Low pressure hydrocephalus

Low pressure hydrocephalus is loosely defined as a paradoxical increase in the size of ventricles despite low to normal CSF pressures in patients with CSF diversion and is associated with neurological deterioration.

Symptoms include postural headaches, lethargy, obtundation, and cranial neuropathies. Most cases involve patients with shunted hydrocephalus, whereas others involve patients with external ventricular drains as well as those with CSF rhinorrhea. The first case series on low pressure hydrocephalus was performed by Pang and Altschuler in 1994 [1)].

Sub-zero drainage is needed for its management and multiple solutions have been described.

Case series

2013

Galbarriatu et al made a retrospective review of all patients diagnosed with LPH and treated with custom-made peritoneal catheters at the Virgen del Rocío Pediatric Neurosurgical Unit. Catheters were coated with antibiotic or silver. The inner diameter of ventricular catheters was 1.4 mm; peritoneal catheters were larger than usual (1.9 mm inner diameter).

They identified four patients in whom five custom-made peritoneal catheters were used over a 3-year period. There were two males and the mean age was 10 years (6 months-17 years). In all patients, placement of an EVD was necessary for sub-zero drainage, with maximum negative pressure of -8 cm H20. The mean time of maintenance of EVD was 102 days (10 days-1 year). Finally, three ventriculoperitoneal (VP) valveless systems, one with antigravitation device, and one Pro-GAV VP shunt were placed, all of them with larger custom-made peritoneal catheters. After a mean follow-up period of 2.3 years (6 months-3 years), two patients are completely recovered, one patient is partially dependent for daily activities with good cognitive status, and the last one is a child who died due to his brain tumor.

The custom-made peritoneal catheters with larger inner diameter could be a good option for the management of this complex pathology [2)].

2011

Nine patients with LPH were identified over a 4-year period. The time from diagnosis of the initial neurosurgical condition to development of LPH varied from 7 days to 5 years. The sub-zero drainage method of Pang and Altschuler was successful in all cases. LPH was accompanied by transependymal edema in five patients despite low ICP. Four patients developed LPH during their initial admission for intracranial bleeding. As patients entered the LPH state, the ICP remained in a normal range yet daily CSF output from the external ventricular drain was reduced. When LPH patients were drained at sub-zero levels, daily CSF output exceeded baseline values for several days and then receded to baseline. Long-term management was achieved with low pressure shunt systems: six programmable shunts; one valveless ventriculoperitoneal shunt; two ventriculopleural shunts. Conditions most commonly associated with LPH are: subarachnoid hemorrhage, chronic hydrocephalus, brain tumors, and chronic

CNS infections.

Low pressure hydrocephalus is a challenging diagnosis. The genesis of LPH was associated with a drop in EVD output, symptomatic ventriculomegaly, and a remarkable absence of intracranial hypertension. When LPH was treated with the sub-zero method, a 'diuresis' of CSF ensued. These observations support a Darcy's flux of brain interstitial fluid due to altered brain poroelastance; in simpler terms, a boggy brain state [3].

1)
Pang D, Altschuler E: Low-pressure hydrocephalic state and viscoelastic alterations in the brain. Neurosurgery 35: 643– 656, 1994
2)
Galbarriatu L, Rivero-Garvía M, Olivares M, Miranda D, Pomposo I, Márquez-Rivas J. Low-pressure hydrocephalus: indication for custom-made catheters? Technical report. Acta Neurochir (Wien). 2013 Oct;155(10):1981-5; discussion 1985. doi: 10.1007/s00701-013-1819-5. Epub 2013 Aug 1. PubMed PMID: 23904087.
3)
Akins PT, Guppy KH, Axelrod YV, Chakrabarti I, Silverthorn J, Williams AR. The genesis of low pressure hydrocephalus. Neurocrit Care. 2011 Dec;15(3):461-8. doi: 10.1007/s12028-011-9543-6. Review. PubMed PMID: 21523524.