Right Upper Lobe Resection after Left Pneumonectomy

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SURGERY of the airway or lungs remains a challenge to the anesthesiologist because adequate oxygenation and ventilation can be difficult to maintain. We report an unusual case that illustrates the use of low-frequency catheter jet ventilation for improving surgical conditions in thoracoscopic procedures.

Case Report

A 59-yr-old, 90-kg man was admitted for thoracoscopic resection of a right upper lobe mass. He had a 150-pack-yr smoking history and in 1990 had undergone a left pneumonectomy for adenocarcinoma. His medical history also was significant for three myocardial infarctions. Medications were diltiazem and isosorbide dinitrate. His preoperative pulmonary function tests showed a forced vital capacity of 2.371 and a forced expiratory volume in 1 s of 1.431. Preoperative arterial blood gas analysis revealed a pH 7.45, a carbon dioxide tension (Pco2) of 39 mmHg, and an oxygen tension (Pao2) of 84 mmHg at a fraction of inspired oxygen of 0.21.

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A device to train and evaluate anesthesiologists’ responses to critical incidents. Anesthesiology 72:191—197, 1990


at 0.2 mg·kg⁻¹·min⁻¹. Ventilation at about 40 breaths/min resulted in minimal movement of the lung and markedly improved operating conditions. Twenty minutes after initiation of jet ventilation, arterial blood gas analysis showed a pH of 7.34, a PCO₂ of 52 mmHg, and a PO₂ of 114 mmHg. The ventilatory rate was then increased to about 60 breaths/min for 20 min, and a second arterial blood gas analysis showed a pH of 7.33, a PCO₂ of 52 mmHg, and a PO₂ of 111 mmHg. Jet ventilation was continued for 45 min. During that time, hemoglobin oxygen saturation remained between 97% and 100%.

After the surgeons had completed a right upper lobe wedge resection and a right lower lobe bullectomy through an expanded "mini-thoracotomy," controlled ventilation via the anesthesia machine was resumed at 14 breaths/min and with a tidal volume of 300 ml, resulting in a peak inspiratory pressure of 22 cmH₂O. A third arterial blood gas analysis at this time showed a pH of 7.38, a PCO₂ of 44 mmHg, and a PO₂ of 439 mmHg. The patient was awakened without difficulty, and the trachea was extubated. Postoperative thoracic epidural analgesia was used. Other than a small air leak that persisted for a few days, the patient's postoperative course was uneventful.

**Discussion**

In the jet ventilation technique, a small stream of quickly flowing gas entrains a surrounding gas by the Venturi effect. High-frequency jet ventilation (HFJV) is defined as jet ventilation at a rate greater than 60 ventilations/min. The technique has been used successfully for procedures involving the trachea, larynx, bronchi, and lungs when low peak pressures are needed or when operating conditions must be improved. Most authors have used commercially available jet ventilators that can supply pulses of gas flow at variable pressures and at rates as great as 250 cycles/min.

This case report describes one method of managing a potentially difficult situation—thoracoscopic lung surgery in a patient who previously had undergone pneumonectomy. Although we did not intend at the outset of the case to perform jet ventilation, a change in anesthetic plan was easily and quickly accomplished when visibility through the thoracoscope was found to be poor. The technique used was very similar to that described by Salzer et al., in that oxygen was delivered distal to the end of the TT through a 2-mm-ID catheter by rhythmic manual pressing of an interrupter valve. Those authors found that a rate of 60–90 jet ventilations/min into the left bronchial tree was able to keep arterial PO₂ at 90 mmHg or greater and arterial PCO₂ at less than 70 mmHg during tracheal or right-lung surgery lasting 36–105 min.

The use of one-lung HFJV during repair of bronchial stump fistulas after pneumonectomy was reported by Mallios et al. They found that with this technique they could maintain adequate ventilation and oxygenation. Lain et al. used HFJV successfully from the 3rd to 6th postoperative days in a patient who had undergone a right pneumonectomy for pulmonary sporotrichosis and who had increasing peak inspiratory pressure. Other authors have described the use of HFJV during pneumonectomy, usually with commercially available HFJV machines. Kan and Oh used a technique similar to ours to reduce inspiratory pressures in patients undergoing bullectomy.

Although this technique maintained oxygenation well, it did produce mild hypercapnia. Although the frequency was increased from 40 to 60 ventilations/min, the PCO₂ remained at 52 mmHg during low-frequency jet ventilation. Hypercapnia can produce a variety of cardiovascular effects, including hypertension, tachycardia, and ventricular arrhythmias. In a patient with significant coronary artery disease and decreased cardiac function like ours, hyperventilation and the effects of hypercapnia are of concern. Our patient, however, did not experience any of these effects from his mild hypercapnia.

To our knowledge, the use of jet ventilation to improve surgical conditions during thorascopic surgery has not been described previously. The technique as we performed it required little equipment and was set up in a matter of minutes. Although HFJV has been shown to increase shunt, this was not a concern in our postpneumonectomy case.

In conclusion, jet ventilation maintained ventilation and oxygenation during thorascopic surgery and improved the surgeon's operating conditions.

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CASE REPORTS


Radiographic Documentation of Increased Visibility of the Larynx with a Belscope Laryngoscope Blade

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AN angulated laryngoscope, the Belscope, for use in patients in whom tracheal intubation was difficult, was developed and introduced by Bellhouse.1 Mayall2 was able to convert all of 12 cases of Cormack and Lehane3 grade 3 to grade 2 or better by using the Belscope. Benumof,4 in contrast, does not consider the Belscope blade superior to the Macintosh or other currently used blades; he asserts that special skill or a prism may be required for difficult cases and furthermore that evaluation of these aspects of its use has not been complete.

Recently, we treated patient in whom intubation was difficult. We performed comparative analysis by means of a lateral radiograph of the line of vision with each blade.

Case Report

A 60-yr-old, 55-kg, 165-cm man was scheduled for nephrectomy during general anesthesia. In the preanesthetic interview we noted that the maxilla was slightly protruding and that the tongue was moderately enlarged (class 2 of classification by Mairampi et al.), suggesting the possibility of difficult intubation.5 After induction of anesthesia with thiopental and vecuronium administered intravenously, we inserted a number 3 Macintosh blade into the right side of the mouth. Drawing the handle anterocaudally with the tip anterior to the epiglottis displaced the tongue to the left. Despite the more than 10-cm elevation of the head, the full sniff-position of the chin and face for full extension of the head on neck, and the application of external laryngeal pressure;6,7 only the epiglottis could be visualized (Cormack and Lehane8 grade 3). Therefore, it was decided that a Belscope blade should be used.

A medium Belscope blade was inserted on the midline in the same position as the Macintosh, and the tip of the blade was rotated anteriorly. This procedure was repeated until the tip reached the esophagus, and then the blade was withdrawn and the epiglottis was held forward, when the posterior end of the laryngeal aperture was partly exposed, without additional maneuvers such as external laryngeal pressure (Cormack and Lehane9 grade 2).

Lateral radiographs were taken with each blade in place (Fig. 1). Tracheal intubation was then successfully performed. All laryngoscopic procedures and intubations were performed by an anesthesiologist with 23 yr of experience (S.W.). The patient and his family were informed of this event after he was awake, and it was described in his medical record.

Discussion

Recently published, the “Practice Guidelines for Management of the Difficult Airway” states that the “difficult airway” has not yet been defined in the literature and emphasizes the importance of objective reporting for the sake of physicians and their patients.8 However, it is difficult to photograph the different views of the glottis obtained with various rigid laryngoscope blades.

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