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The programmable valve of a ventriculoperitoneal shunt for hydrocephalus

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Figure 1 (front cover of this edition) shows a 3-D reconstruction of a computed tomography (CT) scan of the skull of a patient who developed normal pressure hydrocephalus months after severe traumatic brain injury.[1] A programmable valve[2] was implanted as part of a right posterior parietal ventriculoperitoneal shunt using the Keen´s point (3 cm posterior, 3 cm superior to the ear's pinna).[3]

On a ventriculoperitoneal shunt, the cerebrospinal fluid (CSF) flow is, due to the valve, unidirectional, and the CSF is drained from the lateral ventricle to the peritoneum. In Figure 1 the ventricular catheter can be seen exiting the valve towards the posterior parietal burr hole. The peritoneal catheter is attached to the most distal part of the valve and heads downwards, in subcutaneous tissue, towards the abdomen.

In Figure 2, a sagittal and a transversal views of a skull CT shows the lateral fissure and superior temporal sulcus, as well as the localization where the ventricular catheter penetrates the cerebral cortex.

Types of valves can also be subdivided into valve feature, non-gravitational, gravitational, non-programmable, programmable and can be subdivided into non-gravitational non-programmable, non-gravitational programmable, gravitational non-programmable and gravitational programmable.[4] The gravitational ones have more mechanical failures than the non-gravitational ones, the same conclusion was observed for the programmable when compared to the non-programmable ones.[4] In patients with hydrocephalus the most used modalities are ventriculoperitoneal and ventriculoatrial.[5,6]

Advances in bioengineering led to the development of programmable valves;[7-9] it is possible to determine the valve opening pressure so that the CSF passes through the valve and permit adequate drainage, relieving intracranial hypertension or decreasing the volume of the cerebral ventricles.[10]

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The great advantage of this type of valve is that the pressure can be changed or adjusted by placing a device outside the skin over the valve. It is painless and non-invasive and can be done in the doctor's office. Thus, insufficient CSF drainage or excessive fluid outflow from the ventricles, the later a possible cause of iatrogenic chronic subdural hematoma,[11,12] can be carefully regulated.

Programmable shunts also need lower revisions, therefore are more cost-effective and can provide better neurological outcomes than non-programmable shunts by reducing drainage problems.[13]

The patient and his wife authorized the publication of the images in this article.

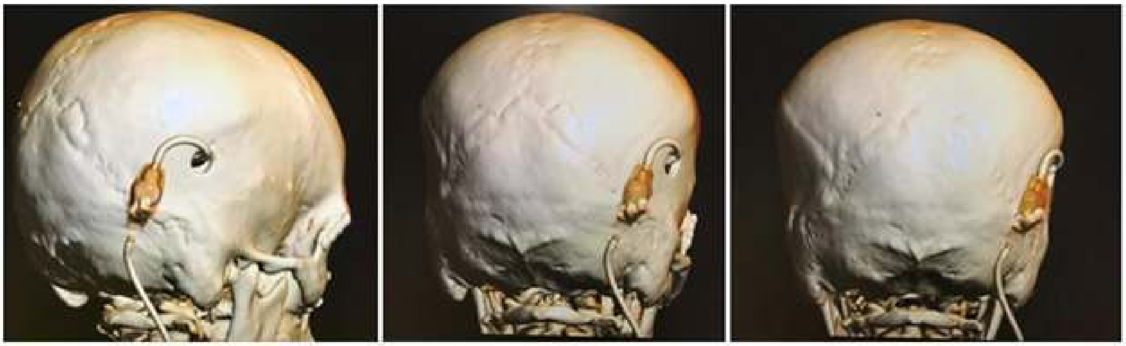

Figure 1. 3-D reconstruction of a CT scan of the skull in a patient who developed normal pressure hydrocephalus months after severe traumatic brain injury. A programmable valve was implanted as part of a right posterior parietal ventriculoperitoneal shunt using Keen´s point.

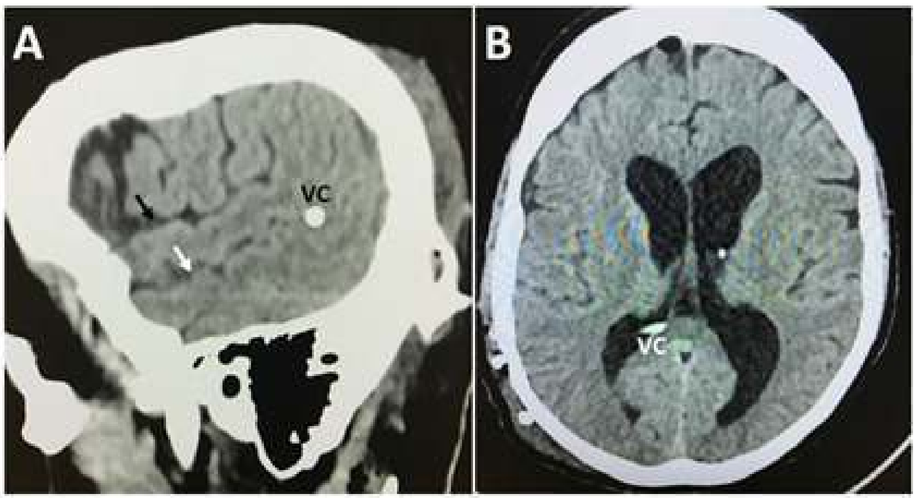

Figure 2. A. Right lateral sagittal view of a skull CT; black arrow, lateral fissure; white arrow, superior temporal sulcus. A: VC, ventricular catheter; B. Transverse CT view of the skull; VC - end of ventricular catheter.

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