

Advancement of supraglottic jet oxygenation and ventilation technique

Submitted: 25-Mar-2024

Revised: 26-Mar-2024

Accepted: 26-Mar-2024

Published: 12-Apr-2024

Huafeng Wei

Department of Anesthesiology and Critical Care, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, USA

Address for correspondence: Prof. Huafeng Wei,

Department of Anesthesiology and Critical Care, University of Pennsylvania Perelman School of Medicine, 305 John Morgan Building, 3620 Hamilton Walk, Philadelphia, PA 19104, USA.

E-mail: huafeng.wei@pennmedicine.upenn.edu

Access this article online
Website: https://journals.lww.com/ijaweb
DOI: 10.4103/ija.ija_330_24
Quick response code


Since the introduction of the supraglottic jet oxygenation and ventilation (SJOV) technique in 2006,^[1] it has been increasingly used for various aspects of airway management. The technique has been facilitated largely by the introduction of the jet endotracheal tube^[1-3] and the jet nasal tube.^[4-18] A large number of studies, including a multicentre randomised clinical trial,^[16] demonstrated the high efficiency of SJOV to prevent or treat hypoxia during upper gastrointestinal (GI) endoscopy,^[3,8,10,11,14-16,19] colonoscopy,^[20] endoscopic retrograde cholangiopancreatography^[4] and hysteroscopy,^[12] under propofol sedation/anaesthesia, especially in obese patients^[11-13,15,21] or in locations with high altitude (e.g., Tibet, China).^[8] In a previous analysis of closed claimed liability cases that took place in non-operating rooms, a majority (58%) of the claimed cases were under monitored anaesthesia care (MAC), while 50% of cases were in the GI suite with inadequate oxygenation and ventilation, which was the most common cause of severe complications or patient death (30%).^[22] Clearly, prevention of hypoxia and hypoventilation during MAC is critical for patient safety in a GI suite. Compared to high-flow nasal oxygenation (HFNO), SJOV not only promoted oxygenation by increasing the fraction of inspired oxygen (FiO₂) and oropharyngeal pressure like HFNO did but was also capable of ventilating patients to eliminate carbon dioxide, especially in

patients with apnoea.^[3] Furthermore, SJOV is also effective to oxygenate/ventilate patients even when the mouth is open in an open airway system.^[3] SJOV has been used to facilitate bronchoscopy under propofol sedation/anaesthesia and prevent or treat hypoxia during the procedure.^[5,9] SJOV has been used to maintain oxygenation/ventilation during elective difficult airway management and to facilitate tracheal intubation.^[1,2,18,23] The new guideline on difficult airway management by the American Society of Anesthesiologists in 2022 suggested that SJOV could be considered one of the approaches to rescue patients with urgent or emergent difficult airways.^[13,17,24] Hence, the SJOV technique has advanced quickly in operating or non-operating rooms to promote oxygenation/ventilation and prevent or treat hypoxia during airway management. Its potential use in treating respiratory failure in emergency or critical medicine needs to be investigated further.

One of the major concerns of using transtracheal jet ventilation (TTJV) during difficult airway management is its high incidence of complications and high failure rate. It was reported that emergent TTJV resulted in barotrauma complications and device failure rate during the 'cannot intubate and cannot oxygenate' emergent airway management, at rates as high as 32% and 42%, respectively.^[25] In contrast, there has

not been a single reported case of barotrauma to date in all studies using the SJOV technique, which has a high success rate in preventing or treating hypoxia/hypoventilation in elective^[3-5,8,9,16,18,23] or urgent/emergent^[13,17] airway management. This advantage of SJOV in comparison to TTJV is largely due to the placement of the jet pulse above the vocal cord, rather than below the vocal cord, which effectively prevents injection of a high volume of gas into a closed airway system and breakage of alveoli with a rapid increase in abnormal high airway pressure.^[3] Common side effects of SJOV are sore throat and dry mouth, with the risk factors being previous history and procedure duration.^[26] In almost all studies to date, humidified oxygen or air was not used for SJOV. Dry mouth could be minimised if humidified oxygen/air is used as a driving gas, especially during chronic use of SJOV for respiratory failure. A minor increase in nose bleeding has been reported in cases when a jet tube is employed via the nose for SJOV,^[16] although SJOV can be performed by inserting a jet catheter via the mouth beside the hollow bite block used for upper GI endoscopy to minimise the minor complications of nose bleeding.

Overall, the SJOV technique has been advancing rapidly and successfully, especially in MAC cases in a non-operating room, with a high efficiency to promote non-invasive oxygenation/ventilation, causing minimal side effects. The potential use of SJOV in emergency and critical medicine requires further investigation.

Conflicts of Interests

Dr. Huafeng Wei is the inventor of the WEI Jet Endotracheal Tube (WEI JET) and WEI Nasal Jet Tube (WEINASALJET or WNJ), which is proposed to generate SJOV used in most clinical studies. Dr. Huafeng Wei is a consultant of Well Lead Medical Company, Guangzhou, China.

ORCID

Huafeng Wei: <https://orcid.org/0000-0003-3077-6574>

REFERENCES

- Wei H. A new tracheal tube and methods to facilitate ventilation and placement in emergency airway management. *Resuscitation* 2006;70:438-44.
- Wu CN, Ma WH, Wei JQ, Wei HF, Cen QY, Cai QX, *et al.* Laryngoscope and a new tracheal tube assist lightwand intubation in difficult airways due to unstable cervical spine. *PLoS One* 2015;10:e0120231. doi: 10.1371/journal.pone.0120231.
- Gupta S. Supraglottic jet oxygenation and ventilation-A novel ventilation technique. *Indian J Anaesth* 2020;64:11-7.
- Su D, Zhang W, Li J, Tan X, Wei H, Wang Y, *et al.* Supraglottic jet oxygenation and ventilation improves oxygenation during endoscopic retrograde cholangiopancreatography: A randomized controlled clinical trial. *BMC Anesthesiol* 2024;24:21. doi: 10.1186/s12871-024-02406-y.
- Wei J, Zhang X, Min K, Zhou H, Shi X, Deng H, *et al.* Supraglottic jet oxygenation and ventilation to minimize hypoxia in patients receiving flexible bronchoscopy under deep sedation: A 3-arm randomized controlled trial. *Anesth Analg* 2024;138:456-64.
- Yang M, Wei H, Hou Q, Wang B, Cheng Q. Evaluation of supraglottic jet oxygenation and ventilation in 105 patients during bronchoscopy using the Twinstream(R) microprocessor-controlled jet ventilator and the Wei Nasal Jet(R) tube. *Med Sci Monit* 2023;29:e938602. doi: 10.12659/MSM.938602.
- Tao X, Xue FS, Hu B, Tian T. Comparing performance of Wei nasal jet tube and nasal cannula during flexible bronchoscopy with sedation. *Eur J Anaesthesiol* 2022;39:297-8.
- Jiang B, Li Y, Ciren D, Dawa O, Feng Y, Laba C. Supraglottic jet oxygenation and ventilation decreased hypoxemia during gastrointestinal endoscopy under deep sedation at high altitudes: A randomized clinical trial. *BMC Anesthesiol* 2022;22:348. doi: 10.1186/s12871-022-01902-3.
- Zha B, Wu Z, Xie P, Xiong H, Xu L, Wei H. Supraglottic jet oxygenation and ventilation reduces desaturation during bronchoscopy under moderate to deep sedation with propofol and remifentanyl: A randomised controlled clinical trial. *Eur J Anaesthesiol* 2021;38:294-301.
- Shao LJ, Zou Y, Liu FK, Wan L, Liu SH, Hong FX, *et al.* Comparison of two supplemental oxygen methods during gastroscopy with propofol mono-sedation in patients with a normal body mass index. *World J Gastroenterol* 2020;26:6867-79.
- Shao LJ, Hong FX, Liu FK, Wan L, Xue FS. Prospective, randomized comparison of two supplemental oxygen methods during gastroscopy with propofol mono-sedation in obese patients. *World J Clin Cases* 2021;9:5479-89.
- Liang H, Hou Y, Sun L, Li Q, Wei H, Feng Y. Supraglottic jet oxygenation and ventilation for obese patients under intravenous anesthesia during hysteroscopy: A randomized controlled clinical trial. *BMC Anesthesiol* 2019;19:151. doi: 10.1186/s12871-019-0821-8.
- Liang H, Hou Y, Wei H, Feng Y. Supraglottic jet oxygenation and ventilation assisted fiberoptic intubation in a paralyzed patient with morbid obesity and obstructive sleep apnea: A case report. *BMC Anesthesiol* 2019;19:40. doi: 10.1186/s12871-019-0709-7.
- Hou Y, Liang H, Wei H, Feng Y. WEI nasal jet tube during monitored anaesthesia care for removal of oesophageal foreign body for a patient with fragile cardiopulmonary function. *Indian J Anaesth* 2019;63:403-5.
- Shao LJ, Liu SH, Liu FK, Zou Y, Hou HJ, Tian M, *et al.* Comparison of two supplemental oxygen methods during gastroscopy with intravenous propofol anesthesia in obese patients: Study protocol for a randomized controlled trial. *Trials* 2018;19:602. doi: 10.1186/s13063-018-2994-8.
- Qin Y, Li LZ, Zhang XQ, Wei Y, Wang YL, Wei HF, *et al.* Supraglottic jet oxygenation and ventilation enhances oxygenation during upper gastrointestinal endoscopy in patients sedated with propofol: A randomized multicentre clinical trial. *Br J Anaesth* 2017;119:158-66.
- Li Q, Xie P, Zha B, Wu Z, Wei H. Supraglottic jet oxygenation and ventilation saved a patient with 'cannot intubate and cannot ventilate' emergency difficult airway. *J Anesth* 2017;31:144-7.
- Wu C, Wei J, Cen Q, Sha X, Cai Q, Ma W, *et al.* Supraglottic jet oxygenation and ventilation-assisted fibre-optic bronchoscope intubation in patients with difficult airways. *Intern Emerg Med* 2017;12:667-73.

19. Levitt C, Wei H. Supraglottic pulsatile jet oxygenation and ventilation during deep propofol sedation for upper gastrointestinal endoscopy in a morbidly obese patient. *J Clin Anesth* 2014;26:157-9.
20. Yang ZY, Meng Q, Xu YH, Wang JW, Yu DS, Wei HF. Supraglottic jet oxygenation and ventilation during colonoscopy under monitored anesthesia care: A controlled randomized clinical trial. *Eur Rev Med Pharmacol Sci* 2016;20:1168-73.
21. Gohil S, Palanisamy P, Munroe R, Wei H. Supraglottic jet oxygenation and ventilation via nasal approach for a morbidly obese patient during cardiac catheterization. 2015: Abstract for Annual Meeting of American Society of Anesthesiologists (ASA), San Diego, California, U.S.A, October 20-15 and World Airway Management Meeting (WAMM) Abstract 386, Dublin, Ireland, November, 2015.
22. Robbertze R, Posner KL, Domino KB. Closed claims review of anesthesia for procedures outside the operating room. *Curr Opin Anaesthesiol* 2006;19:436-42.
23. Peng J, Ye J, Zhao Y, Liang J, Huang H, Wei H, *et al.* Supraglottic jet ventilation in difficult airway management. *J Emerg Med* 2012;43:382-90.
24. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, *et al.* 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. *Anesthesiology* 2022;136:31-81.
25. Duggan LV, Ballantyne Scott B, Law JA, Morris IR, Murphy MF, Griesdale DE. Transtracheal jet ventilation in the 'can't intubate can't oxygenate' emergency: A systematic review. *Br J Anaesth* 2016;117(Suppl 1):i28-38.
26. Xie P, Wu Z, Zha B, Xu L, Shen S, Zhuang H, *et al.* Risk factors for pharyngalgia and xerostomia undergoing supraglottic jet oxygenation and ventilation in gastrointestinal endoscopy: A retrospective study. *Sci Rep* 2023;13:21949. doi: 10.1038/s41598-023-49473-8.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

How to cite this article: Wei H. Advancement of supraglottic jet oxygenation and ventilation technique. *Indian J Anaesth* 2024;68:409-11.

Subscription to the Indian Journal of Anaesthesia (IJA)

Indian Journal of Anaesthesia (IJA) is an official Publication of the Indian Society of Anaesthesiologists (ISA). The journal is indexed with or included in DOAJ, EMBASE/ Excerpta Medica, Emerging Sources Citation Index, Indian Science Abstracts, IndMed, PubMed Central, Scimago Journal Ranking, SCOPUS, and Web of Science.

Impact Factor® as reported in the 2022 Journal Citation Reports® (Clarivate Analytics, 2023): 2.9

For - Individual and INSTITUTE/LIBRARY subscriptions, please visit the link: <https://prepayment.medknow.com/Subscription/Index>

Or email at:

WKHLRPMedknow_subscriptions@wolterskluwer.com

For details related to the journal subscription for ISA members, please visit the ISA website: <https://www.isaweb.in/>

Dr. (Prof) Rakesh Garg

Editor-in-Chief

Indian Journal of Anaesthesia (IJA)

Email: drrgarg@hotmail.com

Mobile: +91 9810394950