

# CSF dynamics assessment in NPH- 25 years of Cambridge experience

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Normal pressure hydrocephalus is more complex than a simple disturbance of the CSF circulation. Nevertheless, an assessment of CSF dynamics is key to making decisions about shunt insertion, shunt malfunction, and for further management if a patient fails to improve after shunting .

Since 1992 4473 infusion studies has been performed in both shunted and non-shunted patients at Cambridge University Hospital NHS Foundation Trust, UK. All shunt-naïve patients had a working diagnosis of primary or secondary NPH, with documented ventriculomegaly, baseline ICP below 18 mmHg and at least two of the three cardinal symptoms of NPH including gait disturbance. They attended the CSF Clinic and an infusion test was indicated as part of their work-up according to hospital protocols and in line with National Institute of Clinical Excellence (UK) guidelines.

We have shown that CSF infusion studies are safe with a very low incidence of infection of less than 1%.

Raised resistance to CSF outflow positively correlates ( $p < 0.014$ ) with improvement after shunting ( $p < 0.02$ ).

CSF infusion studies are valuable in assessing possible shunt malfunction in vivo and the avoidance of unnecessary revisions.

Defective CSF dynamics may co-exist with cerebrovascular disease. In such cases both may contribute to a poor clinical status. It has been shown that in patients with normal CSF circulation ( $R_{out} < 10 \text{ mm Hg}/(\text{ml}/\text{min})$ ), global autoregulation of CBF, as estimated with transcranial Doppler, was worse ( $p < 0.02$ ) than in patients with increased  $R_{out}$  ( $> 13 \text{ mm Hg}/(\text{ml}/\text{min})$ ).

In adults with iNPH, white matter CBF (PET) decreases towards the surface of the ventricles. Autoregulation of CBF is also worse in this region . This may reflect reversal of transependymal CSF flow (increased mean diffusivity) and its interference with periventricular CBF.

In conclusion, Infusion test is safe and brings useful information for clinical decision making for management of patients suffering from hydrocephalus.

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