Korean Journal of Anesthesiology

Letter to the Editor

pISSN 2005–6419 • eISSN 2005–7563

Methods for achieving equilibration during expiration in a modified Rapid-O2 oxygen insufflation device

Dear Editor,

Rapid-O2 oxygen insufflation device™ (Rapid-O2) (Meditech Systems Inc.) [1] was designed primarily for rescue oxygenation in "cannot intubate, cannot oxygenate" events; thus, hypercarbia is inevitable. To address this limitation, we modified Rapid-O2 (Supplementary Fig. 1) to provide actively enhanced expiration, and demonstrated effective ventilatory support [2]. When using modified Rapid-O2, it is essential to adjust the duration of insufflation and expiration to prevent hyperinflation or lung collapse. Considering that the vital capacity of adults is approximately 5 L, a certain amount of hyperinflation may not be an issue. However, if more gas expires than is insufflated, lung collapse or even negative-pressure pulmonary edema may develop after a short period of actively assisted expiration [3]. Therefore, as a safety measure, we attached a T-type thumb-control connector with a hole to the oxygen supply line (Supplementary Fig. 1A). If the hole is opened when excessive gas expires, the modified Rapid-O2 is functionally switched off [2]. Despite its advantages, this system has some drawbacks. Firstly, the driving pressure in the oxygen supply line is quite high, approximately 1600 cmH_2O [2], which makes it somewhat hard to occlude the hole with a thumb during insufflation. Secondly, the user must use one thumb to open or close the end of the silicone tubing while simultaneously using the other thumb to manage the hole. This dual requirement makes it difficult to immobilize the main body of the modified Rapid-O2, which is connected to a transtracheally mounted catheter. If there is a hole in the main body, the user can cover it with the thumb while wrapping their index finger around the body, providing a secure grip. To address these issues, we removed the thumb-control connector and made an opening in the body (Fig. 1). We assessed whether this modification enables proper equilibration of intrathoracic pressure with the atmosphere through manipulation of the opening. Additionally, we evaluated the convenience of using this feature.

The diameter of the holes tested ranged from 3.0 mm to 8.0 mm. A 14 G angiocatheter (Becton Dickinson) was used as the insufflating catheter. A pressure-compensated oxygen flow meter (Ohio Medical) was used, and the oxygen flow rate was set at 15 L/min during the assessment. Two methods were used to assess equilibration during expiration. First, at a certain point during expiration, the end of the silicone tubing was occluded and the hole was opened simultaneously. Second, the hole was opened during expiration. The insufflating pressures, gas flows, and volumes were measured when the end of the silicone tubing was occluded for insufflation while simultaneously opening the hole (with the tubing closed and the hole opened). The expiratory pressures and flows were measured when the hole was opened, while the end of the silicone tubing was opened for expiration (with both the hole and tubing opened). The pressures, along with gas flows, were measured using a VT Plus HF Gas Flow Analyzer (VT Plus Analyzer) (BioTek). The insufflating volume was measured using a trachea-lung model equipped with a test lung (SmartLung2000; IMT Analytics AG) [2].

Statistical analysis was not performed on the measurements using the VT Plus Analyzer (n = 4) and trachea-lung model (n = 6) because of the limited number of experiments and the similarity of the measured values within each group. The results were presented as mean ± SD.

With the tubing closed and the hole opened: At a 3.0 mm hole, insufflating pressures were 7 ± 0 cmH_2O which decreased gradually as the diameter increased. The pressure reached approximately 0 cmH_2O at 7.0 mm diameter. The insufflating flow and volume were 43

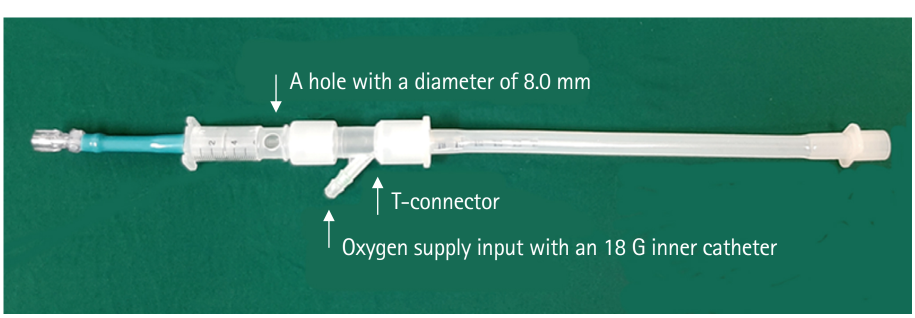

Fig. 1. Modified Rapid-O2 oxygen insufflation device with a hole in the body. A straight connector with a drilled hole was connected between the T-connector and Luer lock connector. Insufflation was performed by occluding the end of the silicone tubing while keeping the hole closed. Expiration was achieved by opening the end of the silicone tubing while keeping the hole closed.

± 0 ml/s and 22 ± 1 ml with a 3.0 mm hole. Beyond the 3.0 mm opening, no insufflating flow or volume was detected. With both the hole and tubing opened: At a 3.0 mm hole, the expiratory pressure and flow were −36 ± 0 cmH_2O and 111 ± 1 ml/s, respectively. As the diameter of the hole increased, both the pressure and flow decreased gradually. At an 8.0 mm hole, the pressure and flow dropped to −5 ± 0 cmH_2O and −35 ± 1 ml/s, respectively.

With the tubing closed and the hole opened, the insufflating pressures were less than 2 cmH_2O for holes larger than 3.0 mm. Additionally, both insufflating flows and volumes were 0 ml/s for holes larger than 3.0 mm. This suggests that the lungs remain static in that position during expiration for holes greater than 3.0 mm. Meanwhile, with both the hole and tubing opened, the expiratory pressure and flow were −5 ± 0 cmH_2O and −35 ± 0 ml/s, respectively, with an 8.0 mm hole. This indicates that, even with an 8.0 mm diameter, a small amount of gas is slowly and continuously expelled from the lungs due to the negative pressure created by the 14 G angiocatheter. Meanwhile, an expulsion rate of 35 ml/s would be acceptable for a short duration. The pressure required to occlude the hole in the thumb-control connector was approximately 1600 cmH_2O [2], while the insufflating pressure through the 14 G angiocatheter was about 170 cmH_2O [2]. Therefore, maintaining a seal with a thumb in an 8 mm hole in the body of the modified Rapid-O2 posed no difficulties. Following the previous report on the modified Rapid-O2 [2], we presented a further modification to improve its usability and safety in clinical settings. Simplifying the operation of the device during emergency situations could help reduce delays in oxygenation.

In conclusion, a more effective method for equilibration is opening the hole while occluding the end of the silicone tubing, rather than opening the hole during expiration. Although opening the hole during expiration is somewhat less effective, it remains a practical alternative. In terms of usability, opening the hole during expiration may feel more straightforward and natural for the user. We recommend using an 8.0 mm hole for optimal performance in both configurations.

Darhae Eum, Hyun Joo Kim, Wyun Kon Park

Department of Anesthesiology and Pain Medicine, and Anesthesia and Pain Research Institute, Yonsei University College of Medicine, Seoul, Korea

Corresponding author: Wyun Kon Park, M.D., Ph.D.
Department of Anesthesiology and Pain Medicine, and Anesthesia and Pain Research Institute, Yonsei University College of Medicine, 50-1 Yonsei-ro, Seodaemun-gu, Seoul, Korea
Tel: +82-2-2228-2420 Fax: +82-2-312-7185
Email: wkp7ark@yuhs.ac

Received: May 12, 2025; Revised: June 20, 2025; Accepted: July 31, 2025

Acknowledgments: The authors thank Yong In Jang (Director, Medical Division, Draeger Korea) for providing the VT Plus HF Gas Flow Analyzer for this study.

Funding: None.

Conflicts of Interest: No potential conflict of interest relevant to this article was reported.

Author Contributions: Darhae Eum (Writing – original draft); Hyun Joo Kim (Writing – review & editing); Wyun Kon Park (Project administration)

Supplementary Material: Supplementary Fig. 1. Modified Rapid-O2 oxygen insufflation device (A). Schematic illustration of the modified Rapid-O2 oxygen insufflation device (B). ID: inner diameter. ET: endotracheal tube.

ORCID: Darhae Eum, https://orcid.org/0000-0003-0048-1476; Hyun Joo Kim, https://orcid.org/0000-0003-1963-8955; Wyun Kon Park, https://orcid.org/0000-0002-5204-3921

References

1. Insufflation Device RAPID O2 [Internet]. Shaftesbury (UK): Meditech Systems Limited [cited 2025 May 12]. Available from www.meditechsystems.co.uk/product/insufflation-device-rapid-o2
2. Jang J, Kim HJ, Kim HJ, Park WK. Transcatheter ventilation with a modified Rapid-O2 oxygen insufflation device. Korean J Anesthesiol 2025; 78: 61-72.
3. Hamaekers AE, Borg PA, Enk D. Ventrain: an ejector ventilator for emergency use. Br J Anaesth 2012; 108: 1017-21.

Korean J Anesthesiol 2025;78(6):601-602
https://doi.org/10.4097/kja.25396

A novel method of ultrasound-guided zygomaticotemporal nerve block for awake craniotomy

Dear Editor,

The zygomaticotemporal nerve is a peripheral branch of the maxillary nerve that innervates the skin of the temple region and is responsible for sensory perception [1]. Zygomaticotemporal nerve blocks are commonly used to treat migraines and to relieve pain [2] at the headpin site during awake craniotomy [2,3]. However, the blocking effect is somewhat unstable, with a relatively high failure rate [3]. Moreover, its proximity to the deep temporal artery raises concerns regarding accidental puncture [4]. Thus, we developed an ultrasound-guided zygomaticotemporal nerve block approach, in which a local anesthetic is injected into the deep temporal fascia. Written consent for this case report was obtained from the patients.

A 42-year-old male with a left frontal tumor was scheduled to undergo awake craniotomy. A zygomaticotemporal nerve block was performed before the induction of general anesthesia. The probe was placed parallel to the zygomatic arch, at the level of the zygomatic tubercle (Fig. 1A). A 25 gauge needle (Terumo Corporation, 25 mm reg-