

Commentary

Maintenance of tracheal tube cuff pressure: where are the limits?

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Abstract

Continuous control of tracheal tube cuff inflation using a pneumatic device resulted in severe tracheal wall damage in ventilated piglets. This damage was similar in piglets managed with manual control of cuff inflation. The periodic hyperinflation of the tube cuff used in both groups of this study may explain these results. This manoeuvre should be avoided in clinical practice.

checking of the P_{cuff} may cause either overinflation or deflation of the cuff and may cause aspiration of contaminated secretions to the lower airway during the manoeuvre. Leaks and loss of P_{cuff} are frequent in intubated patients, and a persistent P_{cuff} below 20 cmH₂O was an independent risk factor for VAP in one study [8]. Consequently, appropriate maintenance of pressure of the tracheal tube cuff is recommended in recent guidelines [9].

In a previous issue of *Critical Care*, Nseir and colleagues presented an article regarding continuous control of endotracheal cuff pressure and tracheal wall damage [1].

In a previous issue of the journal, Nseir and coworkers describe a pneumatic device for the continuous control of the P_{cuff} in an animal model [1]. The aim of the study was to assess whether the continuous control of the P_{cuff} results in reduced tracheal ischaemic lesions in mechanically ventilated piglets. For this purpose, the authors compared the pneumatic device with the manual control of P_{cuff} in a randomized trial. The pneumatic device provided effective continuous control of the P_{cuff} , with longer periods of P_{cuff} within the target values than piglets managed with manual control. This device is therefore potentially useful for clinical practice in order to avoid both excessive inflation and deflation of the cuff. Hyperaemia and haemorrhages in the trachea were observed at the cuff contact area in all animals, however, with no differences between animals with and without the pneumatic device.

Among the pathogenic mechanisms responsible for ventilator-associated pneumonia (VAP), oropharyngeal colonization by potentially pathogenic microorganisms and silent aspiration of subglottic secretions around the tracheal tube cuff seem to play a pivotal role [2]. In order to prevent pneumonia, several approaches have been proposed – such as placing patients in the semirecumbent position [3], continuous aspiration of subglottic secretions (CASS) above the tracheal tube cuff [4], oropharyngeal decontamination by antiseptics [5], and the application of antiseptic-impregnated endotracheal tubes [6].

The key element of the proposed pathogenesis of VAP appears to be aspiration of colonized oropharyngeal and subglottic secretions. Appropriate control of the endotracheal tube cuff pressure (P_{cuff}) may therefore serve as a major prevention target. Intubated patients were recommended to be managed with P_{cuff} values between 20 and 30 cmH₂O to provide a sufficient seal without compromising mucosal perfusion [7]. The routine management of cuff inflation consists of periodic manual checking of the P_{cuff} , which does not ensure the appropriate maintenance of the P_{cuff} during continuous tracheal intubation [8]. Moreover, the manual

Several devices that provide an automatic and continuous effective control of the P_{cuff} have been described in the literature. Most of these devices are not automatic, some devices need frequent control by the attending staff, and other devices operating in a more automatic and continuous way are complex, requiring the use of special and expensive equipment that may not be available routinely [10]. It is probable that these issues concerning complexity and cost could explain the lack of continuous automatic control of cuff inflation in clinical practice.

CASS = continuous aspiration of subglottic secretions; P_{cuff} = endotracheal tube cuff pressure; VAP = ventilator-associated pneumonia.

We have described a simple and cheap device that is very effective for the routine maintenance of adequate cuff inflation during mechanical ventilation that does not require any specific equipment [11]. A recent randomized clinical trial in mechanically ventilated patients comparing this device with the routine manual control of cuff inflation, however, showed no benefits in the prevention of VAP [12]. These findings suggest that other factors than cuff inflation influence the microaspiration of secretions to the lower airways around the tracheal tube cuff. Commercially available high-volume low-pressure tracheal tubes such as those used in the study often form folds around the cuff, hence allowing leakage of secretions pooled above the tube cuff in studies *in vitro*, even at P_{cuff} levels similar to those used by Nseir and colleagues in piglets [13]. Several devices have consequently been recently developed in order to overcome this problem. Among those devices, the Microcuff endotracheal high-volume low-pressure tube features an ultrathin (7 μm) polyurethane cuff membrane around an inner conventional inflatable cuff. This tube is effective in preventing fluid leakage around the cuff in an *in vitro* setup [14]. The combination of this device with CASS is effective in preventing both early-onset and late-onset VAP in a recent clinical study [15].

One of the potential concerns of all these devices, particularly CASS, is the potential damage of the tracheal wall. In an animal sheep model, Berra and colleagues demonstrated important tracheal lesions when using CASS [16]. We do not know whether this is applicable to humans. In the study by Nseir and colleagues, the tracheal lesions found could be explained, at least in part, by the high inflation pressure they applied eight times daily via 50 ml during 30 min. This is not the current clinical practice in humans, and after this study it should be completely avoided.

Competing interests

The authors declare that they have no competing interests.

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