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LETTER TO THE EDITOR

# ONSD monitoring under anesthesia for middle ear surgery

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To the Editor:

We read with great interest the research report by Chang et al. published recently in the *Journal of Anesthesia* [1]. The authors herein delineate the ultrasonographic, i.e. the USG-assessed optic nerve sheath diameter (ONSD) variations with 60-to-90-degree neck rotation in a cohort of patients undergoing middle ear surgery, randomized to receive either sevoflurane or propofol anesthesia [1]. Acknowledging the authors' extrapolation of the noninvasive intracranial pressure surveillance to a novel operative subset, a few caveats in their study approach and analysis warrant thorough appraisal.

Firstly, the mode of mechanical ventilation employed by the investigators for the conduct of general anesthesia in their cases, remains unaccounted for in their methodology [1]. The commonly used pressure-controlled and volume-controlled ventilation techniques have been linked to peculiar effects on ICP, as highlighted by independent researchers like Karaca et al. evaluating the perioperative fluctuations in the ONSD values [2]. Meanwhile, the latter study was limited to a laparoscopic surgical setting, the importance of the above stated fact is equally difficult to undermine in the Chang et al. study cohort where a unique strategy of 'reversing' the neuro-muscular blockade immediately after endotracheal intubation was employed across the sevoflurane-propofol groups [1, 2]. This indeed can be associated with sudden swings in the peak airway inspiratory and plateau pressures. The authors' technique of a neuromuscular blockade free anesthesia can find rationale in the context of intraoperative electromyography monitoring of cranial nerves (facial nerve for middle ear surgery); nevertheless, the alterations in the airway pressures resulting in ICP changes, likely reflect as a concurrent increase in the ONSD [1, 3]. Furthermore, simultaneous concerns are posed by the extent to which the ONSD measurements in the index study could have been affected by the positive end expiratory pressure (PEEP) used during mechanical ventilation. PEEP frequently applied during mechanical ventilation has been described to confound ONSD measurements in research works contemplated across diverse elective-emergency surgical settings [4–6]. We, however, appreciate the detailed depiction by Chang et al. at time limits T0 (5 min. after anesthetic induction and before head rotation) and T1 (on return to neutral head position after surgery) regarding the end-tidal carbon-dioxide levels [1], albeit humbly seeking clarification on the airway-related pressures during mechanical ventilation, considering a substantial literature on their influence on the corresponding ONSD measurements [2–6].

Secondly, it is apparent from the methodology and images illustrated by Chang et al. that the authors have used B-mode technique of Ultrasonography with a high-frequency linear transducer, wherein the optic nerve tends to appear hypoechoic [1, 7]. Of note here, B-scan ultrasound of the ONS is prone to imaging artefacts, often described as the "Bloom artifacts" [7]. Much in contrast to imaging the larger visceral structures, the impact of such artifacts can be difficult to overlook when involving sub-millimetric variations in ONSD as the parameter in question, only having to be extrapolated in a cohort of cases undergoing middle ear surgery with extreme neck rotation possibly affecting ICP [1, 8]. A-scan ultrasound mode, widely used in ophthalmology practice (where the ONS appears hyper-echoic), classifies as the ultrasound imaging modality of choice for performing an ocular ultrasound. With the arachnoid and sub-arachnoid interface being discernible as a high reflective spike on A-scan ultrasound, the method is potentially free from the "Bloom artifacts" [9].

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Lastly, though Chang et al. address that their study is limited by a single un-blinded investigator measuring ONSD at anesthesia induction and after surgery, we believe that the approach is faced with other concerns beyond the benefit of minimising the inter-observer variability [1]. In our experience with extrapolating ONSD to outcome, we often chose to practice a sequence where the investigator 1 secures the ONSD images (pre- and postoperative), labels it digitally and saves the same in the USG system; thereafter allowing the investigator 2 to subsequently perform the requisite measurements who was more importantly blinded to the image sequence [10]. We suggest this as a simple alternative to achieve both coherent blinding and adequate inter-rater reliability with both the investigators duly experienced in performing and interpreting an ocular USG.

Again, acknowledging the meticulous research work behind the Chang et al. observations suggesting no significant difference in the ONSD changes from T0 to T1 between the sevoflurane and propofol groups (0.6 (0.4) mm vs. 0.6 (0.3) mm, respectively; $P$-value = 0.972) [1]; we caution to adhere concomitant vigilance to the technical, computational, and the methodological intricacies involved in the USG measurement of ONSD, in patients undergoing middle ear surgery.

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