

mRS grade at the 1 year follow-up. Use of an adjustable valve correlated significantly with improved mRS scores at last follow-up ($p=0.042$). The shunt revision rate after 1 year was 23.0%. Use of an adjustable valve correlated significantly with lower revision rates both in the univariate ($p=0.032$) and the multivariate Cox regression analysis (HR: 0.19, 95%CI: 0.08-0.46, $p<0.001$). 48.4% of shunt revisions were performed for shunt infections.

Conclusion: VP shunt placement for hydrocephalus following SAH carries a significant revision rate but often improves the patient's functional status significantly during follow-up. Use of adjustable valves was associated with improved mRS scores during follow-up and fewer shunt revision surgeries.

BRAIN AND SPINE 2 (2022) 101190 101340 CEREBROSPINAL FLUID SHUNT SURGERY UNDER ONGOING SYSTEM INFECTIOUS CONDITIONS. ARE THERE MORE COMPLICATIONS?

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Objective: Postoperative cerebrospinal fluid (CSF) shunt infection is a frequent complication requiring pharmacologic treatment or even surgical shunt-revision. Shunt implantation during ongoing infection is regularly avoided, in order to prevent shunt infection. Nevertheless, quick surgery without waiting for an infection to be fully treated, might be favorable in some cases. If ongoing infectious conditions significantly affect the rate of shunt-infections or revisions is not yet clarified. Aim of this study was to investigate the rate of adverse events in patients that underwent shunt implantation under such infectious conditions.

Methods: We performed a retrospective chart review of patients undergoing CSF-shunt surgery in a single tertiary neurosurgical center. Patients were dichotomized according to their infection status. Ongoing infection was defined as systemic infection under antimicrobial therapy, not finally treated at the moment of surgery. Shunt-infection and shunt-revisions within 90 days, age, gender, shunt-type, etiology of hydrocephalus, functional status and immunosuppression were analyzed.

Results: 685(309female) patients (1526 screened) were analyzed. 119 underwent surgery under ongoing infection resulting in higher overall complication rates ($p=.02$) without having more shunt-infections ($n=15$ vs. 54; $p=.32$) or shunt-revisions ($n=10$ vs. 33; $p=.29$). Shunt-infection and shunt-revision were attributed to younger age (53 vs. 61y; $p<.01$ / 53 vs. 61y; $p<.001$) and poorer functional status at discharge (KPSS: 40 vs. 50%; $p<.01$ / 40 vs. 50%; $p<.01$). Cranioplasty together with shunt-surgery was a risk factor for shunt-infection ($p<.001$) and revision($p<.01$). Brain tumor, SAH and TBI patients had higher infection/revision rates.

Conclusions: Shunt surgery under infectious conditions did neither result in higher rates of shunt-infections nor shunt-revisions until 90 days after surgery. Stronger attribution was found to the underlying disease and overall functional status. Infectious conditions should be avoided, if possible, but our data indicate that implantation can be performed, if further reasons favor surgery without delay.

BRAIN AND SPINE 2 (2022) 101190 101341 INTERPRETATION OF M.SCIO WAVEFORM IN THE DIAGNOSIS OF SHUNT MALFUNCTION

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Background: Shunt blockage remains a problem, and its diagnosis is challenging given the overlap of clinical symptoms with other, non-shunt-related, conditions. M.Scios, previously known as Sensor Reservoirs, enable regular non-invasive measurement of ICP. This is instrumental in the management of CSF shunts and complex hydrocephalus and is particularly advantageous when more regular surveillance is needed, for example during management of patients with complex symptom morphology or multiple valve adjustments.

Here we characterise the waveform morphology from an M.Scio during shunt blockage to provide a reference on interpretation to inform clinical decision-making.

Methods: A single-centre case series of patients at the National Hospital for Neurology & Neurosurgery with M.Scio/Sensor Reservoirs (Christoph Miethke,

GmbH & Co) incorporated into their shunt systems. M.Scio readings were taken during hydrocephalus clinics or on the ward, using the reader unit set. Measurements were interpreted using ICPicture software (Christoph Miethke, GmbH & Co).

Results: 4 patients (50% female; age range 34 to 46) with M.Scios incorporated into their shunt systems had confirmed shunt blockage. Indication for CSF diversion included: idiopathic intracranial hypertension (50%), congenital hydrocephalus (25%), and aqueduct obstruction post-surgery (25%). Patients with blocked proximal shunt catheters were found to have a sinusoidal 'flatline' waveform similar to asystole, commonly with an extremely negative pressure, as low as -60mmHg. Shunt blockage was confirmed at revision and symptoms of shunt malfunction resolved after revision. Imaging available for one patient also concurred with the M.Scio waveform, showing blockage of the proximal catheter.

Conclusion: Here we present the first description of the waveform seen from an M.Scio during shunt blockage. This provides evidence to support the clinical utility of both M.Scios and ICPicture software in the improvement of patient management.

BRAIN AND SPINE 2 (2022) 101190 101342 DIAGNOSTIC VALUE OF CEREBROSPINAL FLUID PRODUCTION RATE IN NORMAL PRESSURE HYDROCEPHALUS

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Background: Diagnosis of normal-pressure hydrocephalus (NPH) is a clinical challenge. While many centres rely on the results of extended lumbar drainage (ELD), some studies, using PC-MRI, have shown a cerebrospinal fluid (CSF) flow rate of \geq twice of normal as a diagnostic parameter for NPH. Our study aimed to demonstrate cerebrospinal fluid production rate (PRcsf) of \geq twice of normal in NPH patients.

Methods: We performed a prospective observational study in all suspected NPH patients in our hospital who required ELD. Following baseline cognitive assessment and walking test, ELD was undertaken. The lumbar drain was connected to a LiquoGuard7 (Möller-Medical, Germany) with the intracranial pressure sensor at the level of the external auditory meatus. LiquoGuard7 was used to calculate PRcsf in the patients using the internal software and flow-rate data of the pump. Patients were flat for 10 minutes during the measurement. Cognitive assessment and walking test were performed post-ELD. Patients were followed up for 6 months post hospital discharge.

Statistical analysis used SPSS (version 25.0, IBM) by independent t-test, comparing measured PRcsf to the final diagnosis of the patient.

Results: 18 NPH patients were evaluated. 14 NPH patients demonstrated an average PRcsf of 55-69 ml/hour. These patients showed objective improvement in post-ELD cognitive assessment and walking test. At a 6 month follow up, all 15 patients had received a diagnosis of NPH.

4 suspected NPH patients had an average PRcsf of 22-32ml/hour. At a 6 month follow these patients had failed the diagnosis of NPH and were diagnosed to have vascular dementia.

PRcsf of greater than twice of normal (55-69ml/hour) was significantly associated with a diagnosis of NPH ($p<0.0001$).

Conclusion: PRcsf of $>$ twice the normal may hold diagnostic value in NPH. Along with ELD, this has the potential of being an effective diagnostic tool for NPH.

BRAIN AND SPINE 2 (2022) 101190 101343 SUCCESSFUL WEANING VS. PERMANENT CEREBROSPINAL FLUID DIVERSION AFTER ANEURYSMAL SUBARACHNOID HEMORRHAGE – POST-HOC ANALYSIS OF A SWISS MULTICENTER STUDY

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