Is Bigger Always Bad ? Evaluating Effect of Sedation on MRI-Based Optic Nerve Sheath Diameter Measurements in Children

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Abstract

Objectives: To assess the association between sedation status and optic nerve sheath diameter (ONSD) as measured by MRI in pediatric patients.

Materials and Methods: This retrospective observational study included brain MRI examinations of patients aged 0–18 years. Bilateral ONSD was measured on axial T2-weighted images 3 mm posterior to the globe. Results are summarized descriptively by sedation status, and inter-observer agreement is reported using the intraclass correlation coefficient.

Results: Among 78 pediatric patients, 38 underwent MRI with sedation and 40 without sedation. Mean ONSD was 4.8 ± 0.3 mm in the non-sedated group and 5.7 ± 0.4 mm in the sedated group. Inter-observer agreement was reported as an ICC of 0.93 (95% CI: 0.87–0.97).

Conclusion: Higher mean MRI-based ONSD was observed in the sedated group. Sedation status should be considered when interpreting ONSD in children. Prospective studies with appropriate control of confounding factors and independent ICP assessment are needed to determine whether sedation itself affects ONSD and its use as a surrogate for ICP.

Keywords: Intracranial pressure; MRI; sedation; optic nerve sheath; children

Introduction

Assessing intracranial pressure (ICP) accurately is critical in pediatric neurology, yet direct invasive monitoring techniques can pose significant risks and are often impractical in children. As a result, the optic nerve sheath diameter (ONSD) has gained attention as a non-invasive proxy for estimating ICP, particularly through imaging techniques like MRI and ultrasound [1,2,3]. While ultrasound offers rapid bedside evaluation, its operator-dependent nature can introduce variability. MRI, on the other hand, provides a high-resolution and reproducible alternative for ONSD measurement [4].

However, performing MRI scans in children frequently necessitates sedation to reduce motion artifacts. Sedative agents may potentially alter cerebral compliance, CO_2 levels, or cerebrospinal fluid dynamics - factors that could, in turn, influence imaging-based ONSD measurements. Although prior research has examined the effects of general anesthesia on ONSD, there are limited data on how commonly used sedatives relate to these measurements [5,6]. This study investigates the association between sedation status and MRI-based ONSD readings in pediatric patients.

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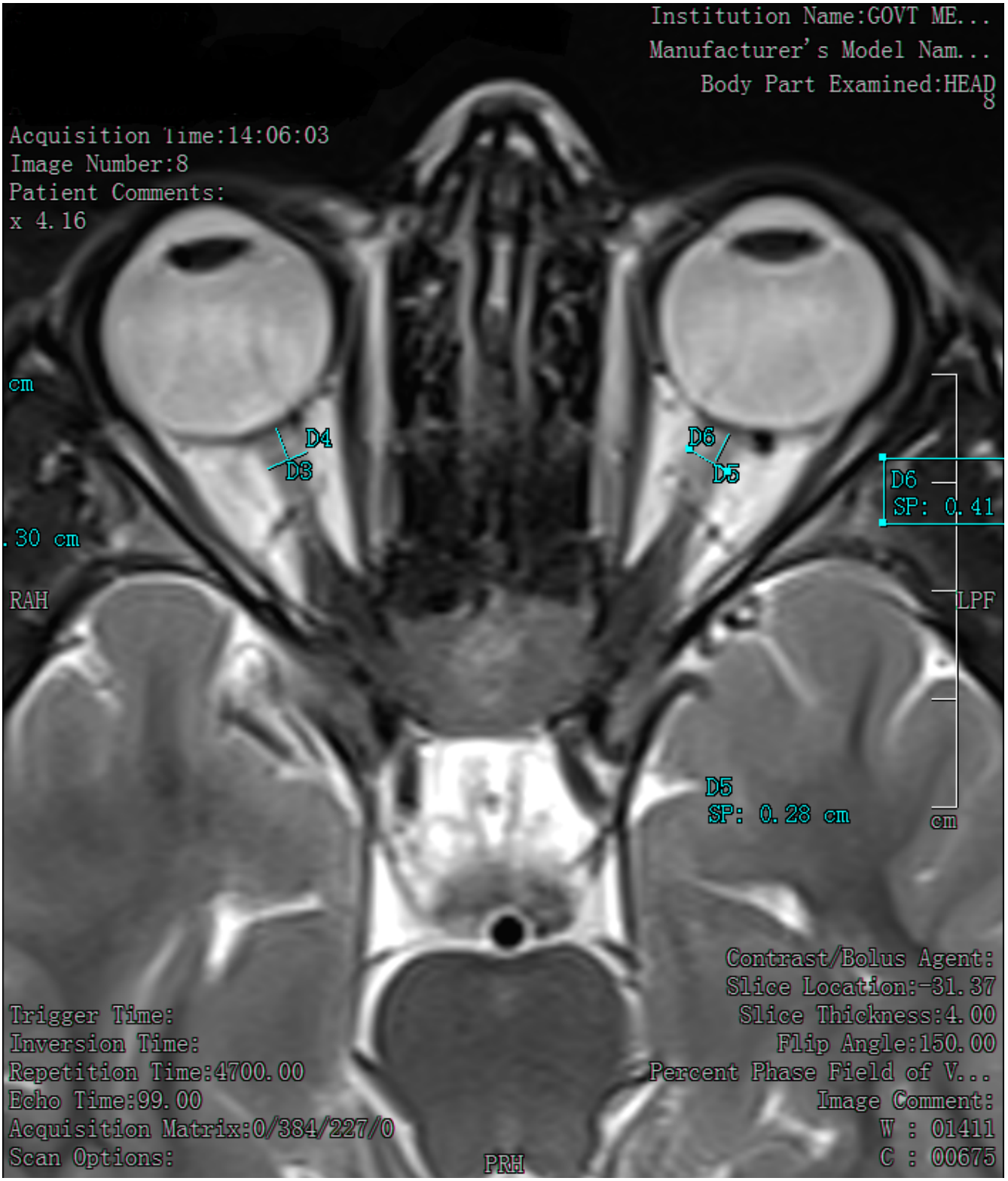


Figure 1. ONSD measured 3 mm behind the globe in a non-sedated patient.

Materials and Methods

Study Population

We conducted a retrospective review of brain MRI scans performed at Government Medical College, Srinagar, India, between January 2024 and January 2025. Pediatric patients aged 0–18 years were included. Exclusion criteria included prior neurosurgical procedures, orbital pathology, poor image quality, or undocumented sedation status.

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Grouping

Patients were categorized into two groups: the sedated group (n = 38) received triclofos (oral), ketamine (IV), or midazolam (IV); the non-sedated group (n = 40) underwent MRI without sedation.

Imaging Protocol and Analysis

MRI was performed using a 3.0T scanner. All patients underwent standard clinical MRI sequences, including T1-weighted, T2-FLAIR, T2-weighted, heme-sensitive (T2* GRE or SWI), and diffusion-weighted imaging. The orbital protocol included 2–3 mm thick axial and coronal slices, post-contrast T1, and T2 sequences with and without fat saturation. Sub-millimeter heavily T2-weighted volumetric images of the orbits were also acquired. ONSD was measured transversely at 3 mm behind the globe on slices demonstrating maximum sheath width [7,8] (Figures 1 and 2).

Statistical Analysis

Continuous variables are summarized as mean ± standard deviation. Group characteristics and ONSD measurements are described by sedation status. Inter-observer agreement is reported using the intraclass correlation coefficient (ICC).

Results

Demographics

A total of 78 pediatric patients were included (mean age 7.9 years; 40 males and 38 females). Mean age was 7.7 ± 3.6 years in the sedated group (n = 38) and 8.0 ± 3.9 years in the non-sedated group (n = 40).

ONSD Findings

Mean ONSD was 4.8 ± 0.3 mm in the non-sedated group and 5.7 ± 0.4 mm in the sedated group. A positive association between age and ONSD was reported. Inter-observer ICC for ONSD measurement was 0.93 (95% CI: 0.87–0.97).

Discussion

The sedated group had a higher mean MRI-based ONSD than the non-sedated group. This retrospective comparison shows an association with sedation status; it does not establish that sedation caused the difference or that intracranial pressure was increased. Sedation status should therefore be considered when interpreting pediatric ONSD measurements.

The optic nerve sheath is a direct extension of the intracranial subarachnoid space, which allows transmission of intracranial pressure changes into the orbit. Sedation-associated differences in ONSD may reflect physiological changes; the absence of invasive ICP measurements limits conclusions about their relationship to true ICP elevation.

Prior literature describes the relationship between ICP and ONSD [1,2,9,10]. A positive association between age and ONSD was reported in this study. Age and sedation status should be considered when interpreting pediatric ONSD measurements [11]. Prospective studies with independent ICP assessment are needed to investigate the relationship between sedation, ONSD and intracranial dynamics.

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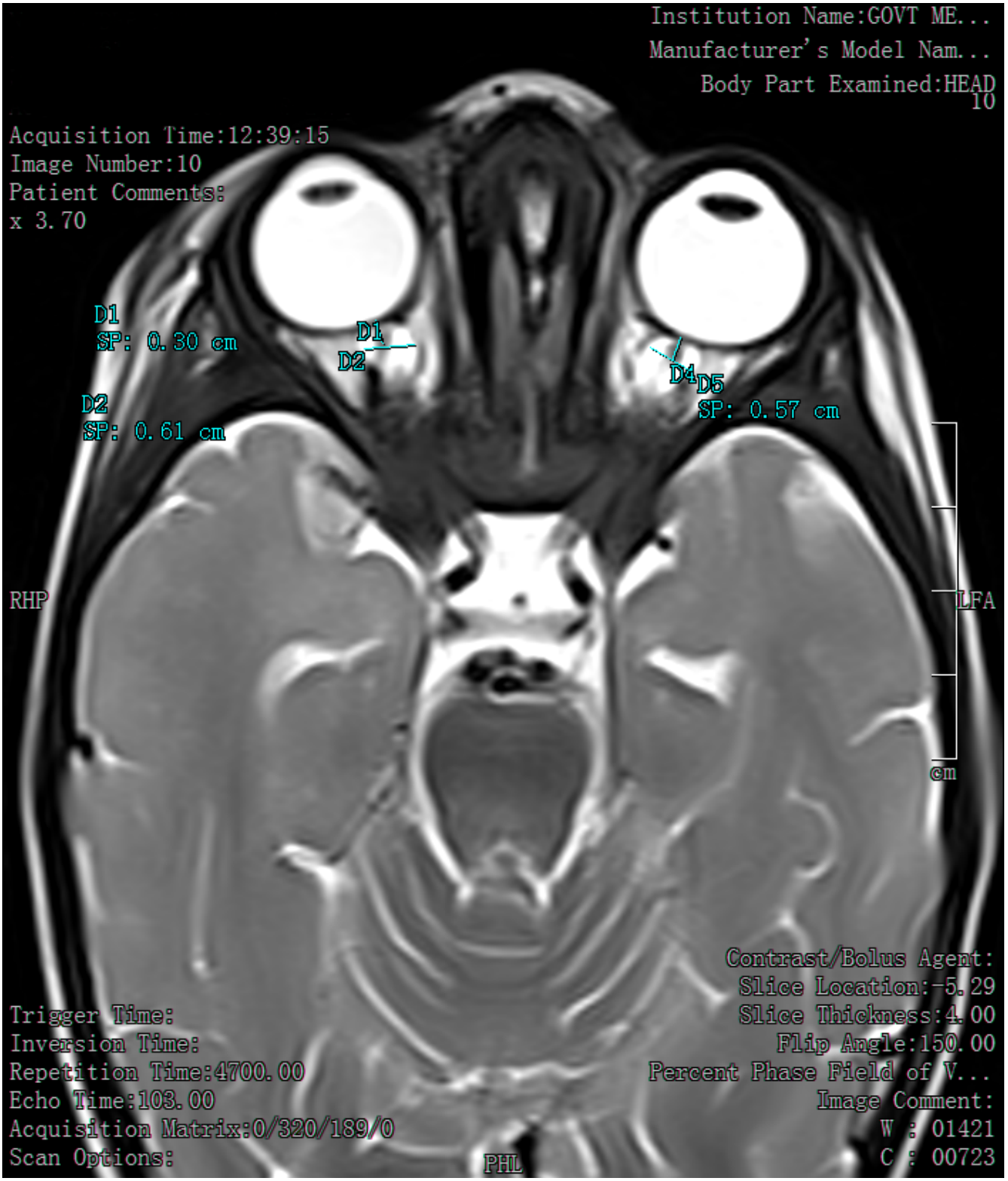


Figure 2. ONSD measured 3 mm behind the globe in a sedated patient.

Clinical Implications

Sedation-associated differences in ONSD should be considered when interpreting measurements. These observations do not establish that a higher ONSD in an individual sedated child represents raised ICP. Agent-specific effects and correction factors require further investigation. Prospective studies with independent ICP assessment are needed to validate these findings.

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Limitations

This study is limited by its retrospective design, absence of invasive ICP measurements, and variability in sedation documentation. These factors may introduce bias and reduce the generalizability of findings.

Conclusion

Higher mean MRI-based ONSD was observed in the sedated group. Sedation status should be considered when interpreting ONSD in children. Prospective studies with appropriate control of confounding factors and independent ICP assessment are needed to determine whether sedation itself affects ONSD and its use as a surrogate for ICP.

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Declarations

Consent for publication: The author clarifies that written informed consent was obtained and the anonymity of the patient was ensured. This study submitted to Swiss J. Rad. Nucl. Med. has been conducted in accordance with the Declaration of Helsinki and according to requirements of all applicable local and international standards.

All authors contributed to the conception and design of the manuscript, participated in drafting and revising the content critically for important intellectual input, and approved the final version for publication. Each author agrees to be accountable for all aspects of the work, ensuring its accuracy and integrity.

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References

1. Rajajee V, Vanaman M, Fletcher JJ, Jacobs TL. Optic nerve ultrasound for the detection of raised intracranial pressure. Neurocrit Care 2011;15(3):506-515. https://doi.org/10.1007/s12028-011-9606-8
2. Koziarz A, Sne N, Kegel F, et al. Bedside optic nerve ultrasonography for diagnosing increased intracranial pressure: A systematic review and meta-analysis. Ann Intern Med 2019;171(12):896-905. https://doi.org/10.7326/M19-0812
3. D'Antona L, Asif H, Craven CL, et al. Brain MRI and ophthalmic biomarkers of intracranial pressure. Neurology 2021;96(22):e2714-e2723. https://doi.org/10.1212/WNL.0000000000012023
4. Sallam A, Abdelaal Ahmed Mahmoud MAA, Kamel MG, et al. The diagnostic accuracy of noninvasive methods to measure the intracranial pressure: A systematic review and meta-analysis. Anesth Analg 2021;132(3):686-695. https://doi.org/10.1213/ANE.0000000000005189
5. Gallagher A, Pike M, Berg S. Beware CSF pressure measured under general anaesthesia. Arch Dis Child 2004;89(7):691. https://doi.org/10.1136/adc.2003.032177
6. Kim Y, Choi S, Kang S, Park B. Propofol affects optic nerve sheath diameter less than Sevoflurane during robotic surgery in the steep Trendelenburg position. Biomed Res Int 2019;2019:5617815. https://doi.org/10.1155/2019/5617815
7. Geeraerts T, Newcombe VF, Coles JP, et al. Use of T2-weighted magnetic resonance imaging of the optic nerve sheath to detect raised intracranial pressure. Crit Care 2008;12(5):R114. https://doi.org/10.1186/cc7006
8. Onder H, Goksungur G, Eliacik S, Ulusoy EK, Arslan G. The significance of ONSD, ONSD/ETD ratio, and other neuroimaging parameters in idiopathic intracranial hypertension. Neurol Res 2021;43(12):1098-1106. https://doi.org/10.1080/01616412.2021.1949688
9. Blaivas M, Theodoro D, Sierzenski PR. Elevated intracranial pressure detected by bedside emergency ultrasonography of the optic nerve sheath. Acad Emerg Med 2003;10(4):376-381. https://doi.org/10.1111/j.1553-2712.2003.tb01352.x
10. Maissan IM, Dirven PJ, Haitsma IK, Hoeks SE, Gommers D, Stolker RJ.Ultrasonographic measured optic nerve sheath diameter as an accurate and quick monitor for changes in intracranial pressure. J Neurosurg 2015;123(3):743-747. https://doi.org/10.3171/2014.10.JNS141197
11. Cardim D, Czosnyka M, Chandrapatham K, Badenes R, Bertuccio A, Noto AD, Donnelly J, Pelosi P, Ball L, Hutchinson PJ, Robba C. Effects of Age and Sex on Optic Nerve Sheath Diameter in Healthy Volunteers and Patients With Traumatic Brain Injury. Front Neurol. 2020 Aug 7;11:764. PMID: 32849220; PMCID: PMC7426488. https://doi.org/10.3389/fneur.2020.00764

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