ICP Measurement under General Anesthesia is not Reliable

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Introduction

There is no reliable way to non-invasively measure intracranial pressure (ICP). A real-time wire, or fluid –fluid coupling is the only reliable method. However, intra-operative measurement is confounded by positioning and general anesthetic technique(1,2). Decisions about treatment are sometimes made based on ICP. Intraoperative ICP wire readings with patients under anesthesia do not always correlate with the postoperative findings once the patient is awake and breathing room air. Specifically, we have found an artificial increase in pressure, sometimes as high as 10-20 cm of water intraoperatively compared to postoperatively.

Methods

An IRB approved protocol was used to identify all patients on the neurosurgical service who underwent placement of ICP monitoring wires between 2011 and 2017. Intra-operative and post-operative ICP, mean end tidal CO2, and pre-operative documentation of papilledema and lumbar punctures were recorded.

Methods Cont.

Patients for whom intraoperative pressure was not recorded and severe traumatic brain injury were excluded. The majority of patients underwent ICP wire placement for evaluation of headache, either with or without shunted hydrocephalus.

Results

Sixty-eight patients were included. Mean intraoperative ICP (14.7) was significantly higher (P=0.01) than post-operative (8.8). 38% of patients (26/68) had a mean ICP intraoperatively that correlated within 5 cmH2O to ICP postoperatively. 57% of patients (39/68) had a mean Intra-operative ICP that was 5 to 25 cm of water higher than their mean postoperative ICP, of those, 23% were > 10 cmH2O higher (Figure 1). All of the 32 patients who had LP values available showed similar poor correlation with wire measurements (Figure 2).

Figure 1

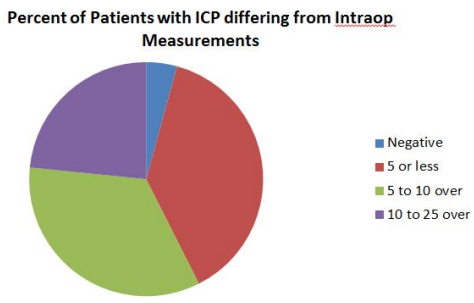

Figure 2: Other Related Findings

- All prior LPs measured > 25 cm H20
- 23% prior LPs measured > 30 cm H2O
- No patient with high LP required CSF diversion for persistent elevated ICP
- 3 patients prescribed CPAP due to nocturnal CO2 retention
- 12 patients underwent shunt revision or valve resetting due to measurements

Conclusions

Intra-operative ICP measurements on patients under general anesthesia were higher in a significant number of patients than awake measurements. Making surgical decisions based on "spot-checking" ICP under anesthesia is unreliable. We recommend 24 hours of monitoring in the awake state to determine true ICP.

Learning Objectives

Understand the means for measuring ICP

Understand the effects of general anesthesia on ICP

References

1)Avery RA: Interpretation of Lumbar Puncture Opening Pressure Measurements in Children. J Neuroophthalmol. 2014 Sep; 34(3): 284–287.

2)Ben Yehuda Y1, Watemberg N. Ketamine increases opening cerebrospinal pressure in children undergoing lumbar puncture. J Child Neurol. 2006 Jun;21(6):441-3.