

Adding to the CRNA Toolbox: Point-of-Care Optic Nerve Sheath Ultrasound (ONSUS) Education and Implementation in Rural CRNA-Only Practices

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Purpose Statement

"To facilitate the adoption and confidence in the use of optic nerve sheath ultrasound among CRNAs in rural settings with the goal to improve patient care and safety"

Background & Significance

- CRNAs provide cost-effective emergency and surgical care in the financially stretched healthcare system (WIANA, 2021)
- Critical access hospitals are often located in underserved rural communities
- The potential lack of resources and/or specialty care, such as neurosurgery, may necessitate alternative non-invasive or technical methods for measuring ICP

Intracranial Pressure (ICP)

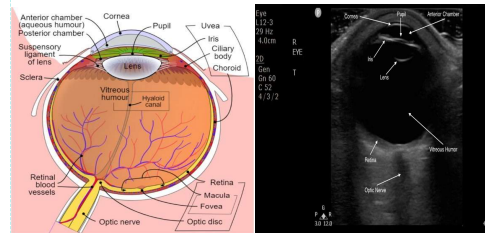
- Normal ICP: < 20mmHg
- Cerebral Perfusion Pressure:
 - MAP - ICP (CVP if higher than ICP)
 - Normal 60-80mmHg

How Do We Measure ICP?

- Ventriculostomy (EVD) is the gold standard for measuring ICP. However, invasive monitoring is not always benign or feasible:
 - Potential risk of EVD include:
 - Cerebral Hemorrhage
 - Infection
 - Malposition
 - Device Malfunction
- Non-invasive imaging (CT and MRI) to measure ICP has several limitations:
 - Transport of a critically ill patient
 - Radiation exposure, especially for serial scans
 - Time consuming
 - High cost

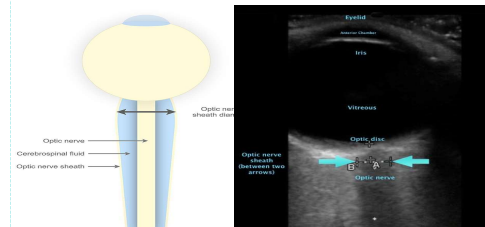
Anatomy of the Eye

- The eye contains fluid filled structures creating an ideal environment for ultrasound beam transduction



Optic Nerve

- Fully surrounded by CSF, dura, arachnoid, and pia matter which allows the optic nerve sheath diameter to fluctuate with ICP changes
- The optic nerve houses a bulbous portion 3mm posterior to the globe which is the most distensible and sensitive to ICP changes



Optic Nerve Sheath Ultrasound

- ONSUS offers unique benefits to measuring ICP:
 - Safe
 - Non-invasive
 - Affordable
 - Simple
 - Reproducible
 - Low intra and interobserver variability
 - Real-time dynamic measurements
- Contraindications:
 - Open globe injury

How to Measure

- Place Tegaderm over the eye and apply ultrasound gel
- Place hand on forehead or midface. Avoid direct globe pressure which leads to discomfort and distorted anatomy
- Scan and identify the anterior chamber, lens, and retina in the same plane as the optic nerve sheath
- Capture and save image
- Measure 3 mm posterior to globe
- Measure the distance of decreased echogenicity between the hyperechoic demarcations of the sheath
- Repeat scan x3 for each eye to limit interobserver variability and reduce the risk of deviation → 6 scans total

Breaking it Down

- Normal ONSD
 - Adults & Children = 5mm
- Elevated ONSD
 - >5.7 mm = ICP > 20 mmHg
 - Sensitivity - 87.5%
 - Specificity - 94.1%
 - Sample size 175 (Matthews et al, 2020)
- ICP Formula
 - $5.00 \times \text{ONSD} - 13.92 = \text{ICP}$

Sites

- Fort HealthCare
 - Fort Atkinson, WI
- The Richland Center
 - Richland Center, WI
- Project Advisor: Dr. Jay Tumalak, CRNA

References

