CORRESPONDENCE

Combination of transnasal humidified rapid-insufflation ventilatory exchange with high frequency jet ventilation for shared airway surgery

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To the Editor,

We would like to report a technique for improving oxygenation during shared airway surgery. This involves the simultaneous use of high frequency jet ventilation (HFJV) with transnasal humidified rapid-insufflation ventilatory exchange (THRIVE).

The following case illustrates the benefit of this combination. A 50-yr-old female (who consented to this report) weighing 124 kg (body mass index, 47 kg·m⁻²) presented for elective microlaryngoscopy, balloon dilation, and steroid injection of a recurrent idiopathic subglottic stenosis. She had a history of challenging episodes of rapid desaturation during similar procedures. For example, during the same procedure under general anesthesia 18 months earlier, both supraglottic HFJV (using a jetting cannula on the surgical laryngoscope) and infraglottic HFJV (using a Hunsaker Mon-Jet ventilation tube) could not achieve a peripheral oxygen saturation (SaO₂) > 90%. At that time, placement of a microlaryngoscopy endotracheal tube was required to allow lung recruitment

and improve oxygenation prior to tracheal dilation. This previous airway management sequence involved several manipulations and was time consuming.

In contrast, during this present admission, improved SaO₂ was achieved using the HFJV-THRIVE combination technique. The patient was positioned with 15 degrees reverse Trendelenburg. Oxygen via Optiflow™ (Fisher & Paykel Healthcare, Auckland, New Zealand) high-flow nasal cannulae was started at 30 L·min⁻¹ pre-induction and was increased to 70 L·min⁻¹ after induction. Total intravenous anesthesia along with 35 mg of atracurium were administered. Supraglottic HFJV was started after introduction of the surgical laryngoscope. The HFJV was paused while the three surgical incisions (first with a sickle knife and then scissors) and balloon dilations were performed. The SaO₂ was maintained at 95% until the last tracheal dilation, when it briefly dropped to 78%, recovering on deflation of the tracheal balloon and resumption of the HFJV-THRIVE combination. Using this approach, the surgical procedure was completed without interruption for endotracheal intubation. The procedure time was 23 min (31 min shorter than the previous intervention). The patient made an unremarkable recovery and was discharged home two days later.

Patel *et al.* previously described the use of THRIVE to extend apnea times during shared airway surgery in anesthetized, paralyzed patients.¹ More recently, Lau *et al.* have described the *sequential* use of jet ventilation and THRIVE,² while Inglis *et al.* have shared their use of *simultaneous* THRIVE with jet ventilation *at the same time*.³ In our experience, when HFJV or THRIVE alone fails to provide adequate oxygenation during shared airway procedures, their combination should be considered to assist oxygenation. This can be performed with either

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Figure Example of the combined use of transnasal humidified rapid-insufflation ventilatory exchange (THRIVE) and high frequency jet ventilation (HFJV) for shared airway surgery. Transnasal humidified rapid-insufflation ventilatory exchange high-flow nasal oxygen is provided at $70 \text{ L} \cdot \text{min}^{-1}$ (blue arrow). Supraglottic HFJV occurs through the access port of the surgical laryngoscope (green arrow). High frequency jet ventilation can also be performed infraglottically. This combined use can be temporary or sustained.

supraglottic or infraglottic HFJV and can be temporary or sustained (see Figure).

As long as the airway is patent, many physiologic mechanisms are involved in maintaining oxygenation and clearing carbon dioxide during THRIVE: oxygen diffusion (i.e., a ventilatory mass flow), cardiogenic oscillations, modest continuous positive airway pressure, and dead space gas washout.⁴ One limitation of THRIVE is that it does not provide enough positive pressure to re-recruit the lung once atelectasis has occurred. One disadvantage of HFJV is the unmeasured entrainment of air that occurs, which lowers the delivered fraction of inspired oxygen (F_iO_2) below the oxygen concentration provided in the jet

itself. When both THRIVE and HFJV are used together, the dead space is washed out with THRIVE's oxygen and HFJV entrains from this enriched oxygen reservoir surrounding the airway. Combined with other mechanisms of gas transport from HFJV such as laminar flow and collateral ventilation,⁵ the delivered F_iO_2 is potentially improved.

The decision to use THRIVE must involve risk assessment. We do not use THRIVE when laser surgery is performed. As with all shared airway procedures, a patient-specific airway plan and backup strategies need to be clearly understood by the operating room team before induction of anesthesia. Appropriately sized extraglottic devices, endotracheal tubes, and front-of-neck access equipment must also be readily available.

Competing interests None.

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