



Transtracheal high-frequency jet ventilation in a patient with limited mouth opening for endolaryngeal surgery: A case report

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ABSTRACT

In this article, we report a case describing the airway management and anesthetic technique of a 47-year-old male patient undergoing endolaryngeal surgery with extremely limited mouth opening due to previous maxillofacial trauma. An excisional biopsy was planned after laryngoscopic examination for a possible pathological right vocal cord irregularity. Anterior open laryngofissure approach under transtracheal high-frequency jet ventilation was performed after reviewing all possibilities. Neither direct laryngoscopy nor any endolaryngeal instrument placement was possible in this case. This approach was considered the most preferable choice to provide an unobstructed surgical field and safe gas exchange without requiring additional invasive procedure.

Keywords: Difficult airway; laryngofissure approach; transtracheal high-frequency jet ventilation.

Management of the airway is challenging for anesthesiologists in patients with laryngeal anatomical abnormalities caused by malignancy, trauma or previous radiotherapy, particularly when endolaryngeal surgery is necessary. In these group of patients, high-frequency jet ventilation (HFJV) can be a valuable alternative to tracheal intubation or tracheostomy ensuring efficient gas exchange but requires direct or indirect laryngeal visualization to place the subglottic jet cannula.^[1] In patients with difficult airway characterized by limited mouth opening (<35 mm), Mallampati >3 and limited neck movements <80°,^[2,3] when the laryngoscopy is impossible, HFJV can be performed via transtracheal way (TtHFJV) that might be a lifesaving technique in “can’t intubate can’t oxygenate” conditions. This approach also

enables surgical access to the endolarynx by laryngofissure technique, also called median thyrotomy, and to perform endolaryngeal intervention without any suspension instrument in the upper airway.^[4]

In this report, we describe the airway management and anesthetic technique in a patient undergoing excisional biopsy of right vocal cord irregularity in whom mouth opening is extremely limited due to previous maxillofacial trauma.

CASE REPORT

A 47-year-old, 164 cm/62 kg male patient presented to ear, nose, and throat department, complaining of progressive hoarseness and

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inspiratory difficulty for six months. Endoscopic laryngeal examination revealed an irregularity of the right vocal cord accompanied with a mass at the glottic area extending towards the anterior commissure. A three-dimensional computed tomography neck scanning showed a lesion with benign characteristics at the glottic area originating from the right vocal cord and extending towards the anterior commissure. Following these examinations, an open approach excisional biopsy was planned due to improbability to complete the endolaryngeal suspension.

Although pre-anesthetic assessment and facial appearance was normal, airway evaluation showed severely limited mouth opening (gradually reduced to 1 cm) due to a childhood maxillofacial trauma. Based on these findings, TtHJV was determined as the method of ventilation during procedure with the consensus between the anesthesiologist and the surgeon. All the evaluations and decision processes were explained to the patient, and a written consent was obtained.

Following standardized monitoring including electrocardiography, pulse oximetry (peripheral capillary oxygen saturation [SpO₂]) and non-invasive blood pressure, nasal oxygen was administered at 5 liters per minute till the end of the first part of the procedure including cricothyrotomy. During this period, oxygen saturation and all other measured vital parameters were within normal limits. Following local infiltration with two milliliters of 4% lidocaine and sedation (midazolam 2 mg and fentanyl 100 µg), a transverse skin incision was performed at the midline between the thyroid prominence and the cricoid cartilage. After the exposure of the cricoid cartilage and cricothyroid membrane, a transverse cricothyrotomy incision in the median line of the cricothyroid membrane was performed.

At the completion of coniotomy, general anesthesia was induced with 180 mg propofol and 2 µg/kg fentanyl. 30 mg of rocuronium was administered to facilitate the insertion of a 40 cm long HFJV catheter with a diameter of 4 mm (Acutrionic Medical Systems AG, Hirzel, Switzerland) through the cricothyrotomy, and

TtHFJV was started at a rate of 150 breath/minute, driving pressure of 1.5 bar, inspiration time of 50%, and fraction of inspired oxygen of 1.0 (Figure 1). Intravenous infusion of 10 mg/kg/hour propofol and 0.1 µg/kg/minute remifentanyl was commenced to maintain general anesthesia. Supplementary medication of 50 mg ranitidine, 1 gram of ampicillin-sulbactam and 1 mg/kg prednol was added at that moment.

During surgery, mass at the glottic area was completely removed. The intervention lasted about 30 minutes, and the blood loss was minimal. During the surgical procedure, the SpO₂ was continuously maintained between 97-98% and no respiratory complication, including barotrauma or hypoxia was seen. At the end of surgery, 1-gram bolus of paracetamol was given for pain management. All anesthetic infusions were stopped, and residual neuromuscular blockage was reversed with sugammadex (400 mg).

After the withdrawal of the TtHJV catheter, the initial spontaneous ventilation effort was supported via a facemask with 100% oxygen. Regular spontaneous breathing started within two minutes. The incision site upon the cricothyroid membrane was covered with a disposable bandage. The patient was transported to the post-anesthesia care unit (PACU). In the PACU, the patient was followed by oxygen supplementation by facemask and monitored by non-invasive end-tidal carbon dioxide monitor



Figure 1. Transtracheal jet ventilation via cricothyrotomy during laryngofissure approach.

via nasal cannulas and SpO₂. The patient was discharged from the PACU 90 minutes after the termination of surgery without any postoperative complications.

DISCUSSION

This case report highlights the safety and efficacy of TtHJV in patients with extremely difficult airway undergoing laryngeal procedures in whom fiberoptic intubation is not feasible.

Transtracheal high-frequency jet ventilation is a rescue technique in difficult airway situations defined as “can’t ventilate can’t oxygenate” scenario. The technique is a valuable choice also in patients requiring general anesthesia for endolaryngeal procedures, by providing adequate ventilation and unobstructed surgical visualization.^[5,6] Finally, the technique can be chosen for patients requiring open laryngeal and pharyngeal surgery in whom direct laryngoscopy and passage of the tracheal tube into the larynx would not be possible because of the extent of laryngeal pathology.^[7]

In our patient, the mass at the glottic area extending to the anterior commissure necessitated an excisional biopsy and resection of the tumor, but transoral approach had been considered impossible due to the extremely limited mouth opening. The benign character of the lesion and the impossibility of the placement of the suspension laryngoscope and other instruments, an open technique, laryngofissure approach was chosen to reach the lesion as previously reported a relevant technique in management of benign laryngeal tumors.^[7,8]

Due to impossibility of surgical instrumentation via oral way, we did not perform an awake fiberoptic intubation, which would be our first choice for a predicted difficult airway as described in our case. Elective insertion of a HFJV catheter through the cricothyroid membrane is much quicker and simpler than tracheostomy.^[9] Thus, spontaneous breathing was conserved, and gas exchange was secured with oxygen supplementation via nasal cannula till the end of coniotomy and HFJV cannula insertion. Although TtHFJV can be considered as a more invasive technique than oro-tracheal way,^[10] the maintenance of gas exchange was obtained

safely by this approach, and tracheostomy was avoided. This choice of ventilation technique was discussed with the surgical team and considered as the more advantageous method which can accomplish all the needs of surgery and anesthesia: a better surgical condition with an unobstructed field and safe gas exchange conditions.

To conclude, our report demonstrates that airway management and ventilation modalities should be altered in the field of laryngeal interventions according to the needs of surgery and anesthesia. Close relationship and collaboration between the team are crucial in order to achieve the best solution.

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