Hydrocephalus

27

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27.1 Normal Anatomy

The normal adult brain weighs on average 1500 g and is immersed in cerebrospinal fluid (CSF). There is approximately 125–150 ml of CSF within and surrounding the brain and spinal cord. CSF, in addition to its metabolic functions, plays an important role mechanically supporting the brain and buffering it from injury. CSF is produced in the ventricles by the choroid plexus at a rate averaging approximately 20 ml/h. CSF then flows from the ventricles through the foramina of Luschka and Magendie into the subarachnoid spaces surrounding the brain and spinal cord, initially flowing caudally but then rostrally where it is resorbed into the dural sinuses through the arachnoid (Pacchionian) granulations (Fig. 27.1).

Any pathology that (1) causes increased CSF production (e.g., choroid plexus papillomas), (2) interferes with CSF flow leaving the ventricles (e.g., tumor, aqueductal stenosis), or (3) interferes with CSF resorption through the arachnoid granulations (e.g., subarachnoid hemorrhage) can cause hydrocephalus. The most frequent causes are neoplastic, hemorrhagic (subarachnoid hemorrhage), and infectious (e.g., TB) [1, 2].

Another clinical entity, normal pressure hydrocephalus, remains of unknown etiology and can be treated surgically in patients with cognitive symptoms, urinary incontinence and ataxia [3].

27.2 Major Clinical Symptoms

The symptoms of hydrocephalus result primarily from the intracranial hypertension and primarily include:

- Headache: diffuse, continuous but more prominent in the morning due to less efficient CSF resorption in the recumbent position.
- Neck pain and dizziness: due to tonsillar herniation through foramen magnum.
- Nausea: due to stimulation of the vagal centers and independent of head movements.
- Vomiting: projectile, more prominent in the morning, independent of meals.
- Papilledema: seen on fundoscopy.

Secondary symptoms can include:

- Diplopia and/or convergent strabismus. Due to pressure on CN VI.
- Dizziness, imbalance, and gait problems.
- Cognitive deterioration that can progress quickly to coma if the condition is not diagnosed and treated.

27.3 Indications for Surgery

- If the symptoms above are rapidly progressing in a patient with a known cause for hydrocephalus, immediate shunting surgery may be

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indicated to relieve the intracranial pressure and save the patient's life.

27.4 Objectives of the Surgery

- To relieve the elevated intracranial pressure, returning it to a more normal pressure, either temporarily or on a more permanent basis as is determined by the cause of the hydrocephalus.

27.5 Surgical Approach(es)

- Extraventricular drain (shunt) placement is used to temporarily relieve the mounting CSF pressure causing neurological symptoms, and is reserved for emergency treatment (Fig. 27.2).
- If the underlying cause of the hydrocephalus cannot be cured (e.g., obstructive hydrocephalus due to a brain tumor), then the shunt can be internalized and made permanent. CSF is drained from the ventricles into the right atrium (ventriculoatrial shunt) and peritoneal cavity (ventriculoperitoneal shunt) or from the spine into the peritoneal cavity (spino-peritoneal shunt) (Figs. 27.3 and 27.4).
- Endoscopic third ventriculostomy (ETV) is a permanent option for patients with obstructive hydrocephalus distal to the third ventricle [2] (Fig. 27.5).

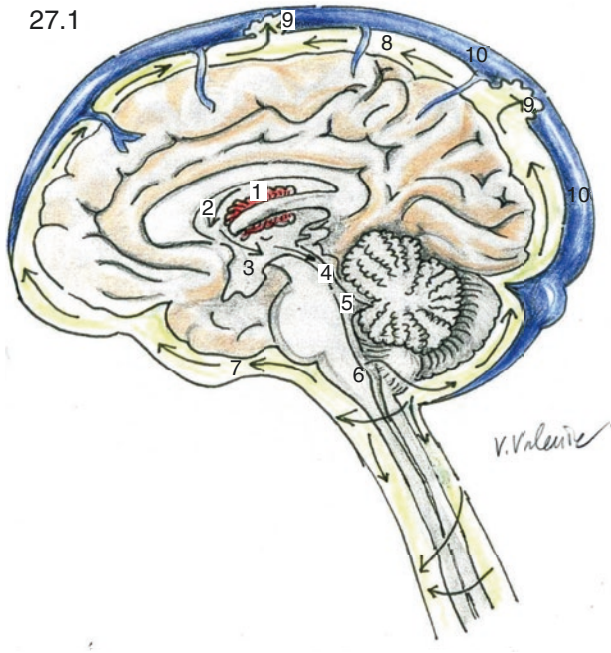

Fig. 27.1 Anatomical view showing normal CSF flow pattern

1	Choroidal plexus
2	Lateral ventricles
3	Third ventricle
4	Cerebral aqueduct of Silvius
5	Fourth ventricle
6	Foramina of Magendie and Luschka
7	Basal cisterns
8	Cortical CSF space
9	Arachnoidal granulations
10	Superficial venous sinus

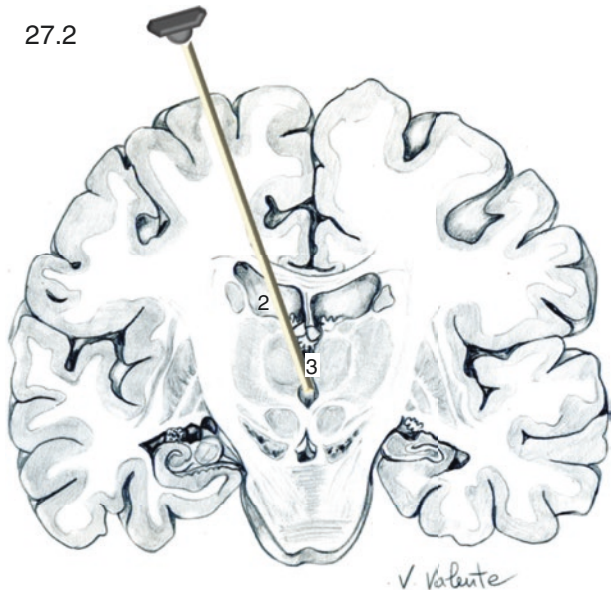

Fig. 27.2 Ideal placement of a trocar for a frontal shunt tube

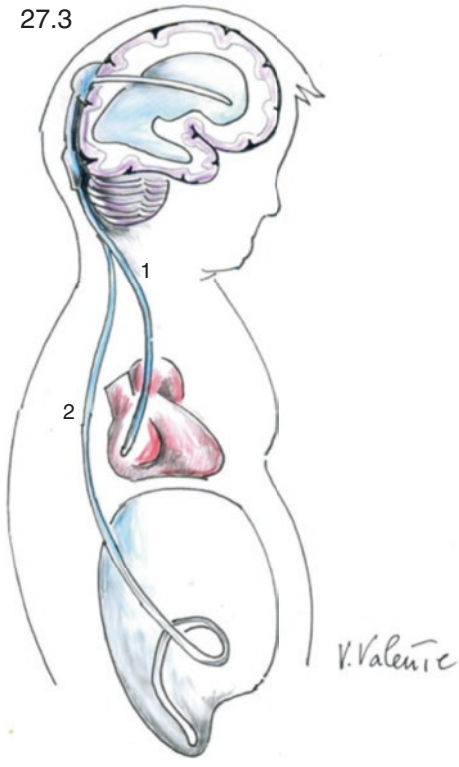

Fig. 27.3 (1) Ventriculoatrial shunt; (2) ventriculoperitoneal shunt

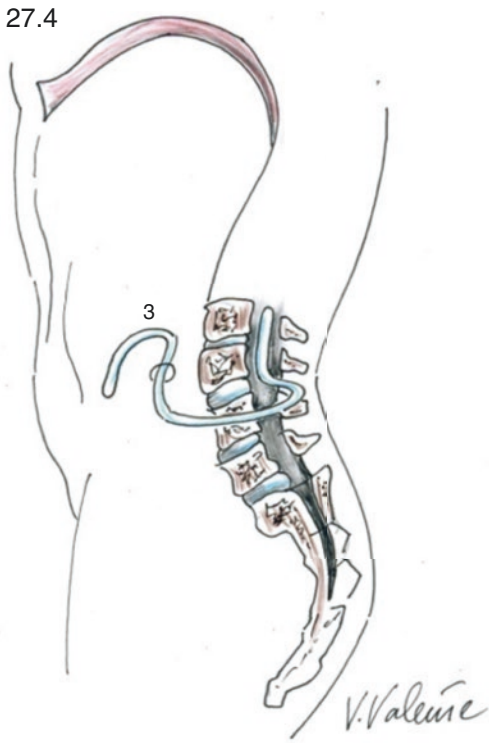

Fig. 27.4 (3) Spino-peritoneal shunt

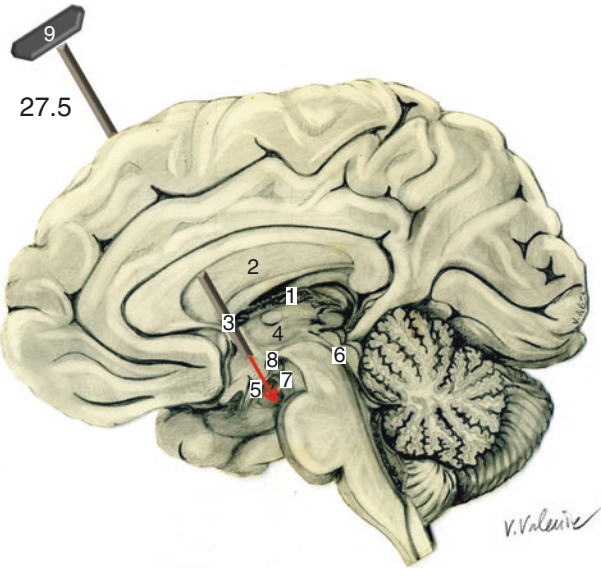

Fig. 27.5 Endoscopic third ventriculostomy

1	Choroid plexus
2	Lateral ventricle
3	Foramen of Monroe
4	Third ventricle
5	Third ventricle floor
6	Aqueduct of Silvius
7	Interpeduncular cistern
8	Mammillary body
9	Endoscope

References

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