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EDITORIAL

Critical importance of tracheal tube cuff pressure management

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Abstract

The ideal range for tracheal tube cuff pressures is usually taken to be between 20 to 30 cm H_2O. This is easily measured with a cuff pressure manometer and should be measured in each instance. The importance of tracheal tube cuff pressures is highlighted by the spectrum of airway complications that can occur with incorrect cuff pressures. High cuff pressures can result in complications ranging from sore throat and hoarseness to tracheal stenosis, necrosis, and even rupture. In such cases, the postulated causative factor is diminished blood flow to tracheal mucosa due to excessive cuff pressure on the tracheal wall. This hypothesized ischemic injury then produces healing fibrosis months or even years later. On the other hand, cuff pressures that are too low place the patient at risk for aspiration of gastric contents and consequently, aspiration pneumonitis and pneumonia. This is why the authors recommend that cuff pressures be measured following all intubations.

Key words: Tracheal tube cuff pressure; Tracheal injury; Tracheal stenosis; Patient safety; Intubation

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Core tip: The ideal range for tracheal tube cuff pressures is typically between 20 to 30 cm H_2O and is easily measured with a cuff pressure manometer. The importance of tracheal tube cuff pressures is highlighted by the spectrum of complications that can occur: high cuff pressures can result in complications ranging from sore throat and hoarseness to tracheal stenosis, necrosis, and even rupture, while cuff pressures that are too low place the patient at risk for aspiration and consequently, aspiration pneumonitis and pneumonia.

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Anesthesiologists who spend the bulk of their clinical time in ear-nose-throat (ENT) and bronchoscopic pro-

cedures (such as the third author) see a surprising number of cases of tracheal stenosis that appear to be related to prior tracheal intubation. In such cases, the postulated causative factor is diminished blood flow to tracheal mucosa due to excessive cuff pressure on the tracheal wall. This hypothesized ischemic injury then produces healing fibrosis months or even years later[1-4]. However, despite a substantial body of published literature dealing with cuff pressure monitoring[5-8], routine monitoring of endotracheal tube (ETT) cuff pressure in clinical practice is rarely done and no established guidelines exist to direct its measurement[9].

The ideal range for ETT cuff pressures is typically between 20 to 30 cm H_2O[10-13] and is most reliably assessed with direct continuous manometers during the operative period[14]. One can easily and inexpensively display real-time cuff pressures using an ordinary patient monitor with invasive pressure capability as follows[5]. An ordinary pressure transducer is first electronically connected to the pressure channel of the monitor and zeroed. Next, the hydraulic end of the transducer is connected to the pilot balloon/cuff inflation line of the ETT using air-filled tubing and a three-way stopcock. A 10 mL syringe inserted in the side arm of the stopcock allows air to be added or removed. Finally, a male plug ("dead ender") is placed in the remaining port of the pressure transducer to seal the system (Ordinarily this port is hooked up to a high-pressure fluid source to make a flush system).

Despite this, few anesthesiologists use such methods in daily clinical practice and typically rely on less quantitative methods to estimate the cuff pressure (Table 1), often with poor compliance. Additionally, these commonly used techniques are much less accurate and often poor estimates of ETT cuff pressures[9,14]. This dilemma is not remedied by clinical experience, as studies have shown that inaccurate cuff pressure assessments can occur in the hands of even the most seasoned anesthesiologists[11,15]. On the contrary, Wujtewicz *et al*[15] concluded that anesthesiologists may be worse at estimating cuff pressure than a decade ago.

The importance of ETT cuff pressures is highlighted by the spectrum of complications that can occur outside the ideal pressure range. High cuff pressures can result in complications ranging from sore throat and hoarseness[16,17] to tracheal stenosis, necrosis, and even rupture[18-21]. Conversely, lower cuff pressures place the patient at risk for aspiration and consequently, aspiration pneumonitis and pneumonia[22,23]. Although certain complications such as tracheal stenosis remain rare entities, the serious morbidity associated with the disease should be balanced against the ease and low expense of intra-operative cuff pressure monitoring.

Despite the large body of literature dealing with cuff pressure monitoring and the relative ease with which accurate intra-operative cuff pressure monitoring can be implemented, there remains a lack of guidelines and recommendations regarding the issue. Given the fact that studies have shown cuff pressures over 30 cm H_2O occur in about 50% of cases where cuff inflation was performed using pilot balloon palpation[24], it raises the question of why mandatory monitoring is not standard of practice. As a profession, should we not be more vigilant with regards to tracheal tube cuff pressures? We say yes.

Table 1 Common techniques for assessing endotracheal cuff pressures[5,9,24]

Method	Description
Minimal occlusive volume technique	Determination of volume of air to inject into cuff based on how much is required to eliminate audible end-inspiratory leak with positive pressure ventilation
Minimum leak technique	Determination of volume of air to injection into cuff based on how much is required to auscultate a small end-inspiratory leak
Predetermined volume technique	Injection of pre-determined volume of air to inflate cuff
Palpation technique	Palpation of pilot balloon after inflating endotracheal cuff
Direct intracuff pressure monitoring	Use of a pressure transducer to directly provide a quantitative pressure reading

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