Journal of Anesthesia & Clinical Research

Dziewit and Wei J Anesthe Clinic Res 2011, 2:6
DOI: 10.4172/2155-6148.1000141

Case Report Open Access

# Supraglottic Jet Ventilation Assists Intubation in a Patient with Difficult Airway Due to Unrecognizable Supraglottic Structures

**J Andrew Dziewit and Huafeng Wei***

*Department of Anesthesiology and Critical Care, University of Pennsylvania, Philadelphia, PA 19104, USA*

## Abstract

A 37-year-old woman with history of dysphagia underwent an elective surgery for cervical lymph node excision. After anesthesia induction and muscle relaxation, mask ventilation was moderately difficult and direct laryngoscopy showed an extremely swollen and deformed epiglottis and throat, with no clear view of the vocal cords. Utilizing supraglottic jet ventilation, we intubated this patient quickly, smoothly and successfully, without any obvious complications.

**Keywords:** Jet ventilation; Intubation techniques; Difficult airway

## Introduction

Difficulties and/or failures in tracheal intubation is still one of the major causes of morbidity and mortality related to the practice of anesthesia and critical care [1-4]. It has been noted that the, "cannot ventilate/intubate" emergency airway may be responsible for up to 28% of all deaths associated with anesthesia practice [4]. Jet ventilation features an opening system and should be ideal for providing supraglottic oxygenation and ventilation during direct laryngoscopy and tracheal intubation [5]. Transtracheal jet ventilation (TTJV) has been recommended as one of two final life-saving steps in the "cannot ventilate/intubate" emergency airway algorithm proposed by both the American Society of Anesthesiologists (ASA) and the Difficult Airway Society [6,7]. However, emergent TTJV is invasive and is associated with a relatively high incidence of barotraumas [4]. In contrast, noninvasive supraglottic jet ventilation can provide effective oxygenation and ventilation during direct laryngoscopy and assist tracheal intubation with only a view of the epiglottis (Grade III view of glottis) under the assistance of end-tidal CO2 (PetCO2) and chest rise monitoring [8]. We recently reported a case utilizing supraglottic jet ventilation (SJV) to maintain oxygenation during direct laryngoscopy and facilitation of tracheal intubation in a patient with Marfan's syndrome and a difficult airway [9]. Here, we report another case using SJV to maintain adequate oxygenation during direct laryngoscopy and to assist smooth and successful tracheal intubation in an apneic patient with an unrecognizable epiglottis and supraglottic structures.

## Case Report

A 37-year-old woman was scheduled for an elective cervical lymph node excision. The patient was 63 inches tall and weighed 50 kg. She is classified as ASA II with past medical history of dyphagia and without any past surgical history. Preoperative airway examination was notable for a Mallampati class II airway; missing top teeth; and full range of motion of the neck with the ability to subluxate her jaw. Based on the preoperative evaluation, we decided to proceed with general anesthesia and tracheal intubation for airway management. Routine monitors were placed and the plan for securing her airway was direct laryngoscopy for endotracheal intubation with back-up use of SJV, in addition to back-up use of an LMA and fiberoptic bronchoscope for potential difficult airway. SJV was planned as the immediate back-up because of this patient's unknown etiology of dysphagia, and the ability of SJV to assist oxygenation and ventilation immediately after placement of a laryngoscope and before inserting an endotracheal tube through the vocal cords [8]. This unique feature is not available in most other currently available techniques in airway management. Additionally, the anesthesia attending is quite familiar with this new technique [8], which has been frequently used by this expert in airway management for the purpose of resident teaching successfully, without serious complications (unpublished data). Similar to our first case report [9], we placed a tube exchanger from Cook Critical Care (Bloomington, IN, U.S.A) with an internal diameter (ID) of 2.3 mm inside lumen of a regular endotracheal tube (ETT) (Mallinckrodt Medical Inc., St. Louis, MO, U.S.A), with its distal tip flush with the distal opening of the ETT, and used it as a jet catheter. We connected the proximal end of the jet catheter to a Sanders manual jet device (Anesthesia Associates, INC., San Marcos CA, U.S.A.) as shown in our previous studies [8,9]. The Sander manual jet ventilator was driven by high pressure 100% oxygen. We also placed a stylet in the lumen of the ETT and shaped its distal end about 20°-30° upwards.

Before induction of anesthesia, we placed routine monitors: electrocardiography (ECG), noninvasive blood pressure (NBP), and pulse oximetry (SpO2). The patient was pre-oxygenated with oxygen 100% via facemask for five minutes. We then induced general anesthesia with intravenous injection of lidocaine 60 mg, fentanyl 100 mcg, propofol 150 mg, and vecuronium 5 mg. We then found the patient was moderately difficult to mask ventilate with small tidal volumes even using two hands and an oral airway. We quickly attempted direct laryngoscopy using a Macintosh laryngoscope #3 and noticed extreme swelling of the uvula, epiglottis and soft tissues of the throat, making it difficult to identify the epiglottis and the supraglottic structures. We then tried to ventilate the patient by mask with 2% sevoflurane in oxygen and no hypoxia occurred. On the second attempt at intubation, we first placed the distal end of the endotracheal tube under a soft tissue structure which somewhat resembled the epiglottis and aligned the longitudinal axis of the ETT with the midline of the patient's body. We

***Corresponding author:** Huafeng Wei, M.D., Ph.D, Assistant Professor, Department of Anesthesiology and Critical Care, University of Pennsylvania School of Medicine, 305 John Morgan Building, 3620 Hamilton Walk, Philadelphia, PA 19104, Tel: 215-662-3193; Fax: 215-349-5078; **E-mail**: weih@uphs.upenn.edu

**Received** February 25, 2011; **Accepted** May 20, 2011; **Published** June 02, 2011

**Citation:** Dziewit JA, Wei H (2011) Supraglottic Jet Ventilation Assists Intubation in a Patient with Difficult Airway Due to Unrecognizable Supraglottic Structures. J Anesthe Clinic Res 2:141. doi:10.4172/2155-6148.1000141

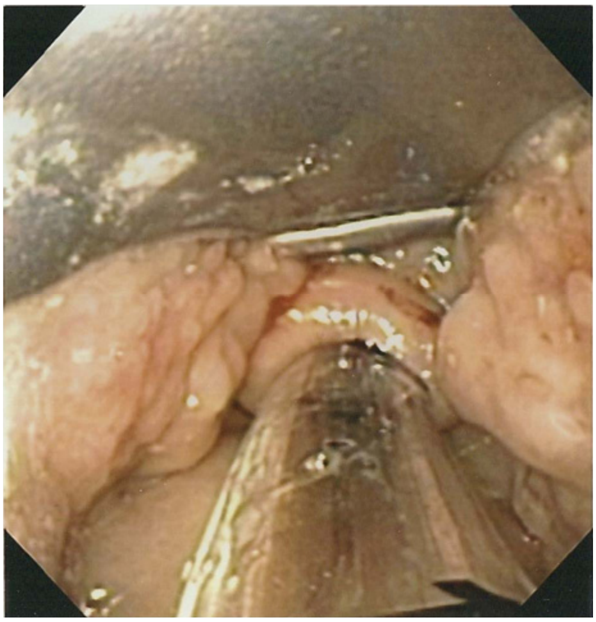

**Figure 1:** Swollen epiglottis and throat structures. A regular endotracheal tube was placed in the trachea with swollen epiglottis and other throat tissues surrounding the endotracheal tube.

then started the supraglottic jet ventilation via the Cook tube exchanger serving as the jet catheter inside the lumen of ETT (driving pressure 15 psi, respiratory rate 15/min, I/E ratio 1:2). While visualizing the patient's chest rise during the inspiratory phase of SJV, we adjusted the angle of the distal tip of the ETT to the right and the left until chest rise was maximized. Thereafter, we advanced the jet catheter blindly through the vocal cord opening into the trachea about 4-6 cm smoothly and successfully on the first attempt. The ETT was then advanced over the jet catheter into the trachea smoothly. The correct placement of the ETT inside the trachea was confirmed by positive PetCO2, bilateral breath sounds, and good chest rise after ventilating the patient manually using the breathing circuit on the anesthesia machine and after removing the jet catheter from the ETT lumen. The patient remained hemodynamically stable and SpO2 remained above 97% throughout the intubation process. There were no signs of gastric distension or other serious complications from SJV such as signs of barotraumas. The surgical procedure occurred without complications. The patient was extubated smoothly at the conclusion of surgery and the patient was stable in the post-anesthesia recovery unit (PACU).

## Discussion

Similar to our previous studies [8,9], SJV proved to be effective in maintaining oxygenation and ventilation during direct laryngoscopy even before tracheal intubation. It also assisted the adjustment of the distal end of the ETT so that the position of the lumen of the jet catheter was optimized to directly face the vocal cord opening. This ensured proper placement of the jet catheter and then the ETT into tracheal in an environment of continuous oxygenation and ventilation. Additionally, the obvious chest rise during supraglottic jet ventilation confirmed the position of the ETT in line with the trachea and assisted smooth placement of the jet catheter and then the ETT into the tracheal without ever definitively identifying the patient's epiglottis. Our previous study in pigs has demonstrated that SJV via the use of the jet endotracheal tube safely provides adequate oxygenation and ventilation for as long as 20 minutes with PetCO2 monitoring [8].

A major concern of using jet ventilation in airway management is the possible complication of barotrauma (subcutaneous emphysema, pneumothorax, stomach insufflation etc.). It has been reported that barotraumas can happen as high as 10% during the use of emergent transtracheal jet ventilation [4]. Barotraumas occur when jet pulses are injected into a closed tissue pocket and build up high pressure in the pocket, like blowing air into a balloon until it ruptures. The most important measure to prevent barotraumas during jet ventilation is to avoid formation of a closed tissue pocket. In the case we have described, we used SJV only during direct laryngoscopy, with a wide open mouth and throat, in addition to the open lumen of the endotracheal tube itself. One concern may be the tissue damage from jet pulses directly. However, we use SJV at relatively low driving pressures (15 psi) and low frequencies (15/min), which minimize this potential risk [10]. We did not detect any significant damage to throat tissues when using supraglottic jet ventilation even in prolonged cases in previous animal studies [8]. Nevertheless, operators who use SJV for difficult airway management should be familiar with the basic features of jet ventilation and learn to use jet ventilation in elective cases first before using it in emergent airway management situations to minimize or prevent possible complications of barotraumas.

In comparison with other devices used for management of difficult airway, SJV via a jet catheter inside the lumen of ETT has a unique feature of maintaining oxygenation during direct laryngoscopy. Compared to the TTJV recommended by the ASA practice guidelines for difficult airway management, [6] the use of SJV in difficult airway management has the following two advantages: 1) Early use of jet ventilation immediately after direct laryngoscopy reduces the chance of hypoxia while allowing for longer times for tracheal intubation as patients are oxygenated and ventilated throughout the process; 2) Non-invasive jet ventilation reduces the possible complications of barotraumas compared to TTJV [11]. Thus, the new SJV technique we have introduced is expected to reduce the chance of the "cannot ventilate and cannot intubate" emergent difficult airway as patients was oxygenated and ventilated through SJV rather than a mask, and theoretically reduce morbidity and mortality related to difficult airway management. It should be emphasized that although SJV did not improve the visualization of the throat structure, it allows operators to buy the time for identifying the unclear throat structure. This case report has added more valuable information on utilizing SJV in the management of difficult airway at different clinical situation in addition to our previous report [9]. Obviously, more studies with larger patient sample are needed to confirm and advance the usefulness and safety of SJV in management of difficult airways in the future.

### Acknowledgement

The authors thank David Katka, MD from the Department of Otorhinolaryngology at the University of Pennsylvania for his valuable discussion and assistance.

### References

1. Cheney FW (1999) The American Society of Anesthesiologists Closed Claims Project: what have we learned, how has it affected practice, and how will it affect practice in the future? Anesthesiology 91: 552-556.
2. Peterson GN, Domino KB, Caplan RA, Posner KL, Lee LA, et al. (2005) Management of the difficult airway: A closed claims analysis. Anesthesiology 103: 33-39.
3. Schwartz DE, Matthay MA, Cohen NH (1995) Death and other complications of

emergency airway management in critically ill adults. A prospective investigation of 297 tracheal intubations. Anesthesiology 82: 367-376.

4. Benumof JL, Scheller MS (1989) The importance of transtracheal jet ventilation in the management of the difficult airway. Anesthesiology 71: 769-778.
5. Ihra G, Gockner G, Kashanipour A, Aloy A (2000) High-frequency jet ventilation in European and North American institutions: developments and clinical practice. Eur J Anaesthesiol 17: 418-430.
6. Caplan RA, Benumof JL, Berry FA, Blitt CD, Bode RH, et al. (2003) Practice Guidelines for Management of the Difficult Airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 98: 1269-1277.
7. Henderson JJ, Popat MT, Latto IP, Pearce AC (2004) Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 59: 675-694.
8. Wei HF (2006) A new tracheal tube and methods to facilitate ventilation and placement in emergency airway management. Resuscitation 70: 438-444.
9. Dziewit JA, Wei H (2011) Supraglottic Jet Ventilation Assists Intubation in a Marfan's Syndrome Patient With a Difficult Airway. Accepted.
10. Boyce JR, Peters GE, Carroll WR, Magnuson JS, McCrory A, et al. (2005) Preemptive vessel dilator cricothyrotomy aids in the management of upper airway obstruction. 52: 765-769.
11. Bourgain JL, Desruennes E, Fischler M, Ravussin P (2001) Transtracheal high frequency jet ventilation for endoscopic airway surgery: a multicentre study. Br J Anaesth 87: 870-875.