Endotracheal cuff leakage: a simple solution for an occasionally serious problem

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Received: 29 July 2009 / Accepted: 13 November 2009 / Published online: 6 January 2010
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To the Editor:

We describe a possible solution for managing a cuff leak of a double-lumen endotracheal tube (DLT) used for an open thoracotomy. After induction of general anesthesia, the trachea of a 69-yr-old patient was intubated uneventfully with clear visualization of the vocal cords. A 39Fr left-sided DLT (Mallinckrodt Broncho-CathTM, Tyco Healthcare Group, Pleasanton, CA, USA) was used. The patient was positioned in a left lateral decubitus position, and the correct DLT position was bronchoscopically verified. Within 15 min of skin incision, a significant leak of the endobronchial cuff was identified. The cuff leak was managed with a nasal cannula connected to an oxygen flowmeter. One of the two nasal prongs was then connected to the pilot balloon of the defective cuff via a well-fitting three-way stopcock. The other nasal prong was connected to an *iv* extension tubing (Baxter Extension Set, Baxter Healthcare Corporation, Deerfield, IL, USA) (86 cm long, 2.4 mm internal diameter). The end of the tubing was placed into a water-filled bottle 20 cm under the water's surface. We then carefully inflated the endobronchial cuff of the DLT with oxygen at a flow rate of 2 L·min⁻¹.

The cuff appeared to maintain adequate pressure. Lung isolation was confirmed by direct inspection of the surgical field, equalization of delivered and exhaled tidal volumes, and bronchoscopic inspection of the cuff. No clinical changes in vital signs or signs of aspiration were present during the remainder of the procedure, which was confirmed by x-ray postoperatively. The system lasted until the end of the surgical procedure 1.5 hr later.

Anesthesiologists are occasionally confronted with defective endotracheal tube (ETT) cuffs. Once an air leak is identified, the anesthesia provider must assess the risk/benefit ratio of changing the tube. Important issues to consider include the stage of the surgery, anticipated airway difficulty, positioning of the patient, degree of compromise of ventilation-oxygenation, and aspiration risk. In most cases, simple replacement of a leaking tube will probably be in the patient's best interest. Leaks frequently can result from issues such as ETT malposition or a defective pilot balloon valve. Often the ETT cuff itself is incompetent, e.g., stressed by contact with teeth, nasal turbinates, or the blade from the laryngoscope during intubation. Also, instances of tracheal puncture and cuff perforations during internal jugular and subclavian vein puncture have been reported.^{1–3} In most cases, such punctures caused only a small leakage and were reportedly managed using 2 % lidocaine jelly 8 mL and saline at a dilution of either 1:3 or 1:1 injected into the cuff.⁴ Unfortunately, two of nine cuffs with the 1:1 dilution could not be deflated, which may have resulted from damage during extubation. Moreover, this technique might be ineffective for larger cuff leaks.

In this case, we assume that the cuff material was stressed by contact with teeth during tracheal intubation, since cuff integrity was checked before DLT insertion. Unfortunately, we identified the leak only after the patient

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Fig. 1 Pressure-controlling device

had been placed in the lateral position with the thoracotomy underway. We were unable to achieve adequate isolation and deflation of the patient's right lung. With consideration of the issues of repositioning a patient with an open chest, we felt that application of the pressure-controlling device as described above would be the most prudent solution. The device was assembled with materials immediately available in the operating room, and it was functional within minutes.

A reasonable concern is the application of excessive pressure to the cuff, especially because tears and defects would be of inconsistent size and location. Furthermore, if the cuff leak is unexpectedly eliminated (due to cuff

compression against the bronchial wall) this could lead to a rapid increase in cuff pressure. We are aware that the resistance of the tubing system and the ability of the excess oxygen to escape play an important role in pressure generation within the system; therefore, the generated pressures only apply to our selected setup, i.e., tubing size and length.

A useful alternative for the extension tube might be a manometer. Effective oxygen flow can be controlled easily by slowly closing the manometer's needle valve up to a pressure of 20 mbar. The needle valve can be closed completely because of its function as a safety valve. In addition, any attempt to compensate for a cuff leak by a continuous flow of oxygen directly from the flowmeter without a pressure controlling device may result in barotraumas. Another concern is the possibility that our described method may be ineffective with large leaks, for instance, the oxygen flowing from a cuff defect could be directed either to the operative lung (with issues of operative lung expansion and, in some cases, oxygen enrichment in a surgical field) or to the non-operative lung (with the potential for an unexpected increase in delivered volumes) (Figure 1).

Competing interests None declared.

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