Letter to the Editor

Systematic use of standardized A-scan technique in neurosurgical intensive care unit

Isabella Fioretto^, Francesco Maria Capuano^, Danilo Biondino^, Francesco Ferdinando Mottola^, Mario Graziano^

Department of Medicine, Surgery and Dentistry, University of Salerno, Baronissi, Italy

Correspondence to: Francesco Maria Capuano, MD. Department of Medicine, Surgery and Dentistry, University of Salerno, Via Salvador Allende 43, Baronissi 84081, Italy. Email: francesco11c@gmail.com.

Comment on: Pokhrel B, Thapa A. Systematic use of point of care ultrasound in neurosurgical intensive care unit: a practical approach. Quant Imaging Med Surg 2023;13:2287-98.

Keywords: A-scan; B-scan; optic nerve sheath diameter (ONSD); ultrasound; eyeball transverse diameter

Submitted May 07, 2023. Accepted for publication Jun 26, 2023. Published online Jul 07, 2023.
doi: 10.21037/qims-23-628
View this article at: https://dx.doi.org/10.21037/qims-23-628

We read with great interest the article by Bibesh Pokhrel and Amit Thapa regarding the use of point-of-care ultrasound (POC-US) for prompt diagnosis and management of patients (1). While we commend the authors on their valuable contribution, we would like to provide additional insights.

The authors utilized a B-scan ultrasound linear array probe for measuring the Optic Nerve Sheath Diameter (ONSD). However, we would like to highlight some concerns regarding their methodology. The authors placed the probe with gel over the upper eyelid and utilized a clear covering (e.g., Tegaderm) to avoid direct contact of the gel with the eyelid. This approach may lead to sound attenuation, potentially compromising the reliability of the results. To address this issue, previous studies have suggested performing the examination with open eyelids, utilizing anesthetic drops and methylcellulose instead of the usual gel (2-4). Additionally, assessing the eye's primary position with closed eyelids can be challenging (5). Measuring the ONSD in the primary position is crucial, as altering the eye's position may affect the cerebrospinal fluid surrounding the optic nerve, resulting in inaccurate ONSD measurements (6).

Furthermore, we would like to suggest avoiding the measurement of ONSD with the sound beam parallel to the optic nerve axis. This approach scatters the sound, making it difficult to distinguish the borders of the ONSD. When measuring a structure, it is best to have the sound beam perpendicular to the borders being measured. This is especially important when small differences, such as less than 0.5 mm, are significant, as in the differential diagnosis of optic nerve lesions. The variation in reported thresholds in different studies may also be attributed to this effect (7).

In contrast, the standardized A-scan technique, which employs an 8 MHz non-focused probe and a special S-shaped amplification, allows for better assessment of perpendicularity to the structure being examined. This technique results in more accurate ONSD measurements due to the prominent high-reflective arachnoid spikes (8). Although the A-scan technique is more challenging to be acquired, it can be easily performed with the assistance of an ophthalmologist who is experienced in orbit and eye ultrasound (9). With this technique, measurements can be conducted with the eye open and in the primary position,

^ ORCID: Isabella Fioretto, 0000-0003-2694-3077; Francesco Maria Capuano, 0000-0002-2487-0006; Danilo Biondino, 0000-0002-9942-4959; Francesco Ferdinando Mottola, 0000-0003-4093-1849; Mario Graziano, 0000-0002-5477-5042.

and the optic nerve diameter is measured as the distance between two spikes, each aligned with the arachnoid that envelops the optic nerve.

In conclusion, while the B-scan technique can be useful in detecting certain lesions, such as optic nerve drusen (10), it may not be very sensitive for measurements. Therefore, we suggest performing all examinations with open eyelids and with the eye in the primary position after administering anesthetic eye drops when the detection of a lesion is planned. However, in the case of measurements, the standardized A-scan technique may yield more reliable results.

Appendix 1: Response to "Systematic use of standardized A-scan technique in neurosurgical intensive care unit".

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was a standard submission to the journal. The article did not undergo external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-23-628/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Pokhrel B, Thapa A. Systematic use of point of care ultrasound in neurosurgical intensive care unit: a practical approach. Quant Imaging Med Surg 2023;13:2287-98.
2. Rosa D, Graziano M, De Paola I. Evaluation of Intracranial Pressure During Neural Laser Discectomy. Pain Physician 2022;25:E414.
3. Graziano M, Biondino D, Fioretto I, Marino AV. Optic nerve sheath diameter measurement by ultrasound after moderate traumatic brain injury. Clin Exp Emerg Med 2023;10:249-50.
4. Di Paola I, Graziano M, Rosa D. Optic nerve sheath diameter, strain ratio, and shear wave elastography. Ultrasonography 2022;41:796-7.
5. Rosa N, Cennamo G, De Bernardo M. Editorial: Ocular ultrasonography and optical coherence tomography in the optic nerve disease. Front Med (Lausanne) 2023;10:1161123.
6. De Bernardo M, Vitiello L, De Pascale I, Capasso L, Cornetta P, Rosa N. Optic Nerve Ultrasound Evaluation in Idiopathic Intracranial Hypertension. Front Med (Lausanne) 2022;9:845554.
7. Vitiello L, De Bernardo M, Capasso L, Cornetta P, Rosa N. Optic Nerve Ultrasound Evaluation in Animals and Normal Subjects. Front Med (Lausanne) 2021;8:797018.
8. Capasso L, De Bernardo M, Vitiello L, Rosa N. Ultrasound Options for Measuring Optic Nerve Sheath Diameter in Children. Pediatr Crit Care Med 2021;22:e329-30.
9. Rosa N, De Bernardo M, Di Stasi M, Cione F, Capaldo I. A-Scan Ultrasonographic Evaluation of Patients with Idiopathic Intracranial Hypertension: Comparison of Optic Nerves. J Clin Med 2022;11:6153.
10. Rosa N, De Bernardo M, Abbinante G, Vecchio G, Cione F, Capasso L. Optic Nerve Drusen Evaluation: A Comparison between Ultrasound and OCT. J Clin Med 2022;11:3715.

Cite this article as: Fioretto I, Capuano FM, Biondino D, Mottola FF, Graziano M. Systematic use of standardized A-scan technique in neurosurgical intensive care unit. Quant Imaging Med Surg 2023;13(10):7396-7397. doi: 10.21037/qims-23-628

Supplementary

Response to "Systematic use of standardized A-scan technique in neurosurgical intensive care unit"

Amit Thapa^

Department of Neurosurgery, Kathmandu Medical College and Teaching Hospital, Kathmandu, Nepal

Correspondence to: Prof. Dr. Amit Thapa, MBBS, MS, MCh. Department of Neurosurgery, Kathmandu Medical College and Teaching Hospital, 184 Baburam Acharya Road, Sinamangal-9, Kathmandu Metropolitan City, Kathmandu, Nepal. Email: dramitthapa@yahoo.com.

Keywords: US-A scan; US-B scan; neurosurgical intensive care unit (ICU); optic nerve sheath diameter (ONSD); point of care ultrasound (POC-US)

We thank Fioretto *et al*. (1) for their interest in our work and appreciate their comments on our article published recently in *Quantitative Imaging in Medicine and Surgery* (2). First described by Karl C. Ossoinig (3) in 1979, our fellow researchers from University of Salerno, Italy have enriched the science in using ultrasound (US) A-scan to measure optic nerve sheath diameter (ONSD). They have elaborated on this modality in an open eye position and have correctly highlighted the importance of having the patient in the primary gaze. This is the same reason we keep the patient's head straight with eyes looking towards the ceiling when performing the study with the eyes closed.

Our study (2) detailed how US B-scan can be used systematically in intensive care unit (ICU) as a part of point of care ultrasound (POC-US) and focused on key technical aspects rather than claiming to be comprehensive. Personally, I scan the eye in an axial plane moving from lateral to nasal direction, fixing at a point where optic cup appears on the retina. Then, I use doppler mode to see the central retinal vessels travelling into the optic nerve. On the frozen image, I then use the methods of measurements as dictated in the article (2) to measure the ONSD.

Most of the neurosurgical patients in ICU are ventilated and, due to trauma, may have swollen eyes, with some having wounds over eyelids. The general prescription of using clear covering over the eyes is to allow the physician to perform the scan without causing any harm even in scenarios where the patients do not cooperate. Keeping the eyes open is difficult to achieve in such patients. Moreover, we avoid anesthetic eye drops unless medically indicated, in neurosurgical patients, particularly those in coma or on medical paralysis. These patients have less frequent eye-blinking which predisposes them to corneal xerosis. These anesthetic eye drops may increase the risk of corneal ulceration by numbing the cornea and weakening the remaining protective corneal reflex.

We rather routinely place artificial tears in such patients which also helps prevent sound attenuation. Certainly, the authors' suggestion of measuring with eyes open is helpful in co-operative patients attending out-patient departments.

Though B-scan has its limitation, it is the most familiar ultrasound modality. US B-scan permits dynamic visualization and assessment of structures, while A-mode is restricted to a single line of measurement. US B-scan has been shown to have excellent correlation with MRI-based measurement of ONSD and has least variation on repetition and least inter-observer variability (4). Besides, it is not just a single high value but a change in value which is important in neurosurgical scenario.

In their comments as well as in their other publications, authors do accept US A-scan studies being more difficult to perform and requires cooperative patients. This makes its use in routine regular monitoring in ICU setting difficult. Besides, US A-scan is contradicted in conditions like corneal ulceration, perforating eye injury or discharge from eye, where B-scan can still be performed over closed eyes.

Regarding their comments on blooming effect and inaccuracy in measurement using US B-scan, there is not enough literature to support this view (5-7). It is however necessary to use standardized protocol to avoid errors. We believe both US A- and B-scans can complement each other and can be used after supervised training to validate the

^ ORCID: 0000-0003-1896-3115.

https://dx.doi.org/10.21037/qims-23-628

findings. However, this modality needs further validation and if possible, a direct comparison with the traditional method. We look forward to more research on this aspect of ONSD measurement.

References

1. Fioretto I, Capuano FM, Biondino D, Mottola FF, Graziano M. Systematic use of standardized A-scan technique in neurosurgical intensive care unit. Quant Imaging Med Surg 2023. doi: 10.21037/qims-23-628. [Epub ahead of print].
2. Pokhrel B, Thapa A. Systematic use of point of care ultrasound in neurosurgical intensive care unit: a practical approach. Quant Imaging Med Surg 2023;13:2287-98.
3. Ossoinig KC. Standardized echography: basic principles, clinical applications, and results. Int Ophthalmol Clin 1979;19:127-210.
4. Kerscher SR, Zipfel J, Groeschel S, Bevot A, Haas-Lude K, Schuhmann MU. Comparison of B-Scan Ultrasound and MRI-Based Optic Nerve Sheath Diameter (ONSD) Measurements in Children. Pediatr Neurol 2021;124:15-20.
5. Carter SB, Pistilli M, Livingston KG, Gold DR, Volpe NJ, Shindler KS, Liu GT, Tamhankar MA. The role of orbital ultrasonography in distinguishing papilledema from pseudopapilledema. Eye (Lond) 2014;28:1425-30.
6. Saenz R, Cheng H, Prager TC, Frishman LJ, Tang RA. Use of A-scan Ultrasound and Optical Coherence Tomography to Differentiate Papilledema From Pseudopapilledema. Optom Vis Sci 2017;94:1081-9.
7. Newman WD, Hollman AS, Dutton GN, Carachi R. Measurement of optic nerve sheath diameter by ultrasound: a means of detecting acute raised intracranial pressure in hydrocephalus. Br J Ophthalmol 2002;86:1109-13.

https://dx.doi.org/10.21037/qims-23-628