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Validation Of A Noninvasive Test Of Csf Shunt Function

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Introduction
We lack a single diagnostic test which can reliably assure that a CSF shunt is functioning. This study evaluates a noninvasive, self-contained device to confirm flow in shunts.
Methods
The device (ShuntCheck®) uses transcutaneous thermal convection to measure flow through subcutaneous shunt tubing. An ice cube (or crushed ice) is applied proximally for several seconds, and the distal temperature change is measured. The higher the flow rate, the greater the temperature drop recorded by the sensors. An algorithm based on in vitro responses calculates flow rate. The authors tested the device in four pigs of various ages and skin thicknesses, using a constant infusion pump and subcutaneous shunt tubing. Flow rates of 0 to 20 ml/hr were used.
Results
There was close agreement between the flow rates and the amplitude of temperature drop recorded by the thermal sensors. The relationship is highly linear at flow rates above 3 ml/hr (0.07 ml/min). The correlation coefficient between actual and measured flow rates (r2) is 0.94-.97 for individual pigs and 0.88 when measurements from all four pigs were pooled.
Conclusions
ShuntCheck appears to be a reliable way to measure flow in CSF shunts. The use of this device may help to diagnose or to rule out shunt malfunction. Preliminary results of confirmatory experiments in shunted patients will be discussed.

Keywords: hydrocephalus shunt|shunt malfunction|noninvasive test|diagnostic device