CASE REPORTS

Anesthesiology
1999; 91:557-8

Tension Pneumothorax Complicating Jet Ventilation *via* a Cook Airway Exchange Catheter

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BAROTRAUMA with resultant pneumothorax has been reported with transtracheal jet ventilation and with translaryngeal jet ventilation.[1-3] Tension pneumothorax also has been reported secondary to oxygen insufflation *via* an endotracheal tube during apnea testing to determine brain death.[4] The current report shows that a similar complication can follow oxygen jet ventilation *via* a Cook airway exchange catheter (Cook Critical Care, Ellettsville, IN).

Case Report

A 45-yr-old man who weighed 90 kg was scheduled for laparoscopic cholecystectomy. He had no preoperative cardiac or respiratory problems, and results of his chest radiograph were normal. Anesthesia was induced using thiopentone and fentanyl, and paralysis was induced using 0.1 mg/kg vecuronium. Laryngoscopy using a MAC3 blade only visualized the tip of the epiglottis. Glottic visualization was improved by cephalad, backward, and right displacement of the thyroid cartilage. However, the glottic view was still limited, and thus the trachea was intubated using a #6 ID oral endotracheal cuffed tube. Because of the patient's body weight, it was decided that the tube be changed to a larger size, using a Cook airway exchange catheter. The exchange catheter, with an internal diameter of 3 mm, was inserted into the tracheal tube and advanced until resistance was felt. This was interpreted as the carina. A high-pressure (50 pounds per square inch) oxygen source with a hand-controlled interrupter valve was connected to the proximal end of the exchange catheter *via* a Luer-lock adapter. Jet ventilation, consisting of 1-s bursts followed by 2 or 3 s of exhalation, was started. This resulted in visible inflation of the right chest but incomplete deflation. After only three jet pulses, cardiac asystole (isoelectric electrocardiograph) was noted. The development of tension pneumothorax was considered. The exchange catheter was withdrawn, and ventilation *via* the endotracheal tube and cardiopulmonary resuscitation were initiated. Chest auscultation revealed decreased air entry to the right lung. Needle thoracoscopy resulted in an audible escape of air and was followed by restoration of sinus rhythm. Cardiac arrest lasted 150 s. A right chest tube was inserted. Because of this complication, anesthesia and controlled ventilation were maintained *via* the original endotracheal tube throughout surgery. The patient recovered without complication.

This article is accompanied by an Editorial View. Please see: Benumof JL: Airway exchange catheters: Simple concept, potentially great danger. ANESTHESIOLOGY 1999; 91:342-4.

Discussion

Intermittent oxygen jets (50 psi) *via* the lumen of an airway exchange catheter can result in barotrauma and tension pneumothorax. Passing a high-pressure oxygen jet through a narrow orifice creates a Venturi effect that results in air entrainment and a marked increase in the total flow.[5] The presence of the exchanger within the endotracheal tube can decrease significantly the cross-sectional area that impairs the passive exhalation, leading to air trapping with consequent barotrauma. In addition, the tip of the exchange catheter may wedge in a bronchus, thus obstructing air escape. Similar problems may occur when fiberoptic bronchoscopy is performed in patients whose tracheas are intubated; the introduction of the bronchoscope into the endotracheal tube can create a significant increase in airway resistance with a subsequent increase in the peak airway pressure.[6]

The smaller the cross-sectional area of the endotracheal tube, and (or) the larger the external diameter of the bronchoscope or the exchange catheter inserted, the higher will be the resistance to exhalation.[6] Thus, a high flow of oxygen or oxygen jet ventilation delivered *via* the lumen of the catheter or the bronchoscope may result in barotrauma and catastrophic tension pneumothorax. Tension pneumothorax will displace the mediastinal structures and potentially decrease the venous return to the heart, resulting in cardiovascular collapse. Thus, the risk of barotrauma should be weighed carefully against the need for jet ventilation.

To maintain oxygenation during tube exchange and

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Received from the Department of Anesthesiology, American University of Beirut, Beirut, Lebanon. Submitted for publication December 28, 1998. Accepted for publication March 18, 1999. Support was provided solely from institutional and/or departmental sources.

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Key words: Barotrauma; cardiac arrest; tube exchanger.

minimize the risk of barotrauma, the following precautions are recommended.

1. The patient must be adequately preoxygenated and hyperventilated by the original endotracheal tube using 100% oxygen.
2. An exchange catheter must be selected that is proportional to the size of the endotracheal tube. If the catheter meets resistance, it should be withdrawn slightly.
3. The clinician should consider maintaining oxygenation by administering a low flow of oxygen (1 or 2 l/min) *via* the lumen of the exchange catheter. This can provide adequate apneic diffusion oxygenation, because oxygen consumption in adults is only approximately 250 ml/min. Jet ventilation may not be necessary during the brief period of tube exchange, because the carbon dioxide tension increases during apnea at a rate of only 3 mmHg/min.
4. Whenever jet ventilation is used, the incidence of complicating barotrauma may be decreased by minimizing airway pressure, providing a long expiratory time, and selecting a properly sized exchange catheter, all of which prevent air trapping. A catheter with multiple distal side holes also may decrease the pressure delivered at the distal end, minimize the catheter whip, and center the catheter within the trachea during jet ventilation.[3]

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Anesthesiology
1999; 91:558-60

Blood Pressure Control with Fenoldopam during Excision of a Pheochromocytoma

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WE report the use of fenoldopam for perioperative blood pressure control during excision of a pheochromocytoma in two patients. Fenoldopam was chosen because of its vasodilatory effects and its efficacy in increasing renal blood flow in patients with renal compromise.

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Received from the Department of Anesthesiology, Stanford University School of Medicine, Stanford, California. Submitted for publication December 15, 1999. Accepted for publication April 2, 1999. Supported by the Department of Anesthesiology, Stanford University School of Medicine.

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Key words: Adrenalectomy; antihypertensive; catecholamine; dopamine 1 receptor; renal disease.

Case Reports

Case 1

A 64-yr-old woman experienced cardiorespiratory arrest and multisystem organ failure (subendocardial myocardial infarction, renal failure, hepatic dysfunction, quadraparesis, and pulmonary edema) after knee arthroscopy. While in the intensive care unit, a 6-cm left adrenal pheochromocytoma was diagnosed by ultrasound, computed tomographic scan, and plasma (epinephrine: 56,778 pgm/ml, normal: 10-200 pgm/ml; norepinephrine: 123,052 pgm/ml, normal: 80-520 pgm/ml) and urine catecholamine assays (vanillylmandelic acid: 82.9 mg/