Clinical Experience with Telemetric Intracranial Pressure Monitoring in a Danish Neurosurgical Center

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Background

Monitoring of intracranial pressure (ICP) is essential in the optimal treatment of various neurological and neurosurgical diseases. Traditionally ICP is estimated by lumbar puncture or by surgical insertion of an intracranial wired pressure transducer followed by monitoring in a neurosurgical ward or at home using a mobile monitor. Telemetric ICP monitoring allows continuous measurements in the patient's everyday life and the possibility to perform additional measurements without the procedure related risks of repeated transducer insertions.

Materials and methods

We identified all patients in our clinic with an implanted Raumedic® telemetric ICP probe (NEUROVENT®-P-tel) between Sept. 2011 and Sept. 2013. For each patient we identified diagnosis, indication for implantation, number of ICP recording sessions (in relation to symptoms of elevated ICP) and their result. The clinical consequence of ICP monitoring was classified in 4 entities: 1) no action, 2) new recording session, 3) change in drug dose or programmable valve setting, and 4) surgical shunt revision. Complications as well as reason for explantation (if performed) were also noted.

Key results

21 patients (11 male, 10 female) were included with a total of 22 implanted probes. Among these patients, 11 had hydrocephalus (6 had congenital hydrocephalus), 7 had idiopathic intracranial hypertension (IIH) and 3 had normal pressure hydrocephalus (NPH). Median age was 28 years (range 2-83) and median time from diagnosis to implantation of the telemetric probe was 11 years (range 0-30). At the time of probe implantation, 15 patients had a ventriculoperitoneal or ventriculoatrial shunt. Implantation was performed in general (15) or local (7) anesthesia through a right frontal (8), left frontal (12) or right parietal (2) burr hole. In 4 patients we had to explant the probe due to infection (2) and ethylene oxide allergy (2).

Number of implanted probes	22
Implantation period (median)	248 days (49-666)
Reading period (median)	154 days (8-433)
Number of ICP recording sessions	86

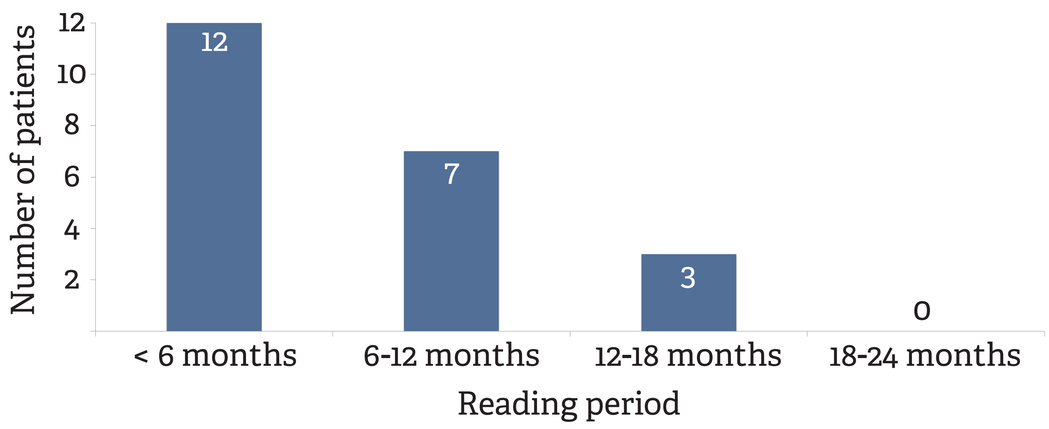

Figure 1: Period from implantation to last valid recording session

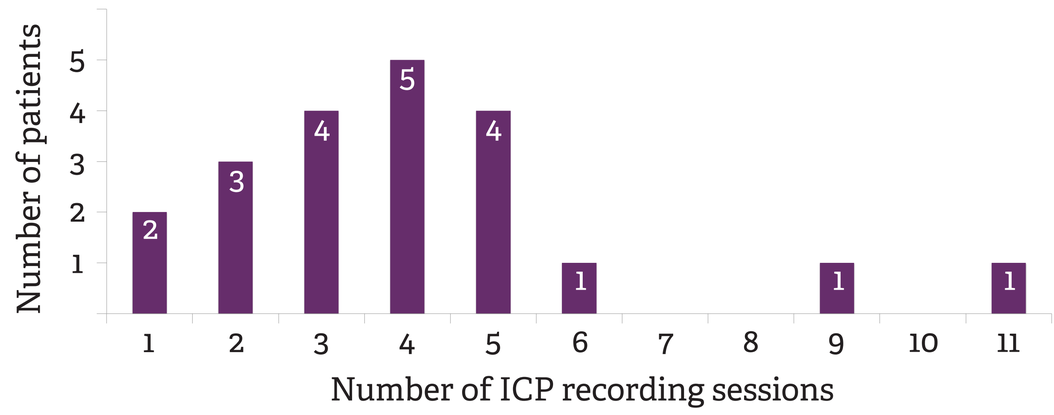

Figure 2: Number of ICP recording sessions per patient. Median was 4 and only 3 patients had more than 6 sessions. The patients with 9 and 11 recording sessions were diagnosed with IIH and both had programmable valves implanted

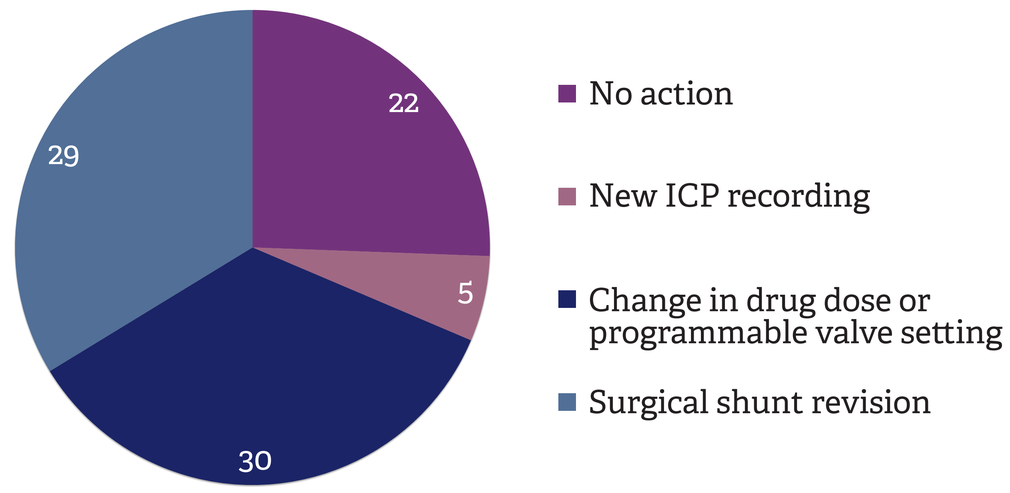

Figure 3: Consequence of the 86 ICP recording sessions performed in relation to clinically suspected raised ICP. Change in drug dose (Diamox®) were relevant for patients with IIH. Programmable valves were Codman® Hakim® and Codman® Certas™ valves.

Limitations of the technology

1) The telemetric probe has no integral memory or power source, meaning that the recording unit has to be placed over the probe for it to measure and store the ICP-values.

2) The software package used for reviewing the ICP curves is very limited and lacks basic functionality such as the ability to compare two ICP curves.

3) 5 Hz frequency of sampling is too low for pressure wave analysis.

Conclusions

We experienced very few complications, high quality of measurements and reading periods up to 15 months. Only 35% of the recording sessions led to a surgical procedure. Telemetric ICP monitoring is useful in patients with complicated CSF dynamic disturbances who would otherwise require repeated invasive pressure monitoring. It seems to be a feasible method to guide adjustment of programmable valve settings and to identify patients with chronic or repeated shunt problems.

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