

# Airway management using O<sub>2</sub> flush via Cook airway exchange catheter<sup>®</sup> for microlaryngeal surgery

Hyung Tae Kim, Soo Young Moon, Dong Un Song, and Ki Hyun Lee

Department of Anesthesiology and Pain Medicine, Presbyterian Medical Center, Jeonju, Korea

A 31-year old male patient who was 173 cm tall and weighed 67 kg visited our ENT clinic with dyspnea and laryngeal papilloma as his main complaints. According to laryngoscopic findings, a diffuse large papilloma was observed at the posterior wall of the left subglottis (Fig. 1A). The patient was scheduled for the removal of the papilloma under general anesthesia.

Since the patient was adamantly opposed to invasive procedures such as a tracheostomy, awake intubation was considered for safety reasons, but finally a fiberoptic bronchoscopy (FOB) and cricothyroidotomy set were prepared in case of trachea obstruction, considering that the size of the tumor was not large enough to obstruct the trachea. Anesthesia was induced with propofol, remifentanyl, and rocuronium. Fortunately, ventilation was satisfactory, and tracheal intubation was performed. A tracheal tube 6.0 mm in inner diameter (ID) was inserted. Upon completion of preparations for surgery, an attempt was made to replace the tracheal tube with a tube that was 5.0 mm in ID using a Cook airway exchange catheter<sup>®</sup> (CAEC: Cook Critical Care, Bloomington, USA) with a 14.0 of French size, 83 cm of length and 3.0 mm of ID, but only the CAEC was left in due to difficulty in surgery, and the tracheal tube was removed to surgery (Fig. 1B). The CAEC was fixed at the teeth after fitting at 22 cm because the length between the teeth and the superior aspect of the carina through FOB using a tracheal tube was 22 cm. In order to immediately reintubate and monitor end-tidal CO<sub>2</sub> (EtCO<sub>2</sub>) in case of problems in ventilation or oxygenation, an adapter and the tracheal tube were left on the CAEC (Fig. 1C). Additionally, an injector for high-frequency jet ventilation (HFJV) was also prepared

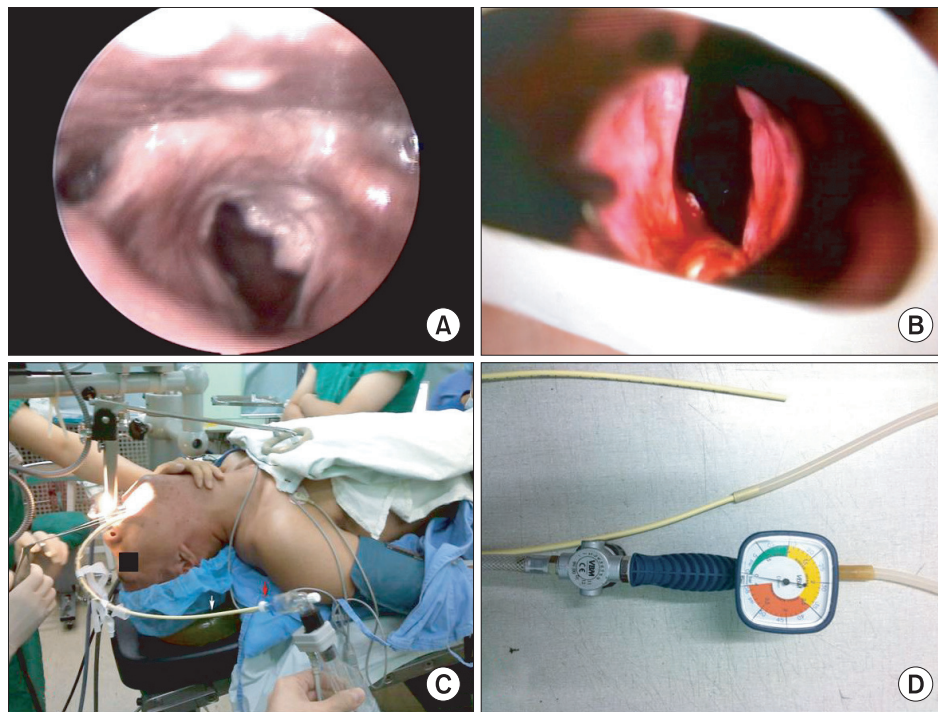
(Fig. 1D). For preventing aspiration, the patient's position was changed to the Trendelenburg position (Fig. 1C). In an attempt to avoid risks of developing ignition caused by the electrocautery, continuous ventilation was replaced by the on-and-off procedure; when the pulse oximeter oxygen saturation (SpO<sub>2</sub>) of the patient fell to 90% or below, the procedure was stopped, and the reservoir bag was filled with an O<sub>2</sub> flush; and after bagging at 100–120 times/minute, and the peak inspiratory pressure did not exceed 30 cmH<sub>2</sub>O resulting in an SpO<sub>2</sub> of at 95% or greater, the procedure was resumed. At the end of the operation (Fig. 1C), a tracheal tube that had a 6.0 mm ID was intubated.

Since microlaryngeal surgeries are performed under general anesthesia, small-diameter endotracheal tubes or jet ventilation are generally used for tracheal airway management according to the size and location of tumors. As one of the most useful methods of airway management in laryngeal surgery, jet ventilation, has been widely used because the view of the larynx is not blocked [1]. Supraglottic jet ventilation is a method of jet oxygenating via the vocal cords, which is ideal for surgical exposure, but anesthesiologists experience difficulty when using this method of airway management. Moreover, supraglottic jet ventilation may cause gastric distension because of high pressure and malalignment, inefficient or ineffective ventilation caused by barotraumas and malposition, and many potential complications including aspiration of blood and debris in the hypercarbia and bronchi [2,3]. Subglottic jet ventilation is a method using a small tube via the glottis below the vocal cord, which requires a tube and an injector. Subglottic

---

Corresponding author: Hyung Tae Kim, M.D., Department of Anesthesiology and Pain Medicine, Presbyterian Medical Center, Junghwasan-dong 1-ga, Wansan-gu, Jeonju 560-750, Korea. Tel: 82-63-230-1593, Fax: 82-63-230-8169, E-mail: [ingwei2475@gmail.com](mailto:ingwei2475@gmail.com)

© This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.



**Fig. 1.** (A) pre-operative laryngoscopic image shows a diffuse large papilloma on the posterior wall of the left subglottis. (B) Intra-operative laryngoscopic image after excision of the papilloma. Laryngoscopic image shows the clear posterior wall of the subglottis and Cook airway exchange catheter<sup>®</sup>. (C) Intra-operative image. The red arrow shows a RAPI-FIT<sup>®</sup> adapter. The white arrow shows a Cook airway exchange catheter<sup>®</sup>. (D) A Cook airway exchange catheter<sup>®</sup> and injector for jet ventilation.

jet ventilation provides anesthesiologists with convenience in ventilation, and does not cause aspiration of blood and debris. When a small tube is used, surgical exposure and access are not blocked. Recent animal and human studies proved the superiority of subglottic jet ventilation in microlaryngeal surgery [4]. Despite this, the method is not free from the risk of developing complications including barotraumas.

In this case, oxygenation was well maintained to prevent barotraumas by filling the reservoir bag with an O<sub>2</sub> flush, and adjusting the water so as not to exceed 30 cmH<sub>2</sub>O of maximum inhaling pressure through bagging at 100–120 times/min. If oxygenation was not well maintained, a CAEC could be used as a tube, and the airway could be maintained by HFJV using an injector already prepared. If that method was not enough, the tracheal tube could be re-intubated, enabling a controlled mode of ventilation. Accordingly, airway management using a CAEC is considered to be very safe for airway management of patients. If clinics are not well equipped with injectors, a CAEC can be used as a tube, and subglottic jet ventilation may be performed using an O<sub>2</sub> flush with the anesthesia machine as an injector. In this case, the anesthesia machine, an S/5 Aespire<sup>™</sup> (GE Healthcare, USA), was used. In this machine, the O<sub>2</sub> flush is activated by setting the O<sub>2</sub> flush button to  $241 \pm 7$  kPa ( $35 \pm 1.0$  psi) of pressure, which can be used as an injector in case of an emergency to help airway management.

A CAEC is a hollow and semirigid catheter enabling oxygen insufflations, and has a blunt catheter tip, lowering the risk of

tracheobronchial trauma or lung laceration, and consequently, it has been used for tube replacements or extubation trials [5]. Unlike the tubes for general jet ventilation, since a CAEC can be used for intubating a tracheal tube by virtue of the catheter functioning as a guide wire, can be connected with a typical circuit or EtCO<sub>2</sub> adapter through a RAPI-FIT<sup>®</sup> adapter (Fig. 1C), and can be connected with the injector for HFJV (Fig. 1D), anesthesiologists may be able to perform airway management much more easily and safely. CAECs with various types and sizes are produced, and anesthesiologists may choose CAECs appropriate to cases for effective airway management during anesthetic procedures.

In conclusion, when a CAEC is used in operations using laryngoscopy, the merits are summarized as follows: First, no additional tube is necessary for jet ventilation. Second, a CAEC can be connected to a typical anesthesia machine and a capnograph monitor via a RAPI-FIT<sup>®</sup> adapter. Third, a tracheal tube can be intubated at any time in an emergency such as unexpected oxygenation and development of ventilation problems or aspiration. Last, the intubated tracheal tube may be usefully used for confirming through FOB.

## References

1. Albert SN, Shibuya J, Albert CA. Ventilation with an oxygen injector for suspension laryngoscopy. *Anesth Analg* 1972; 51: 866-70.
2. O'Sullivan TJ, Healy GB. Complications of ventri jet ventilation

- during microlaryngeal surgery. Arch Otolaryngol 1985; 111: 127-31.
3. Rontal M, Rontal E, Wenokur M. Jet insufflations anesthesia for endolaryngeal surgery. Laryngoscope 1980; 90: 1162-8.
  4. Zimmerman AA, Yorj JK, Pickett M, Hunsaker DH. Supragottic vs subgottic jet ventilation for surgery of the larynx: the use of Mon-Jet tube. Anesth Analg 1994; 78: S502.
  5. Cooper RM. Extubation and changing endotracheal tubes. In: Airway Management: Principles and Practice. Edited by Benumof J: St. Louis, Mosby-Yearbook. 1996, pp 874-85.