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# In-vivo assessment of shunts inserted for the treatment of hydrocephalus

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## Background

Over a three-year period (2002–2004), we have performed 312 constant rate normal saline infusion studies in 197 patients with CSF shunts inserted to treat varying types of hydrocephalus. The data has been analysed retrospectively with two main objectives: 1. To investigate which parameters describing CSF dynamics correlate with the clinical finding of shunt malfunction (under drainage or over drainage). 2. To estimate accuracy of this method.

## Materials and methods

A constant rate infusion of normal saline was performed into the shunt prechamber or previously implanted Ommaya reservoir. The CSF pressure and arterial pressure (from Finapress finger cuff) were monitored continuously during 10 minutes of baseline recording and during the infusion in 99 tests. CSF compensatory parameters, steady state pressure levels, cerebrovascular pressure reactivity and vasogenic waveforms of CSF pressure were calculated

## Results

In 161 of the 312 infusion tests results indicated under draining shunts. Patients with under draining shunts had higher baseline and plateau CSF pressures, higher resistance to CSF outflow and higher levels of baseline respiratory and pulse amplitude waveforms. A significantly greater increase in intensity of vasogenic waves during the test was seen in cases where shunts were under draining. In 21 patients who underwent operative revision of the shunt, reports of intraoperative shunt assessment were available in patients' notes. Shunt malfunction was confirmed at surgery in 19 cases. None of the patients in whom shunt was assessed as patent were admitted to hospital with symptoms of acute intracranial hypertension within subsequent 2 weeks. There was no increase in complications related to the performance of the constant rate infusion of normal saline.

## Conclusion

Shunt testing in-vivo to detect malfunction and under drainage by a constant rate infusion of normal saline is easy, safe, clinically useful and has satisfactory positive prediction power (estimated 90%).