

## CASE REPORT: SEPTEMBER 2016

An adult male patient had just undergone an anterior cervical decompression and fusion along with corpectomy after suffering several cervical fractures due to trauma. At the end of the surgery I considered the decision to extubate the patient or leave intubated. With an additional history of long-term alcohol abuse and prolonged surgical procedure, there were several reasons to extubate the patient to minimize the risk of post-operative pulmonary complications, such as prolonged mechanical ventilation and ventilator-associated pneumonia. However, re-intubation posed several serious threats to this patient, including an anticipated difficult airway secondary to the fused neck, limited cervical motion, presence of C-collar, and the possibility of having to perform an emergency cricothyrotomy.

In weighing the risks and benefits, I decided to extubate the patient. I anticipated the patient would need some ventilatory support and opted to use the SuperNO<sub>2</sub>VA™ device, along with a hyperinflation bag in order to provide positive pressure to maintain airway patency and prevent de-recruitment of lung tissue leading to atelectasis, pulmonary shunting, and respiratory failure. The patient was extubated around 1:00 PM and was immediately placed on the SuperNO<sub>2</sub>VA™ device connected to a hyperinflation bag (ie: supplemental oxygen tubing connected to a reservoir bag, with an adjustable APL-valve) with fresh gas flows of oxygen set to 15 lpm. I titrated the APL-valve on the hyperinflation bag to allow positive pressure to be generated and give recruitment breaths via the reservoir bag as needed. The patient tolerated it well, his airway remained patent, and his oxygen saturation remained 100%. The hyperinflation bag was connected to a transport oxygen tank and patient was transported to the Surgical ICU (SICU) without events. In the SICU, the patient was unable to follow commands and there were questions as to whether or not he had suffered a stroke intra-operatively.

When the patient arrived to the SICU the nursing staff was unfamiliar with the device and requested it be taken off and a nasal cannula be placed at 3 lpm. Within 10 minutes of placement of the nasal cannula, the patient's oxygen saturation level dropped to 90%, his respiratory rate significantly increased, and his ventilation became labored, with audible evidence of upper airway obstruction. An arterial blood gas (ABG) was drawn at this time to evaluate the patient's oxygenation and ventilation status on nasal cannula. The ABG on 3L of nasal cannula was as follows:

- Partial Pressure of Oxygen (PaO<sub>2</sub>): 95mmHg (normal is 105-110mmHg on room air)
- Partial Pressure of Carbon Dioxide (PaCO<sub>2</sub>): 30mmHg (normal is 35-40mmHg)
- pH: 7.52 (normal is 7.4-7.45)

The SuperNO<sub>2</sub>VA™ device with hyperinflation bag was then returned to the patient. Within two minutes of reapplying the SuperNO<sub>2</sub>VA™ device and hyperinflation bag, the patient's oxygen saturation level returned to 100% and his respiratory rate normalized. After 8 minutes, a second ABG was drawn, which read as follows:

- PaO<sub>2</sub>: 315mmHg
- PaCO<sub>2</sub>: 40mmHg
- pH: 7.43

Approximately one hour after being in the SICU, the patient's mental status had not improved and he was still requiring the SuperNO<sub>2</sub>VA™ device to relieve his upper airway obstruction and maintain adequate oxygenation and ventilation. With the SuperNO<sub>2</sub>VA™ device and hyperinflation bag still on the patient, he was transported to the CT scanner for a head CT to rule out stroke. During the exam, the SuperNO<sub>2</sub>VA™ device and hyperinflation bag was functional while the clinicians were outside of the CT scanner and away from the patient, hands-free. The patient tolerated the CT without events and his oxygen saturation remained 100%.

Over the next several hours the patient's mental status slowly improved. At approximately 7:30 PM the patient began to follow commands and was able to communicate with the nursing staff despite the SuperNO<sub>2</sub>VA™ device and hyperinflation bag in use. The nursing staff was hesitant to remove the SuperNO<sub>2</sub>VA™ device due to fear of acute respiratory failure. Follow up ABGs with the SuperNO<sub>2</sub>VA™ device on the patient remained unchanged and within normal limits.

At 11:30 PM the patient's mental status had fully recovered, his respiratory effort had significantly improved, and the patient was very comfortable, tolerating the SuperNO<sub>2</sub>VA™ device over his nose. The nursing staff began weaning him off of the SuperNO<sub>2</sub>VA™ device by titrating open the APL-valve on the hyperinflation bag over the course of the next hour. By 12:30 AM, the SuperNO<sub>2</sub>VA™ device with the hyperinflation bag was removed and the patient was tolerating nasal cannula.

This is a case report demonstrating a high risk patient who had undergone a high risk procedure with clear indications for post-operative extubation and apparent risks for re-intubation in the case of respiratory failure. It is clear that with nasal cannula in the SICU, this patient quickly decompensated and impending respiratory failure requiring rescue intubation was expected. The successful use of the SuperNO<sub>2</sub>VA™ device, along with the positive pressure generated by the hyperinflation bag, allowed for maintenance of airway patency and continued ventilatory support with evidence that it may have prevented a high risk rescue endotracheal intubation and potentially prolonged mechanical ventilation.

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