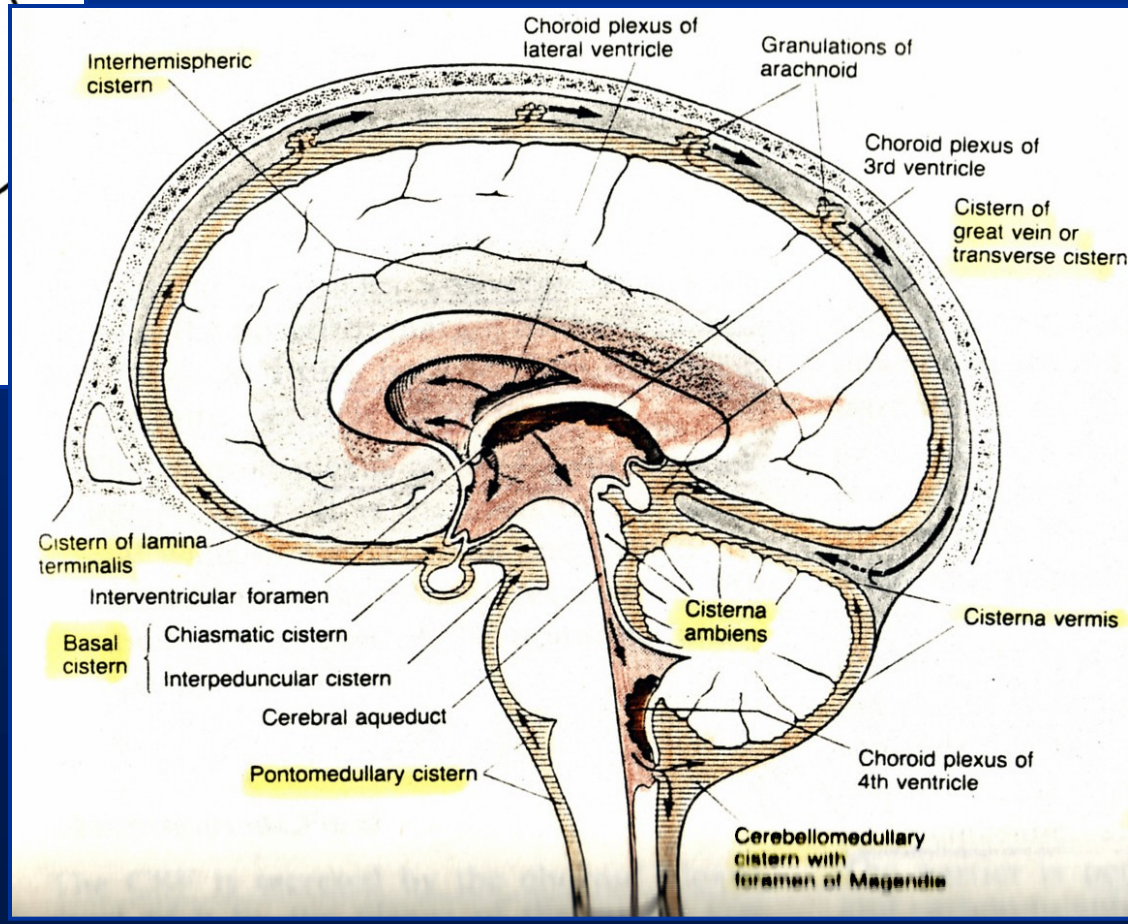
Ventricle system



Ventricle system, cerebral cisterns



Hydrocephalus taxonomy

- hypersecretion
- hyporesorbtion

- internal
- external

- obstructive (non-communicating)

- communicating (non-obstructive)

- active
- arrested

- congenital
- acquired
  - *posthaemorrhagic*
  - *postinfekctious*
  - *posttraumatic*

Signs and symptoms

- Makrocephaly, fontanelle bulging, „setting sun sign“, Parinaud sy
- Intracranial hypertension
  - cephalea - diffuse, valve headache, reverse Tinnel´s sign
  - vomitus - explosive, no nausea
  - vertigo
  - seazures
  - unconsciousness
  - respiratory and cardiac arrhytmia

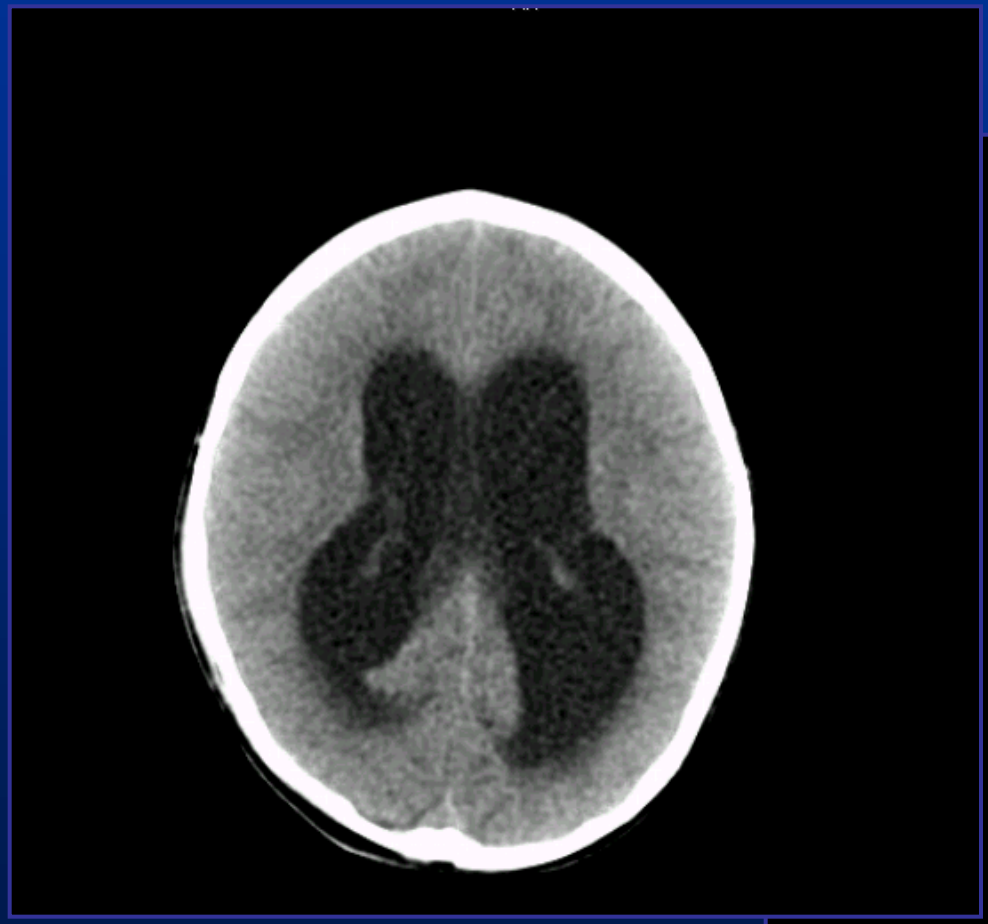
Hydrocephalus

Diagnosis of hydrocephalus

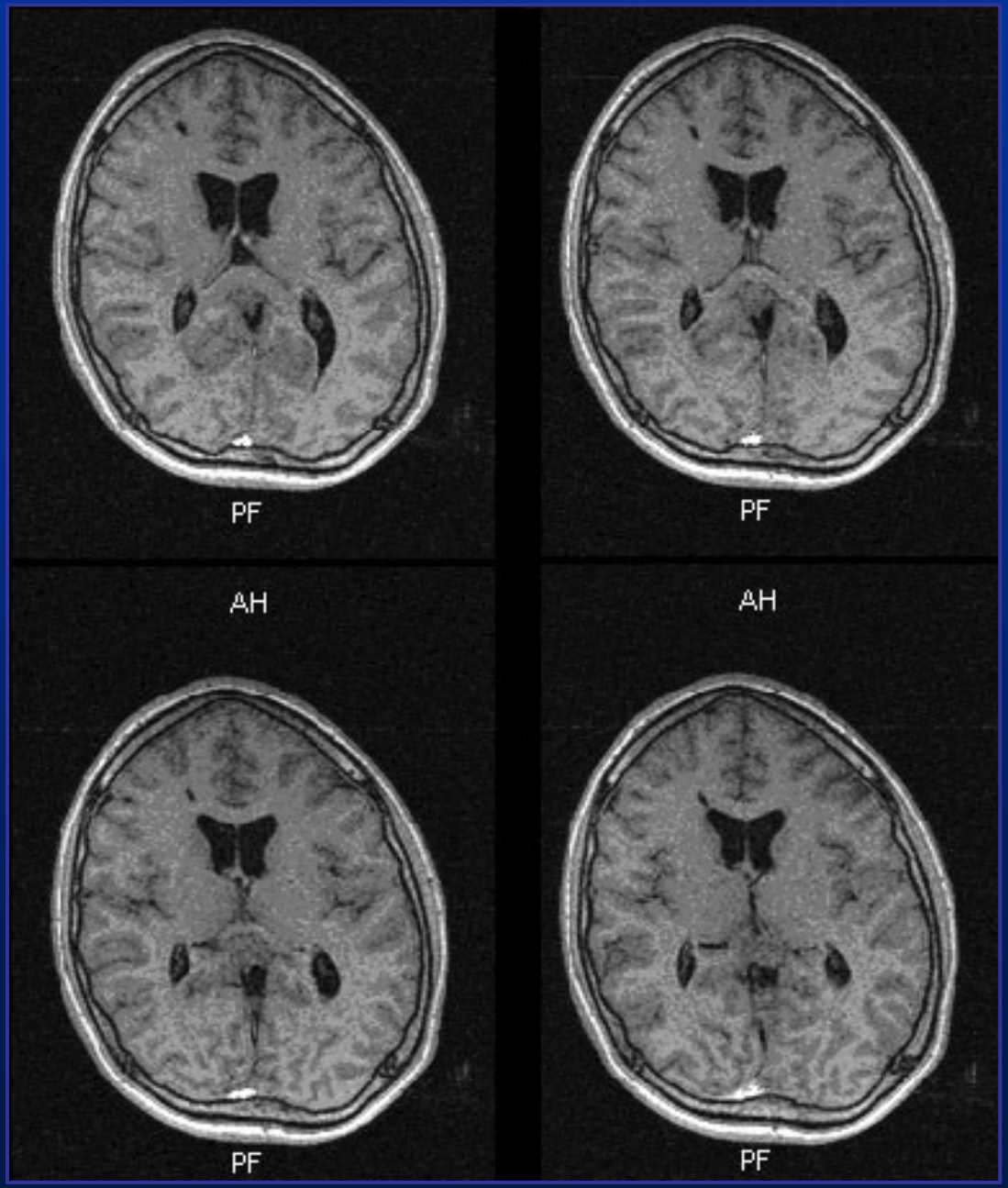
- Neurology examination
- Neuroimaging modalities
  - ultrasound
  - CT
  - MRI
- Ocular fundus

Cerebral ultrasound examination

Cerebral CT

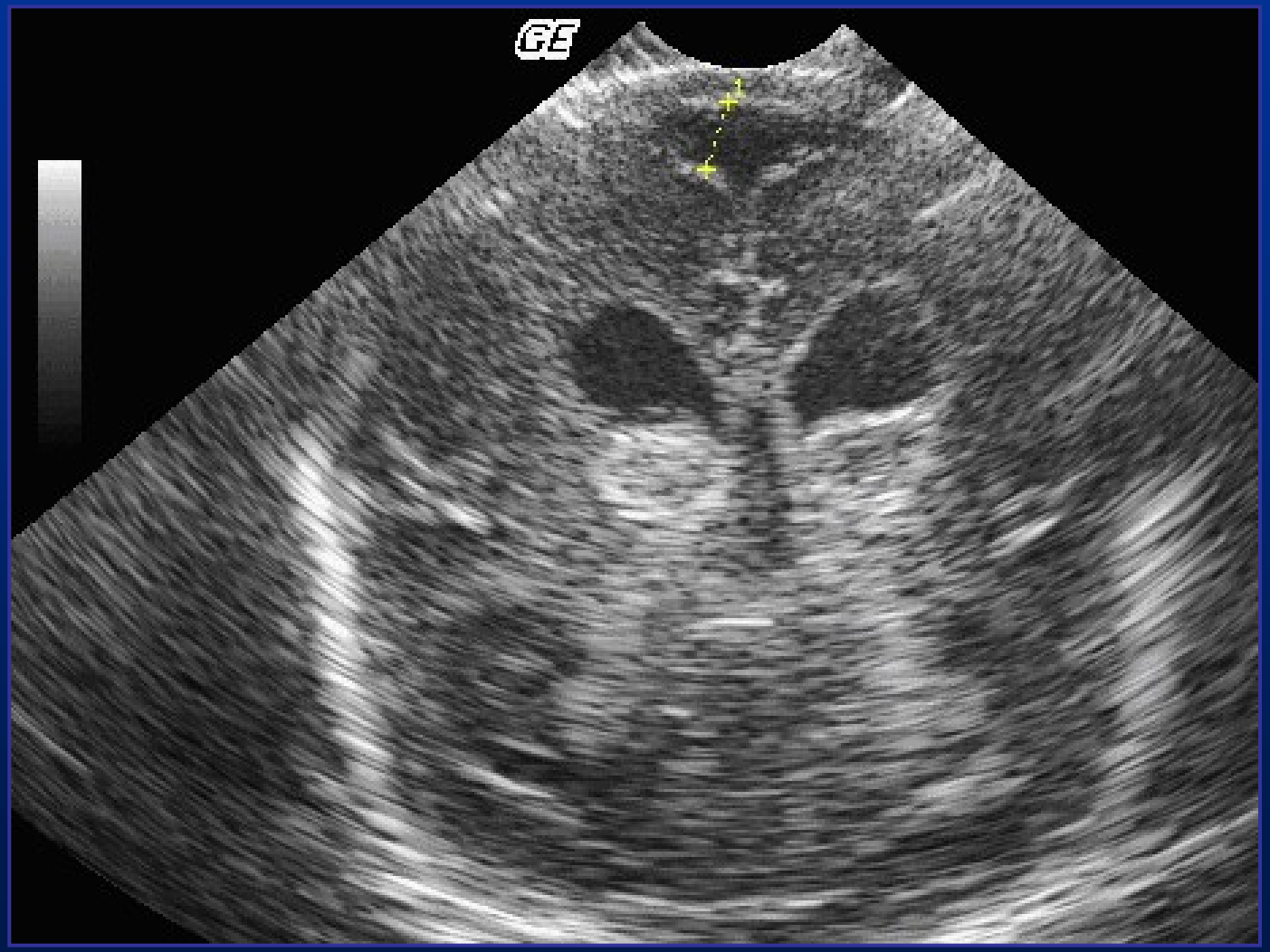


Cerebral MRI



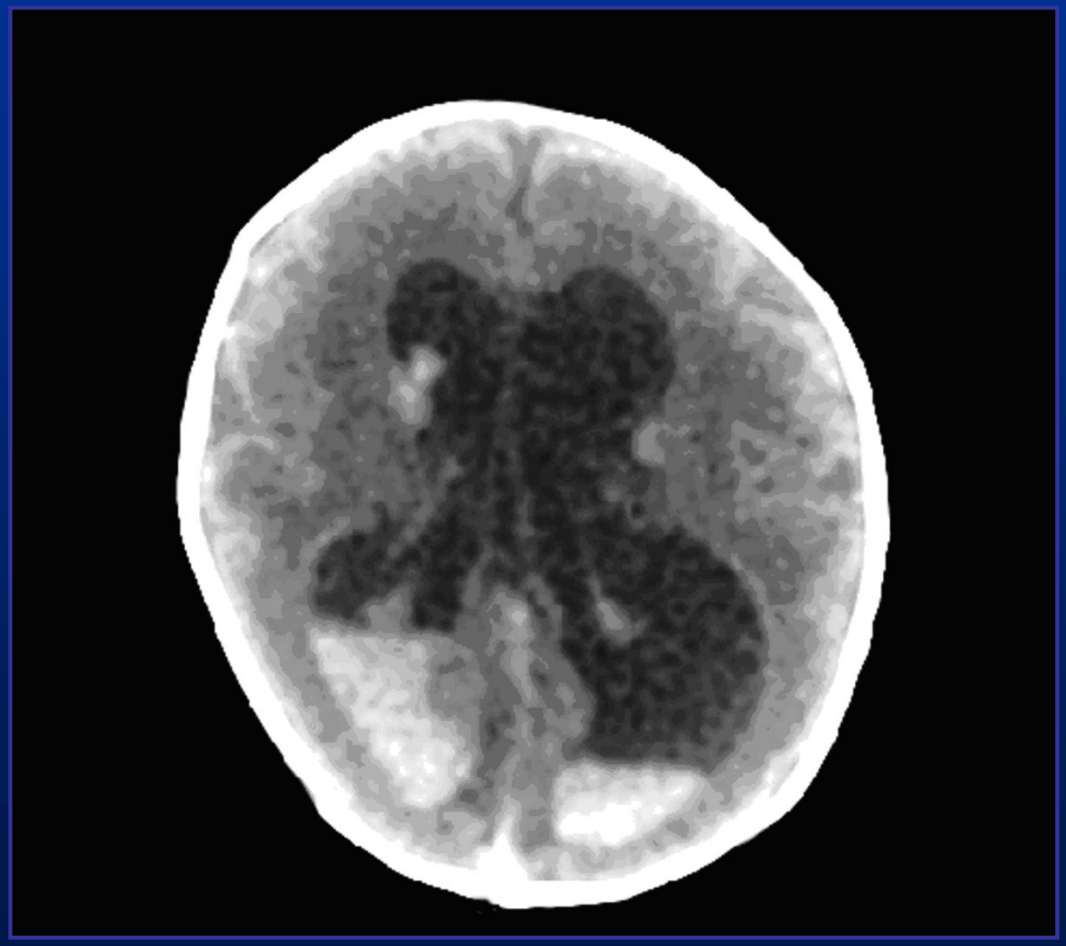
Posthaemorrhagic hydrocephalus

ultrasound imaging



Posthaemorrhagic hydrocephalus

CT imaging



Hydrocephalus treatment

- Medical
- Surgery

Hydrocephalus treatment temporary

- Medicamentose (diuretics)
- Spinal tap
- Ventricular punction
- Ventricular drainage
- Lumbar drainage

Posthaemorrhagic hydrocephalus

temporary treatment

Surgical treatment of hydrocephalus

Drainage – shunting – VA, VP,

(Nulsen, Spitz, Holter, Pudenz)

Neuroendoskopy techniques

Surgical treatment of hydrocephalus

A) Eliminating of obstruction cause (e.g. tumor exstirpation)

B) Arteficial CSF communication (neuroendoskopy, Stoockey – Scarff)

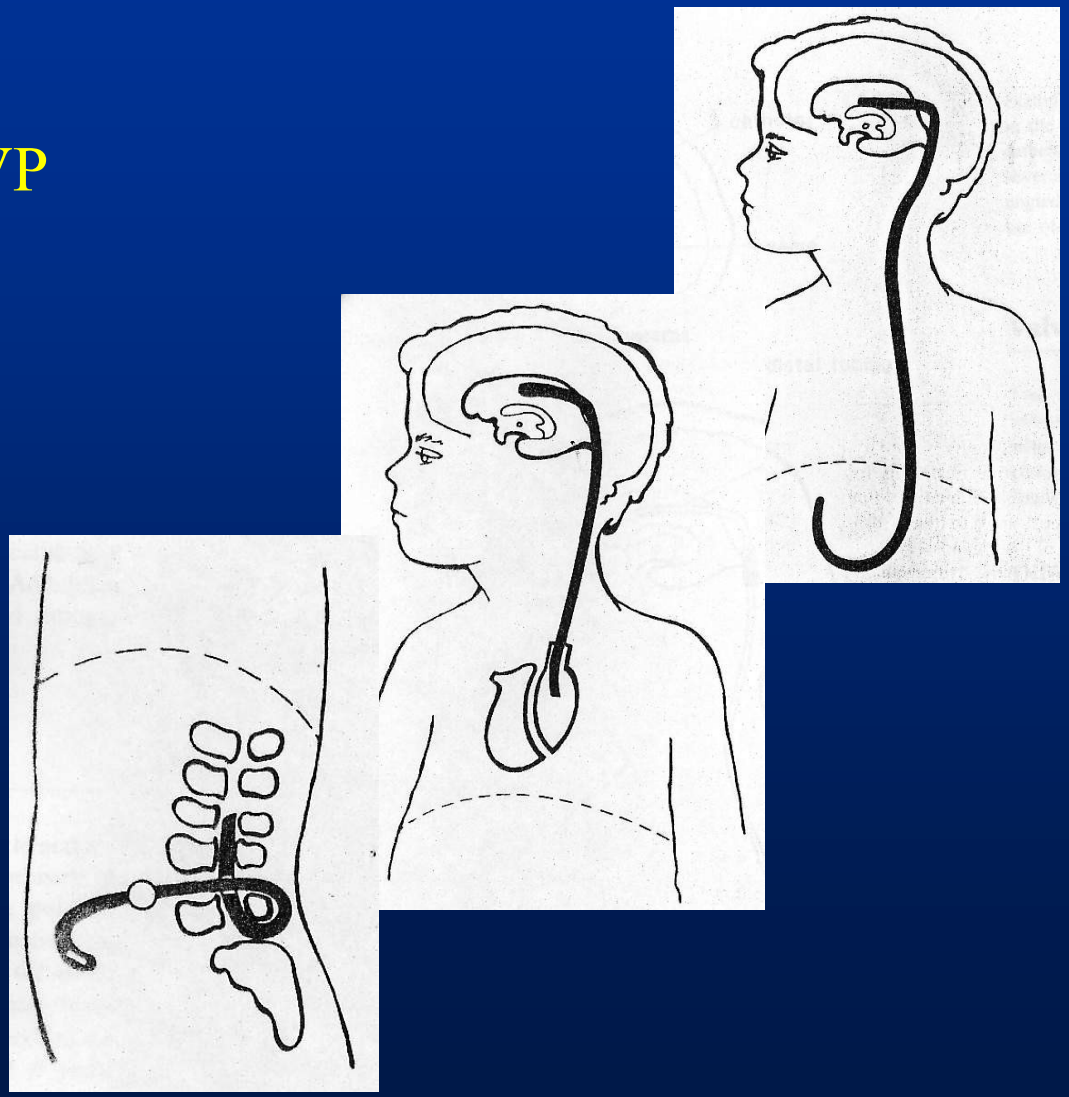
C) CSF drainage

Drainage

- Most common surgery performed
- Communication between the ventricles and CSF resorbtion space

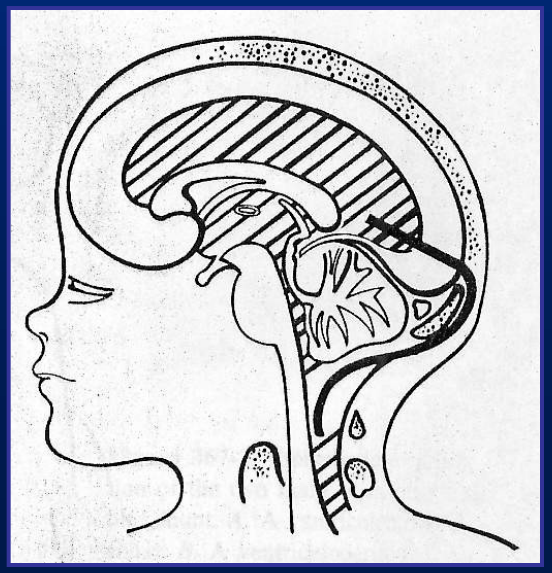
Drainage modifications

- ventriculo – peritoneal VP
- ventriculo – atrial VA
- lumbo - peritoneal

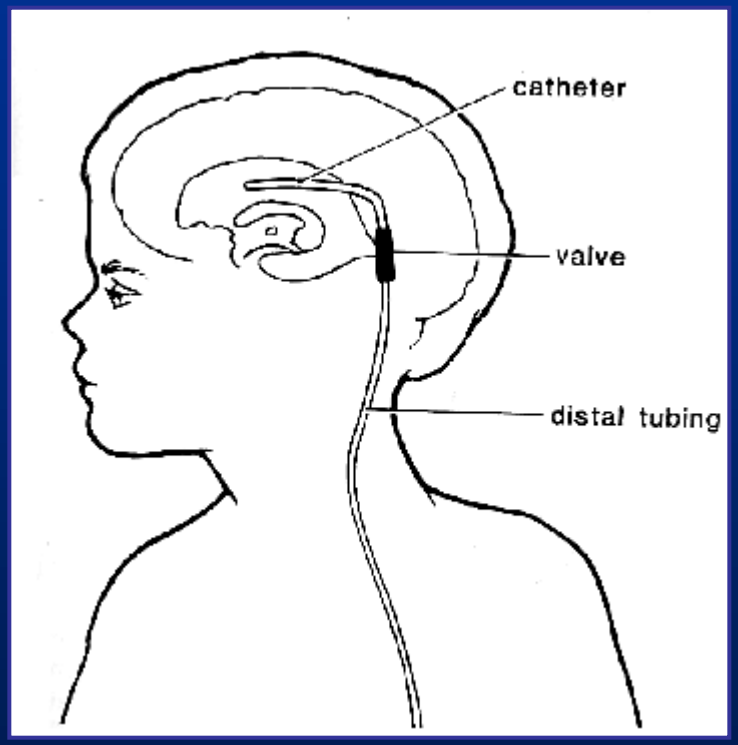


Drainage modifications

- ventriculo - subgaleal
- ventriculo - pleural
- Torkildsen



V-P drainage



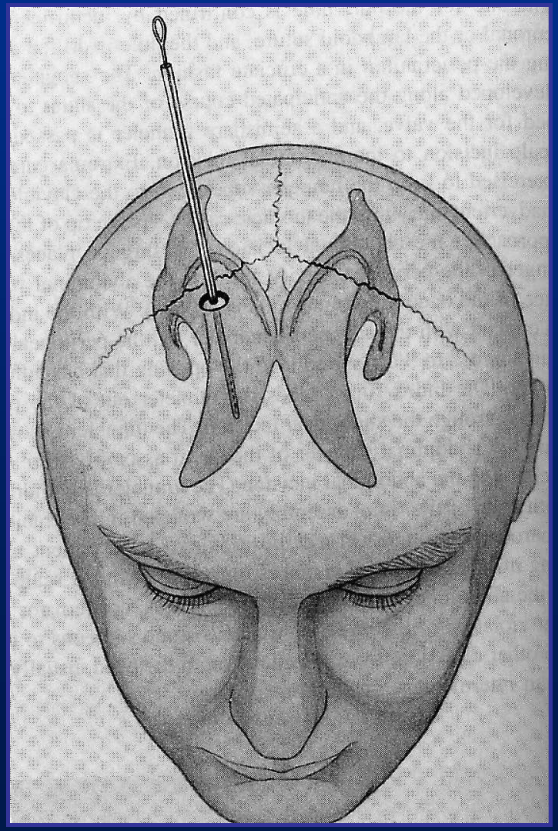
ventricular catheter

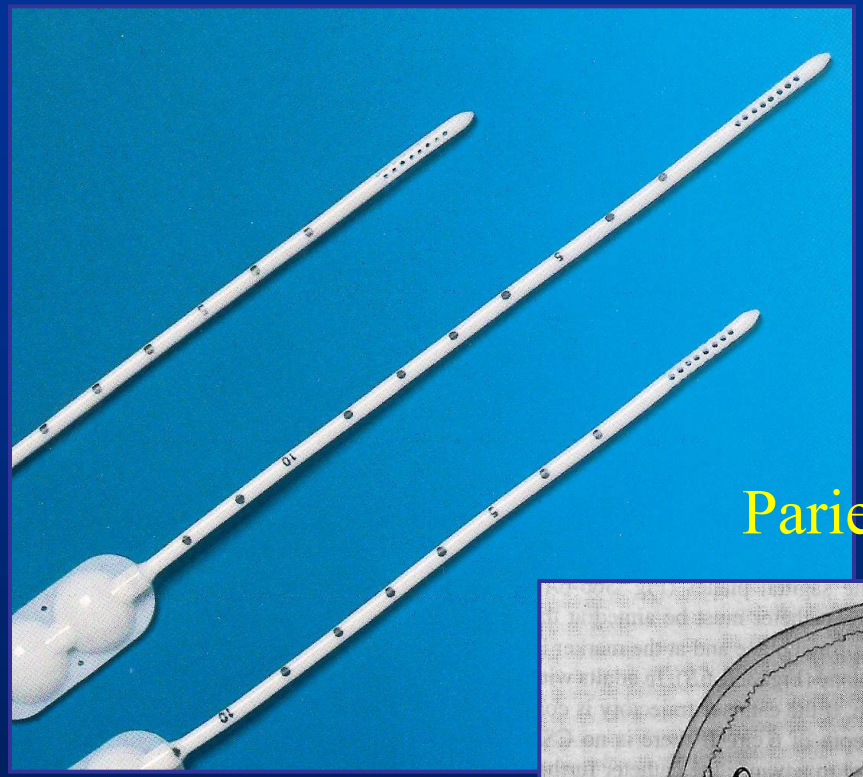
valve

peritoneal catheter

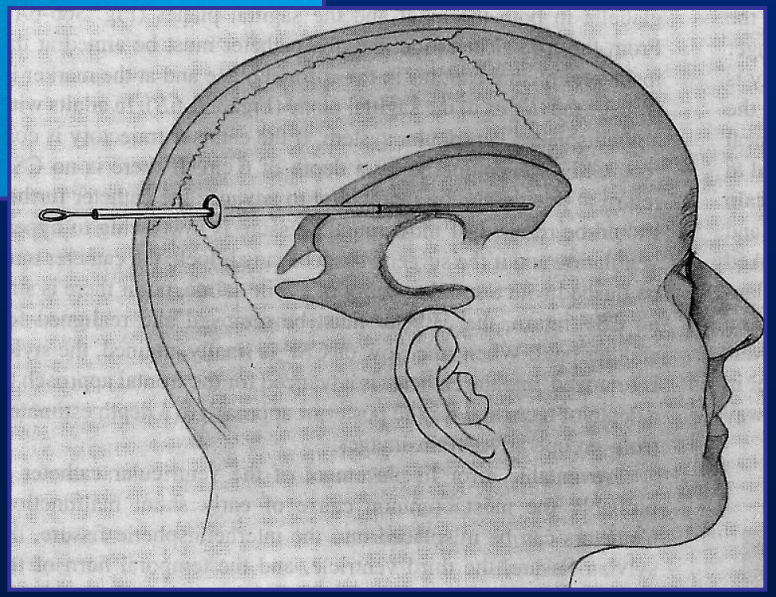
Insertion of ventricular catheter

Dorso-frontal





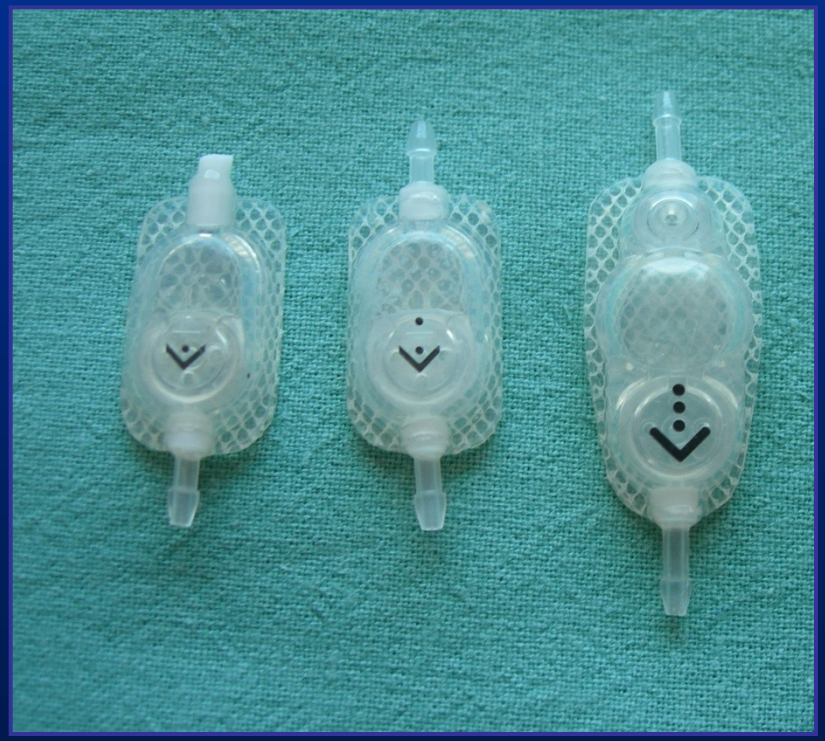
Parieto-occipital



Valves – non programmable

Valve opening pressure:

low pressure	50 mm H_2O
middle pressure	100 mm H_2O
high pressure	150 mm H_2O



Programmable valves

system Codman

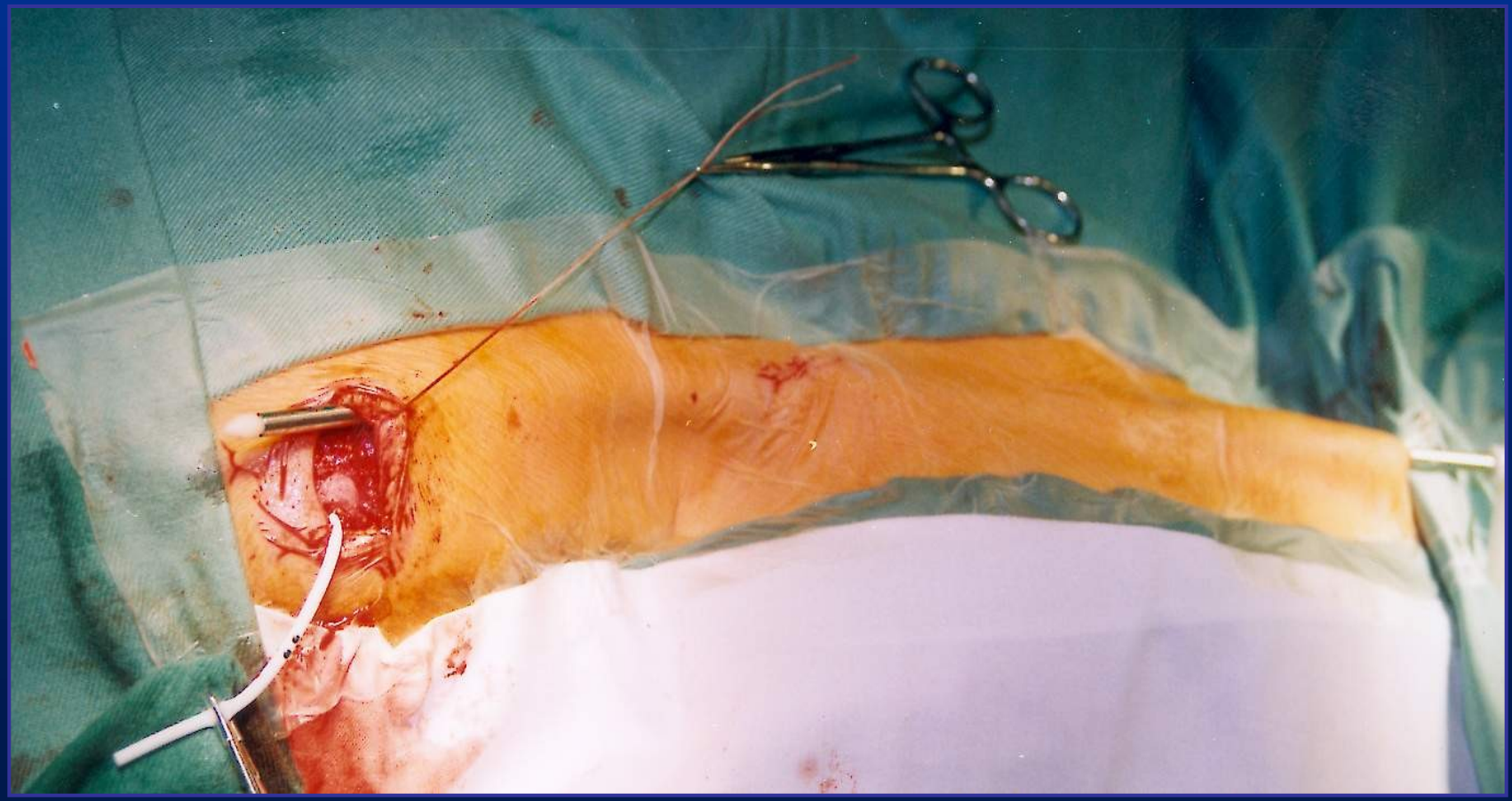
Programmable valves

system Strata Medtronic

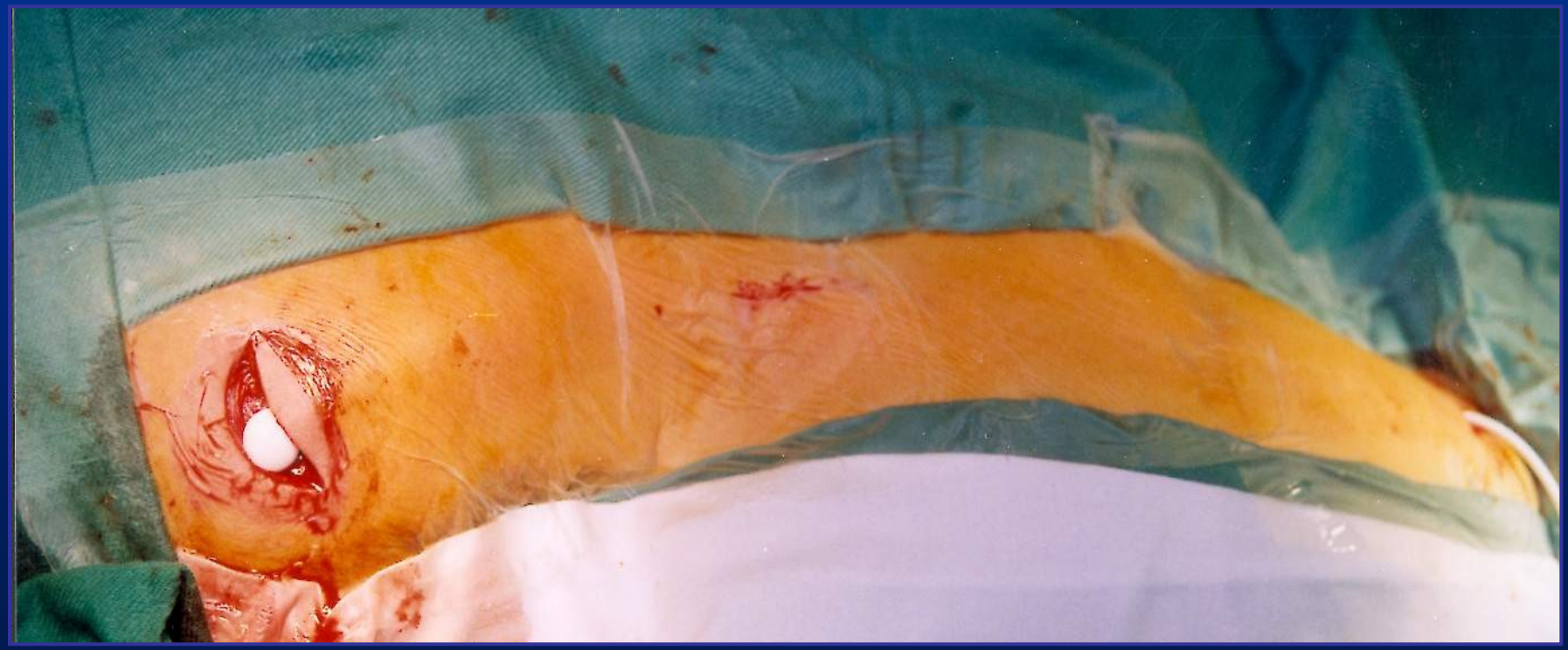
Surgery - drainage
VP shunt
patient positioning

Surgery - drainage - VP shunt

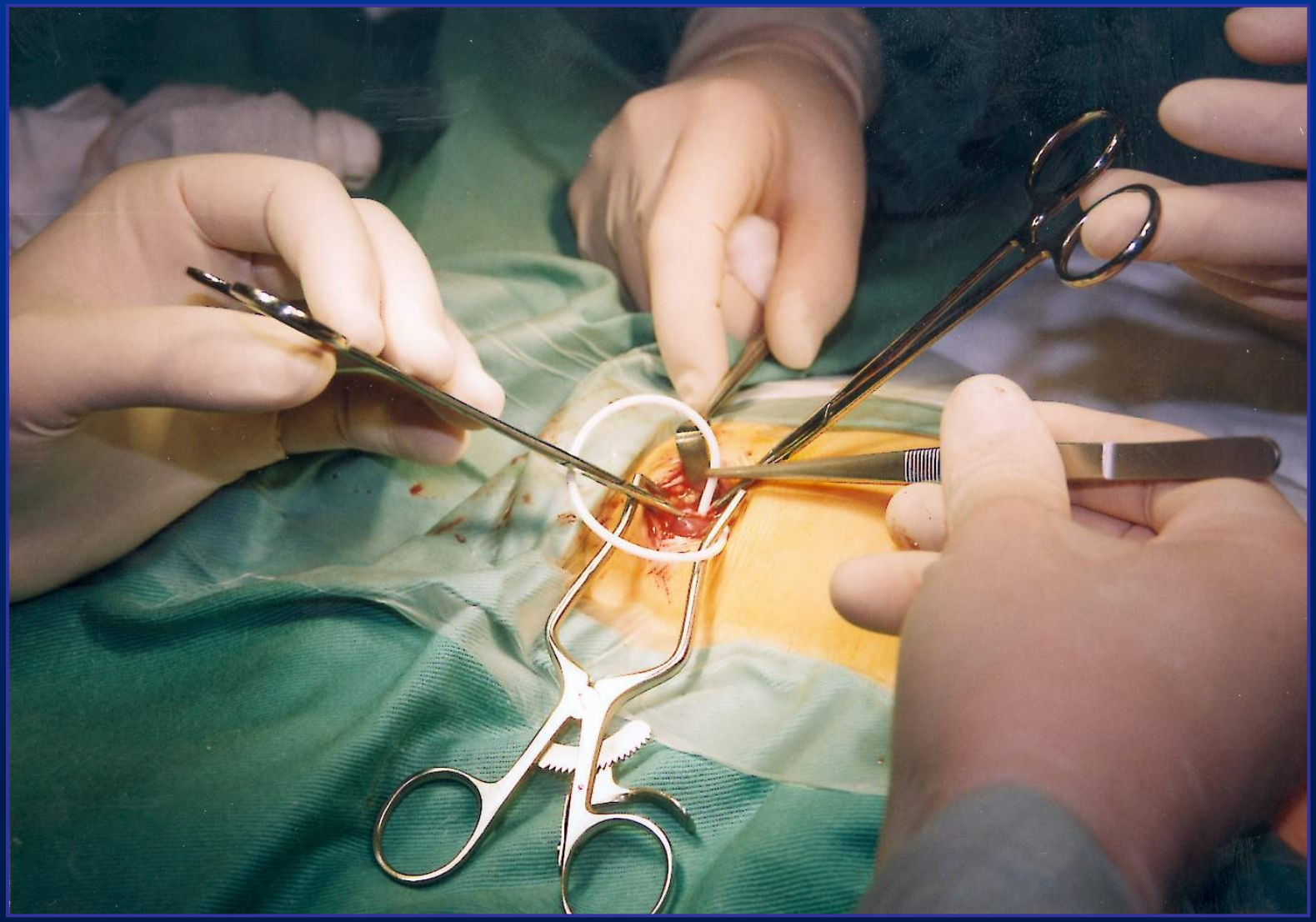
Surgery - drainage - VP shunt



Surgery - drainage - VP shunt



Surgery - drainage - VP shunt



Surgery - drainage - VP shunt

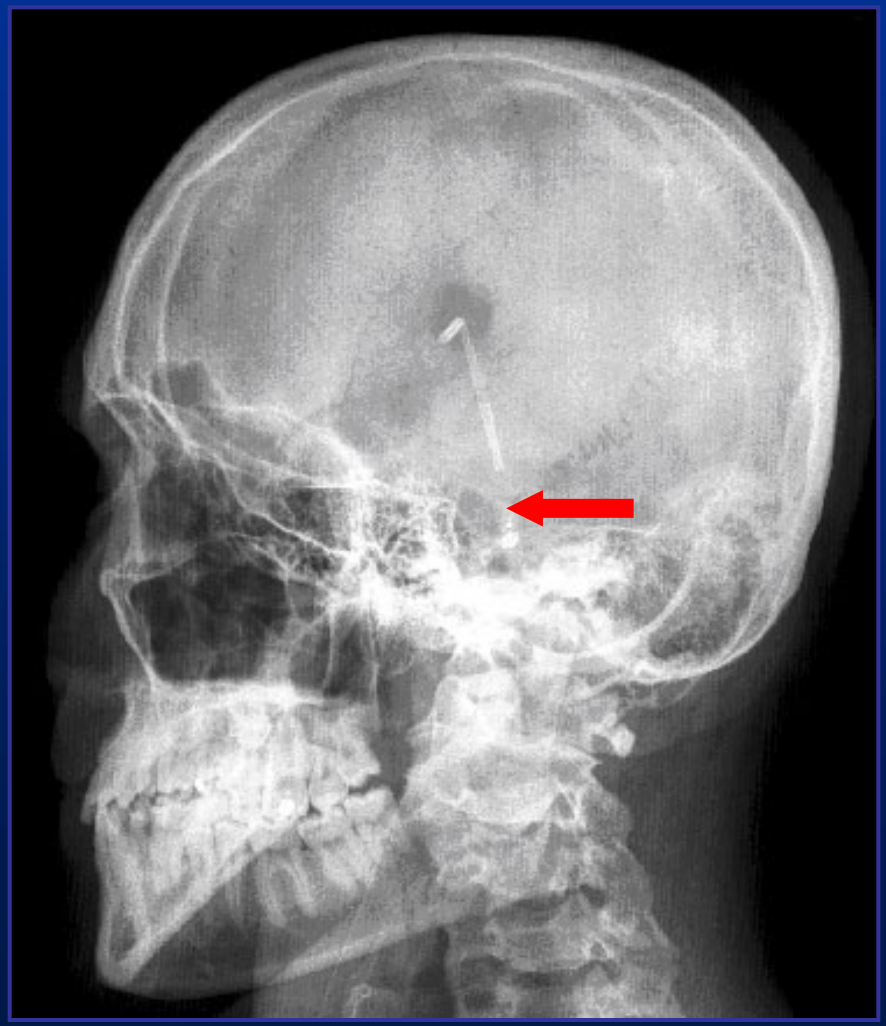
Shunt malfunction

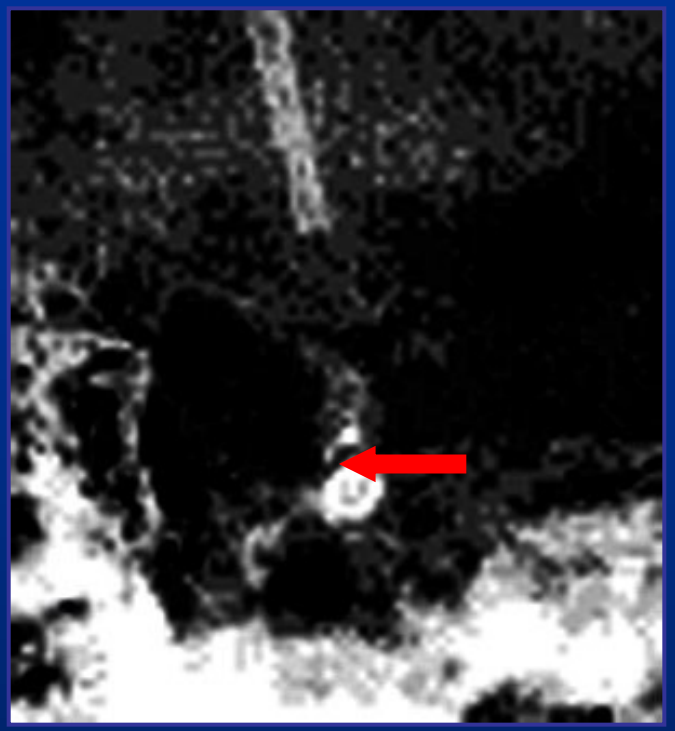
- Neurological examination
- Fundus oculi
- Percutanneous valve test
- Velve pressure resetting

(programable valves only)

X-rays

(systém Codman valve markers)

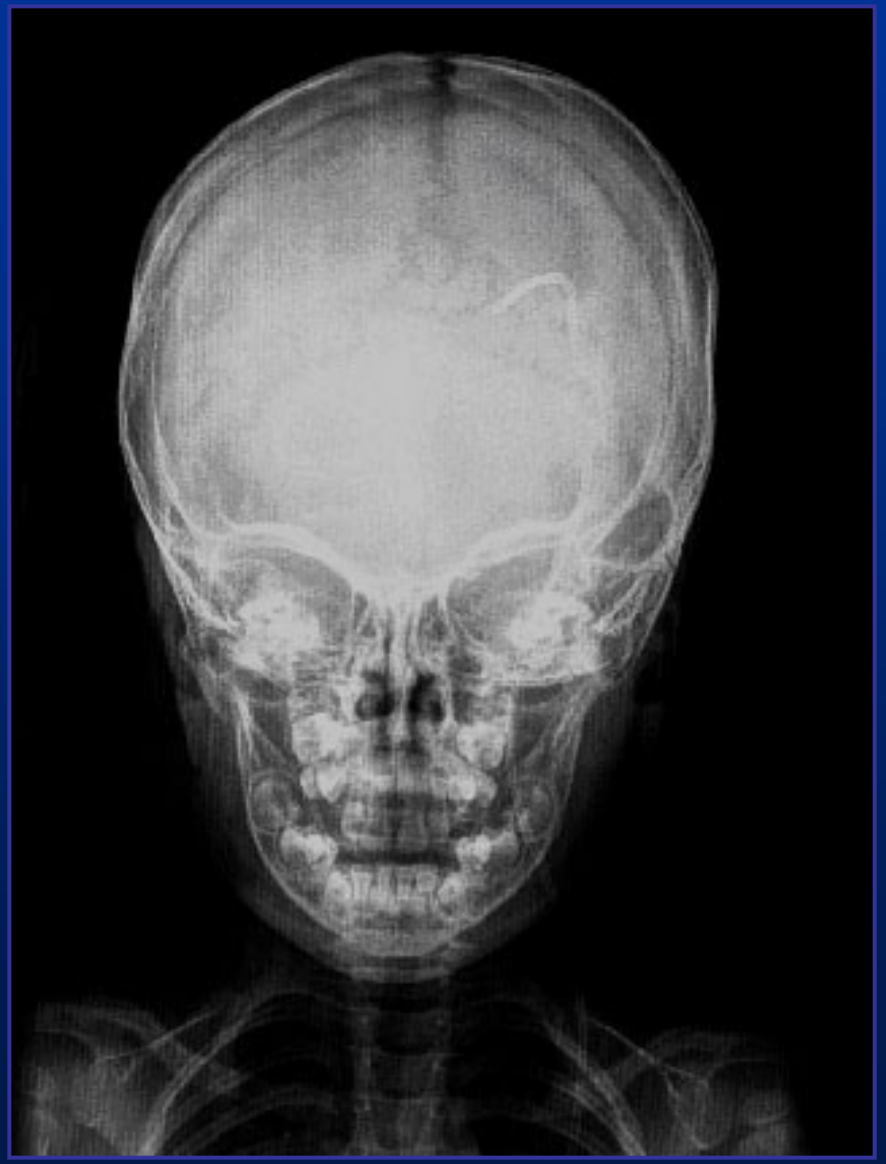




Laboratory examinations:

- FW, blood count, inflammation markers, serum osmolarity
- CSF examination – valve punction
  (bakcteriology, biochemistry, cytology)

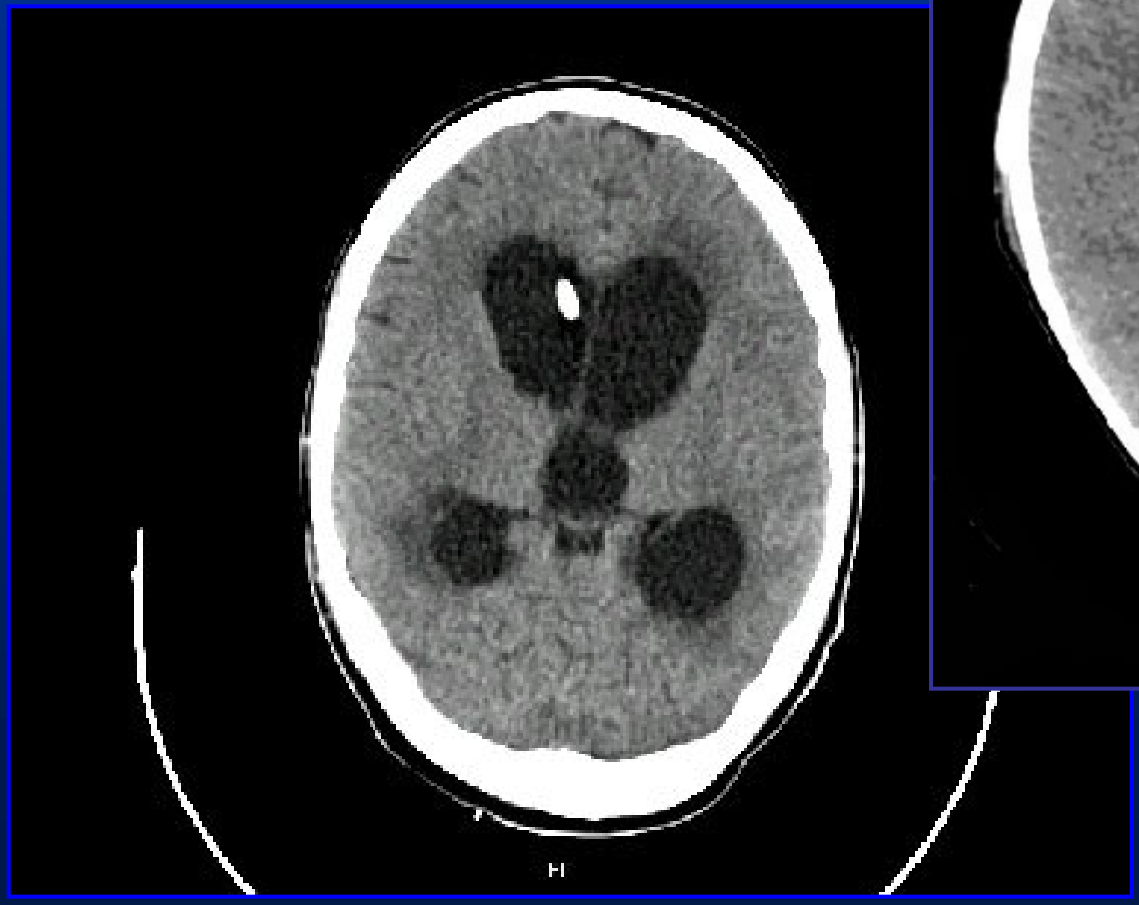
X-rays:



X-rays:

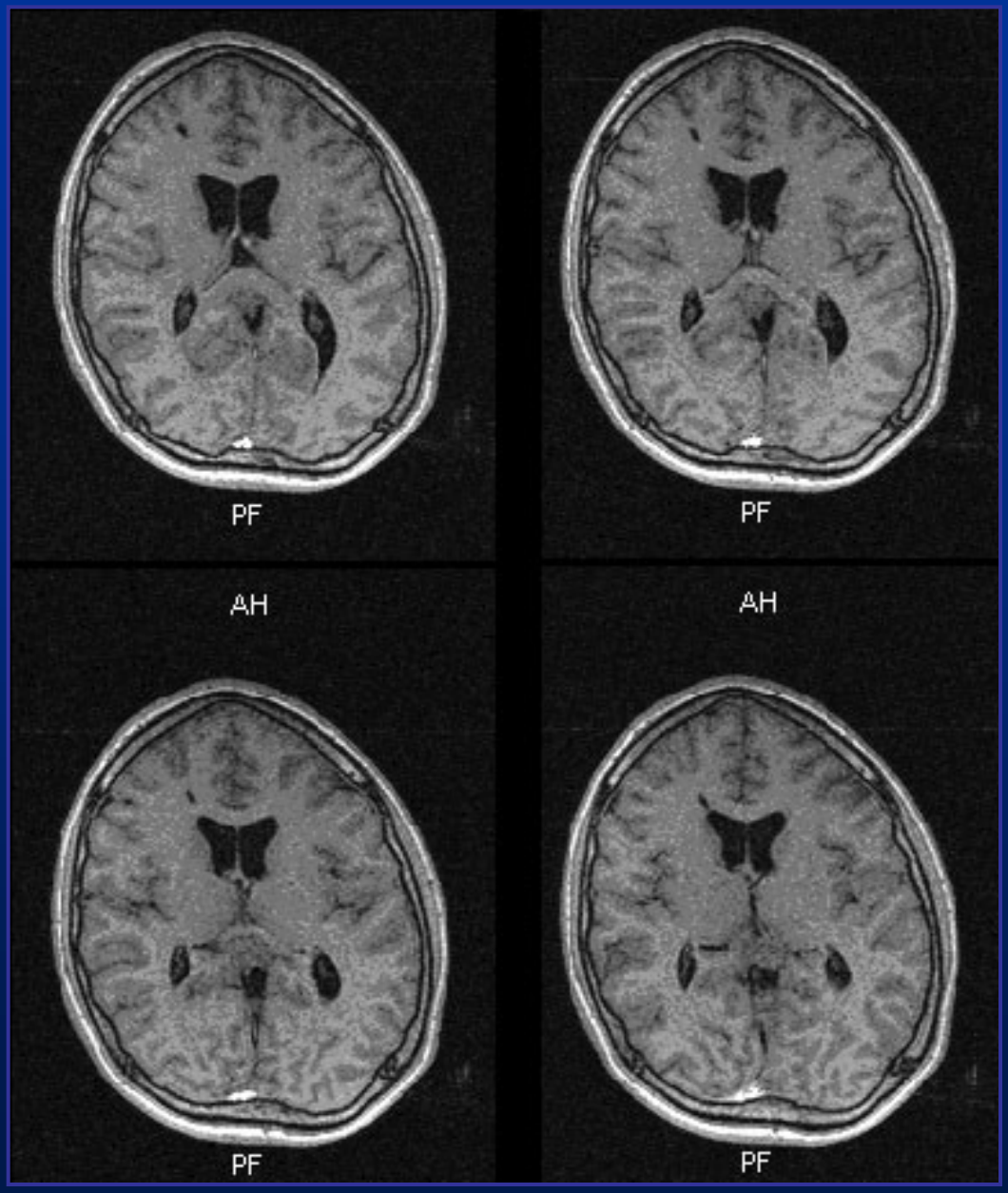
Ultrasound:

CT



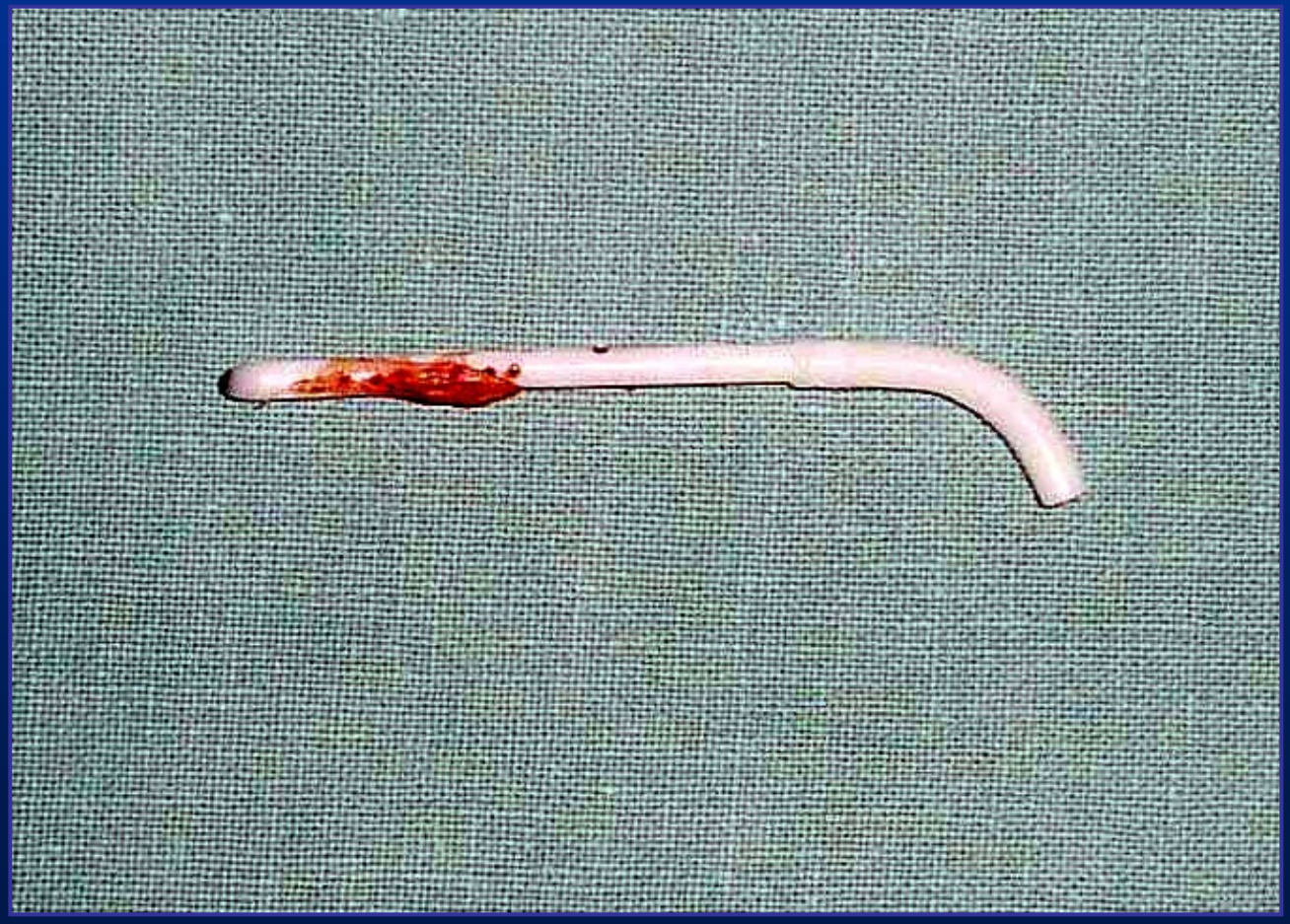
MRI

(cave programmable valves)



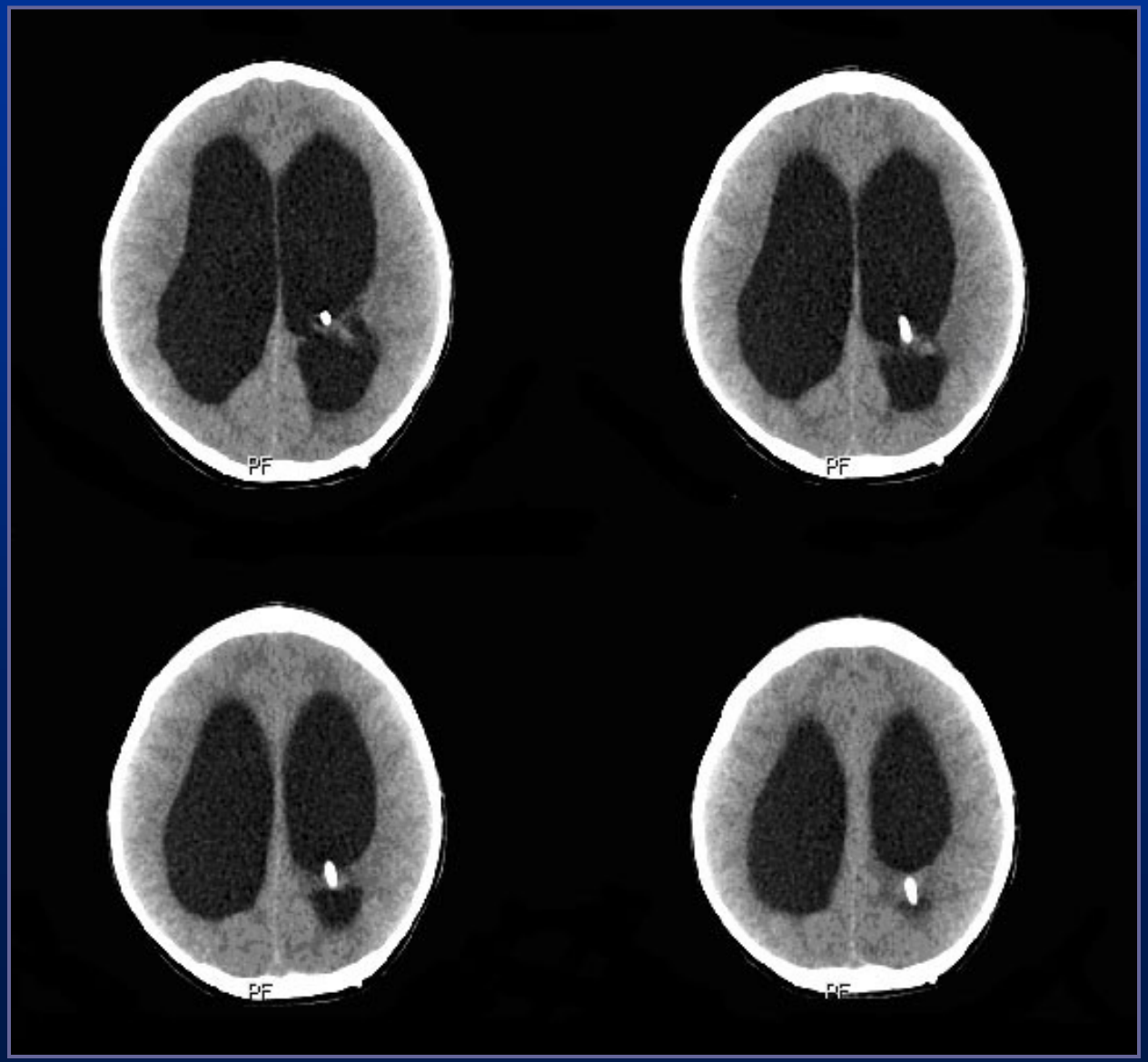
Central (ventricular) catheter malfunction

- blood clot obturation



Central (ventricular) catheter malfunction

chorioideal plexus adhesions



Central (ventricular) catheter malfunction

malposition

Central (ventricular) catheter malfunction

Surgical treatment – catheter repositioning or replacement

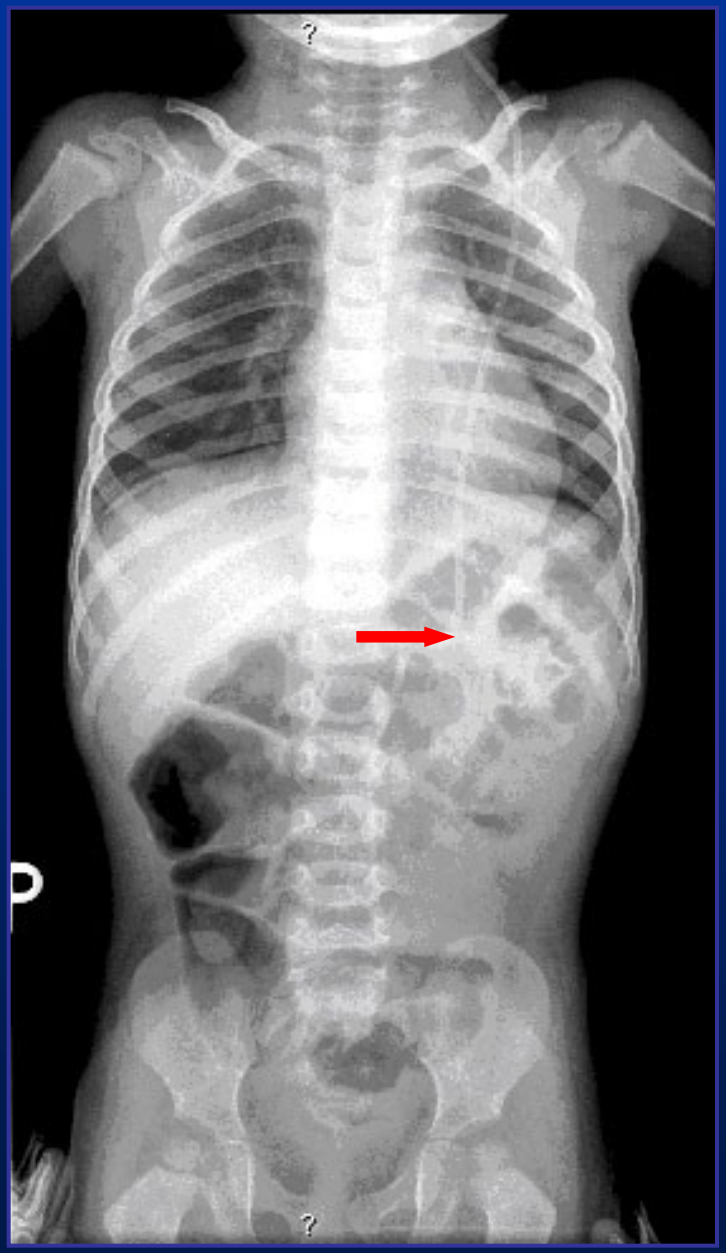
Valve malfunction:

- blood clot obturation
- elevated CSF viscosity
  (inflammatory process)
- slit ventricle syndrom

Distal catheter malfunction:

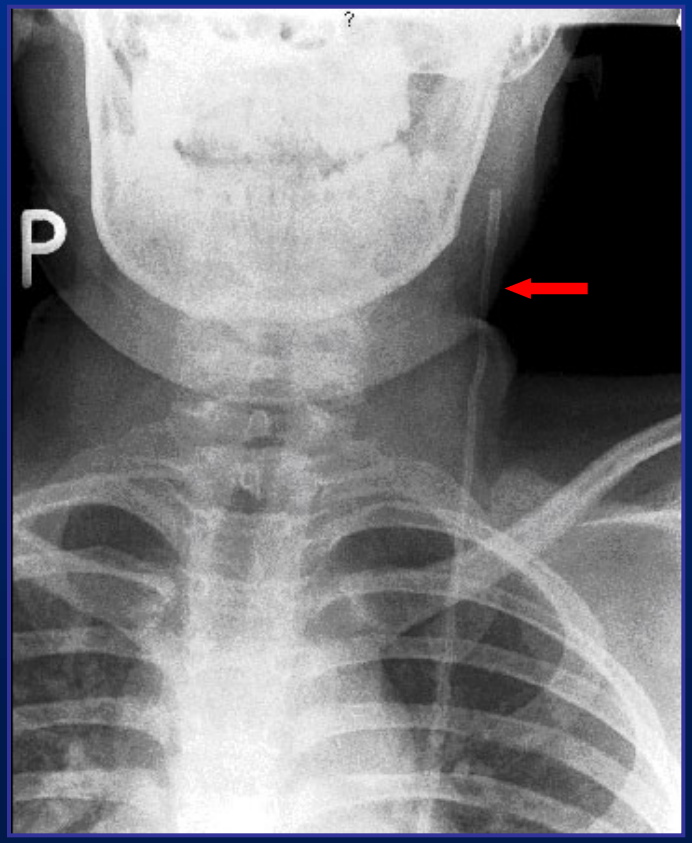
- Unsufficient catheter lenght due to pts growth (X – rays)
- Distal catheter malfunction causes:
  - continuity cut-off
  - peritoneal adhesion
  - peritoneal pseudocyst - septic
    - aseptic
  - peritonitis due APE
  - hyporesorbtion – ascites
  - catheter intolerance, catheter expulsion
  - displacement to subcutaneous tissue
  - intestine perforation
  - hernia inguinalis, umbilicalis
- Atrial catheter malfunction causes:
  - catheter thrombus (heart ultrasound)

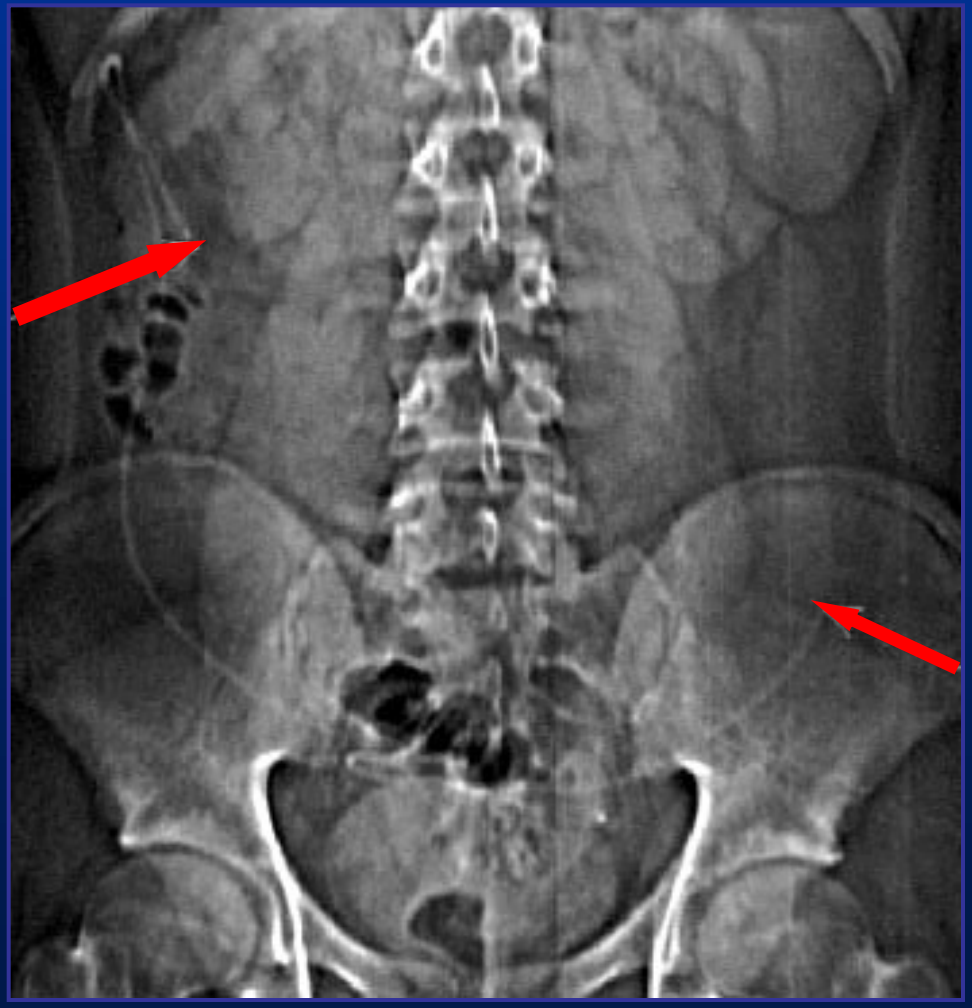
Unsufficient catheter lenght due to pts growth



Continuity cut-off:

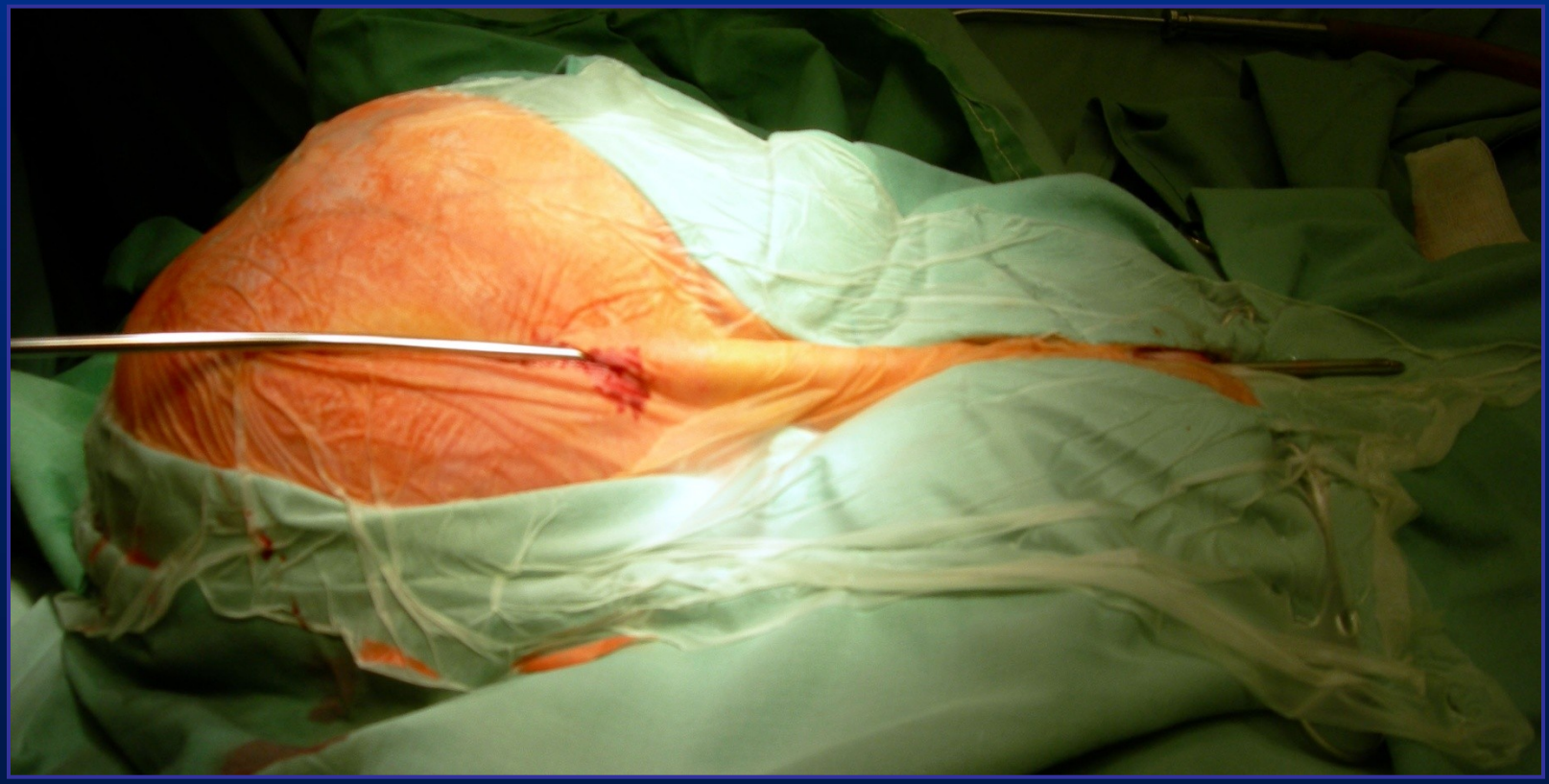
- diconnection
- disruption





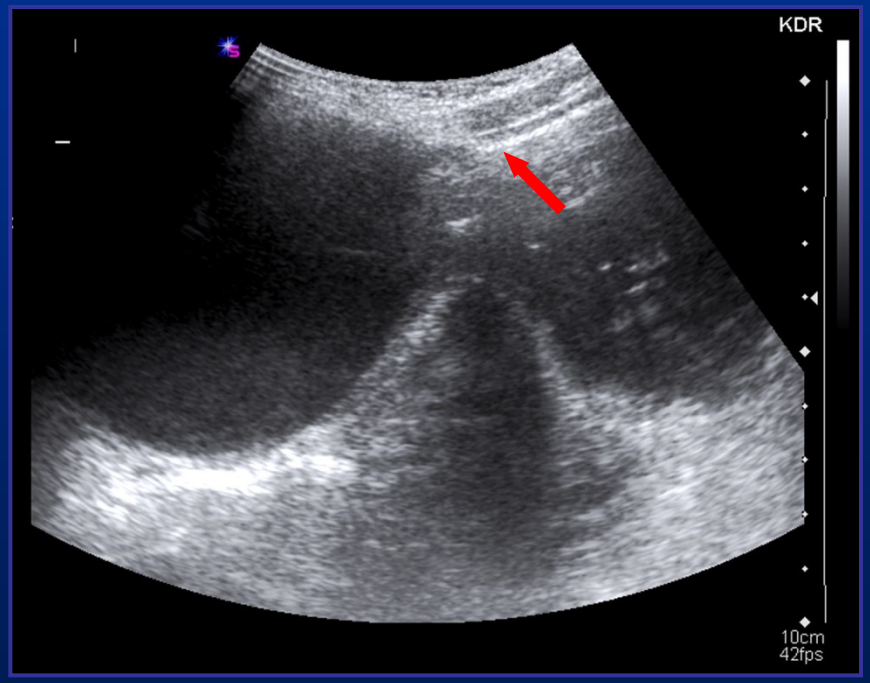
Treatment – immediate surgery

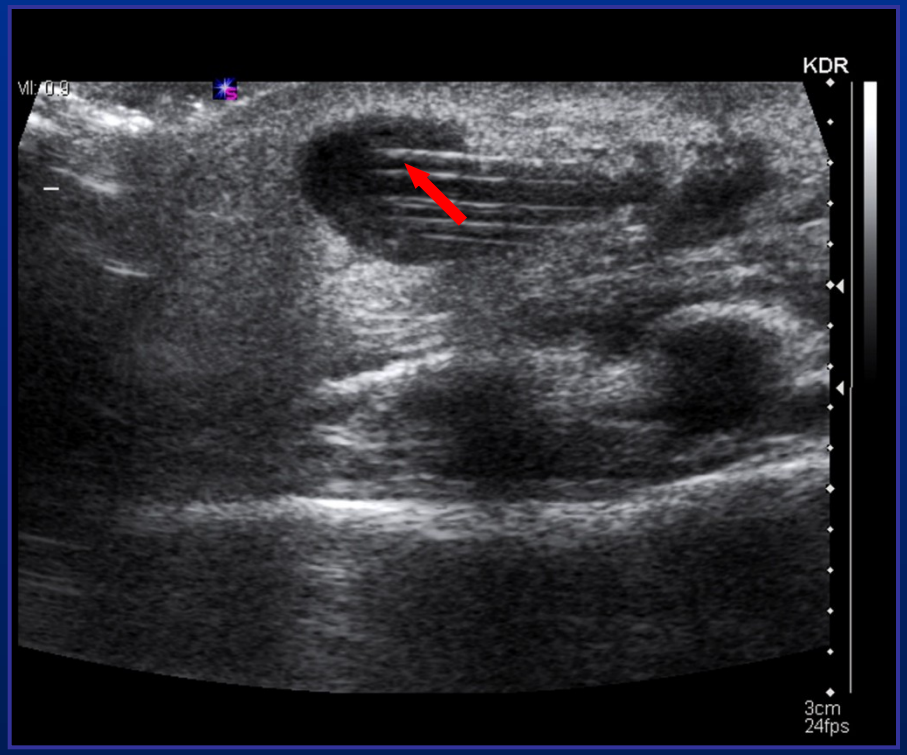
- re-connection if possible
- catheter replacement (removing the displaced one)



Peritoneal catheter – distal end - pseudocyst

Ultrasound:





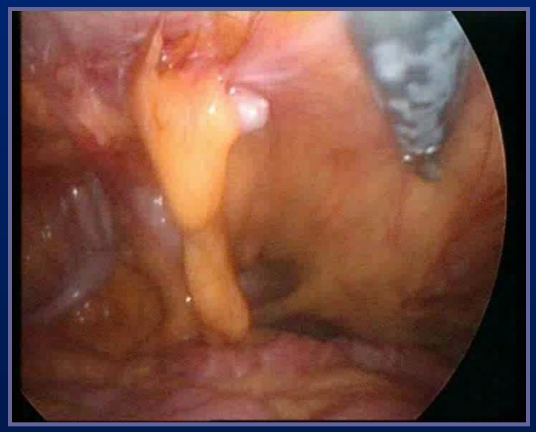
Septic: elevated CRP, FW, leukocytosis

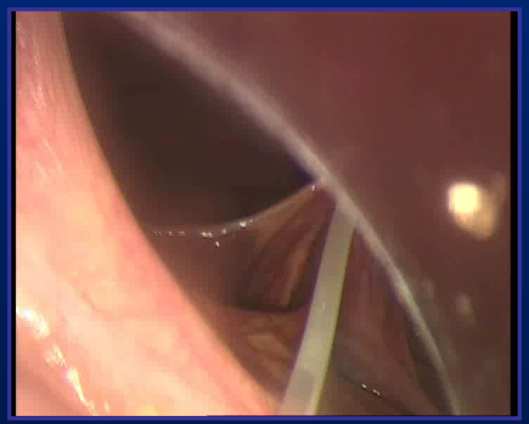
Peritoneal adhesions

Localized – laparoskopy, catheter deliberation, replacement

Difffuse – temporary external drainage

Intraluminal – catheter replacement



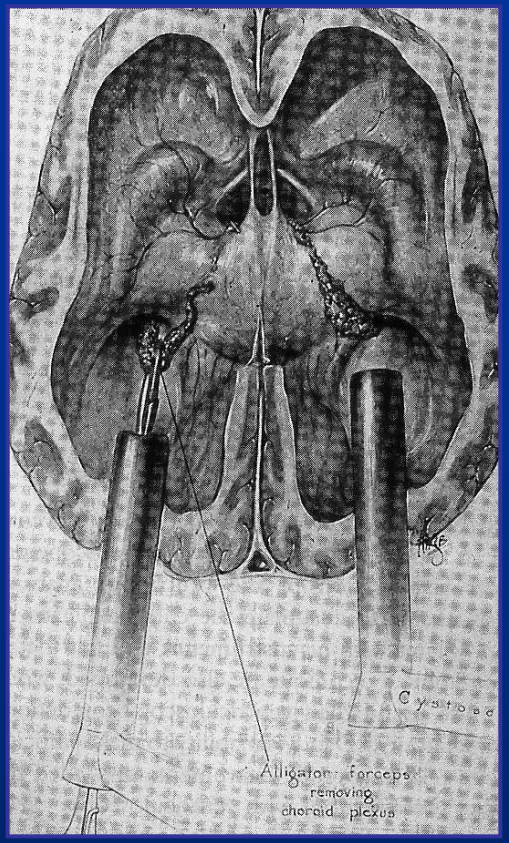


Laparoskopy 3D, system Viking

Infectious complication:

- drainage extraction
- temporary external drainage
- antibiotics

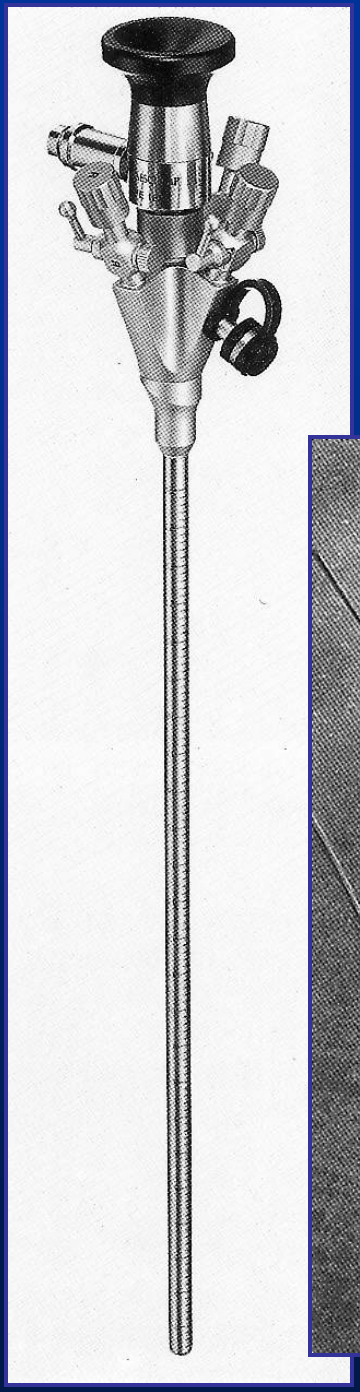
Neuroendoscopy

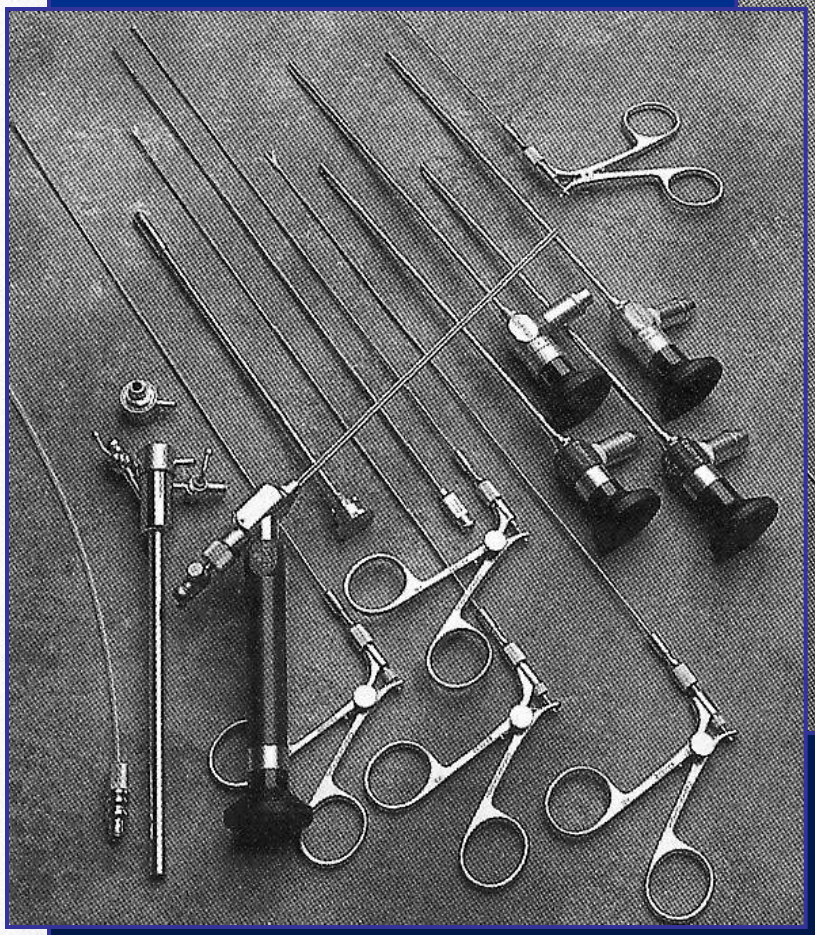


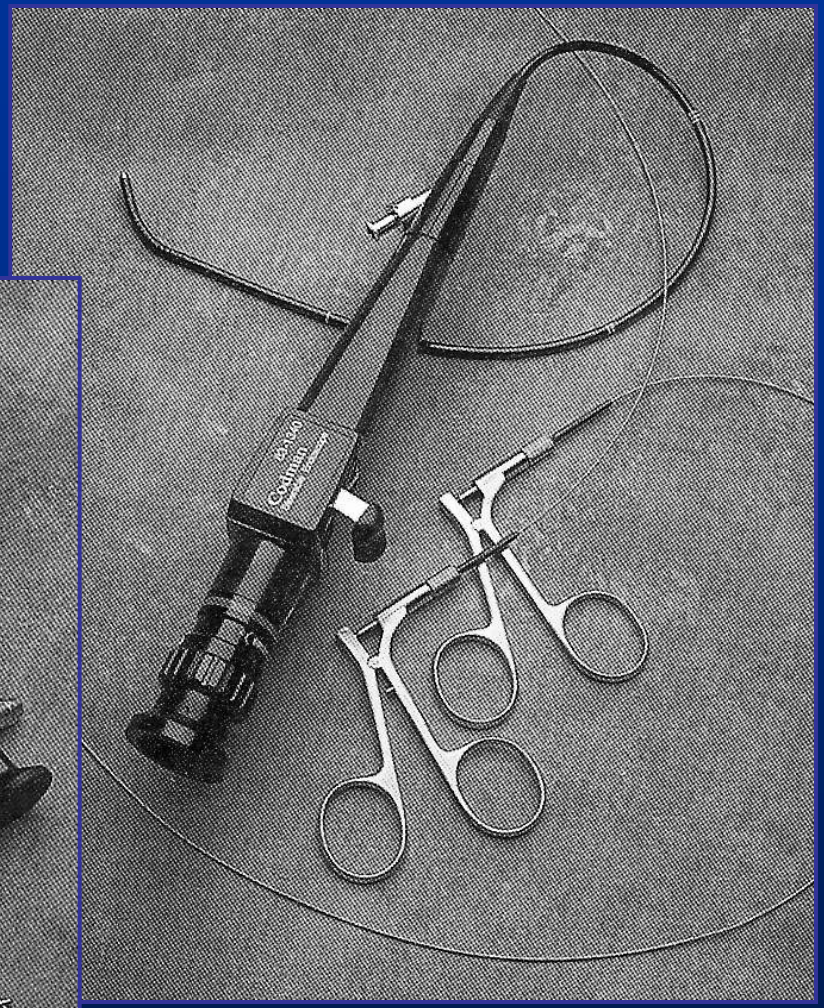
1923 Mixter - first 3rd ventriculostomy

80s - neuroendoskopy techniques
(flexible endoskopy, assisted endoskopy)

Neuroendoskopy







Neuroendoskopy:

- Exstirpatio and biopsy of intra or periventricular expansions
- Cyst marsurpialisation
- Aqueductoplasty
- Third ventriculostomy

Indications for Nuroendoskopy:

- Obstructive hydrocephalus
- Ventricular catheter implantation or replacement
- Ventricular (paraventricular) tumors
- Arachnoideal cyst
- Subdural space revision

Neuroendoskopy – complications:

- haemorrhagy
- hyperthermia (aseptic)
- pneumocephalus
- periventricular tissue damage
- CSF fistula
- infection
- SD haematoma