Technical Communication

Using a modified syringe technique to adjust the intracuff pressure of a laryngeal mask airway

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A B S T R A C T

Limiting the intracuff pressure of a laryngeal mask airway (LMA) to <60 cmH2O is recommended in clinical practice. This report aimed to assess the efficacy of a modified syringe technic to adjust the intracuff pressure of an LMA. In a preclinical study, commercially available 20-mL syringes were attached to the pilot balloon of LMA with different preset intracuff pressures (40 cmH2O, 50 cmH2O, 60 cmH2O, 70 cmH2O, 80 cmH2O, 100 cmH2O, and 120 cmH2O). After attachment, the syringe plunger was allowed to passively rebound. If no rebound of the plunger was observed after attachment, 1 mL of air was withdrawn and the plunger was allowed to passively rebound again. This technique allowed the plunger to overcome static friction and avoid excessive deflation of the LMA cuffs. The intracuff pressure was measured using a manometer after the plunger ceased moving. In the preclinical study, the intracuff pressure was always less than or close to 60 cmH2O after adjustment using this modified syringe technique. After evaluating the performance and characteristics of the syringe in the preclinical study, we concluded that the modified syringe technique may be useful for adjusting LMA intracuff pressure effectively.

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1. Introduction

The laryngeal mask airway (LMA) is commonly used for airway management during general anesthesia. Because pharyngeal mucosal perfusion may be reduced progressively when transmitted pharyngeal mucosal pressure is increased from 34 cmH2O to 80 cmH2O,1 the use of an overinflated LMA may be associated with the occurrence of postoperative pharyngolaryngeal morbidity.2 Although the use of a manometer to limit the intracuff pressure of an LMA to <60 cmH2O is recommended,2 this device is rarely used in routine clinical practice. Rice et al4 reported that when using specific combinations of syringes (30-mL and 60-mL BD™ and B Braun™ syringes), the intracuff pressure of an LMA could be mantained to less than, or very near to, the recommended upper safe limit of 60 cmH2O. Because commercially available syringes are not design to adjust the intracuff pressure of an LMA, this report aimed to provide a modified syringe technique that can be useful in this regard.

2. Methods

In a preclinical study, the characteristics of commercially available 20-mL syringes (Perfect Medical Industry Ltd., Changhua, Taiwan, R.O.C.) were evaluated. When the 20-mL syringe was attached to the pilot balloon of the LMA, we found that the static friction may sometimes prevent the rebound of the plunger even when the cuff of the LMA was overinflated. To adjust the intracuff pressure of an LMA to <60 cmH2O effectively, we modified the syringe technique as follows: (1) before use, the syringe was warmed up by moving the plunger fully back and forth two times; (2) if no rebound of the plunger was observed after attachment, 1 mL of air was withdrawn and the plunger was allowed to passively rebound again. These modified techniques allowed the plunger to overcome the static friction between the plunger and the barrel. The intracuff pressure was measured using a manometer after the plunger ceased moving.

This modified syringe technique was evaluated for its performance in a preclinical study. A ProSeal laryngeal mask airway (PLMA; Laryngeal Mask Company North America, San Diego, CA, USA) size 4 and a 20-mL syringe were chosen for the preclinical study. After the three-way stopcock was attached to the pilot balloon of the PLMA and a manometer (Mallinckrodt Medical GmbH, Hennef, Germany), the PLMA cuff was inflated with air to a...
preset intracuff pressure (40 cmH2O, 50 cmH2O, 60 cmH2O, 70 cmH2O, 80 cmH2O, 100 cmH2O, or 120 cmH2O). A fresh 20-mL syringe was connected to the third port of the three-way stop-cock and the intracuff pressure was measured using the modified syringe technique. For each preset intracuff pressure, a new syringe was used (N = 7) and eight measurements were made for each syringe.

3. Results

As shown in Table 1, the intracuff pressure was always less than or close to 60 cmH2O after adjustment using this modified syringe technique. In the preclinical test, we noticed that the plunger of the 20-mL syringe often rebounded automatically when the preset intracuff pressure was >60 cmH2O. However, we did observe instances in which the intracuff pressure exceeded the 60-cmH2O limit (ranged from 62 cmH2O to 64 cmH2O) even after adjustment with the syringe technique when the preset intracuff pressure was 70 cmH2O or 80 cmH2O. Overall, the frequency of intracuff pressure >60 cmH2O was 14% (8/56). When the preset intracuff pressure was <60 cmH2O, the plunger of syringe seldom rebounded automatically. Because 1 mL of air was routinely withdrawn when rebound of the plunger was not observed, the intracuff pressure was always less than the preset intracuff pressure even when the PLMA was not overinflated.

4. Discussion

A manometer may be used to control the intracuff pressure of an LMA precisely, however, this device is rarely used in clinical practice. In this report, we have found that a modified syringe technique is effective and convenient to adjust the intracuff pressure of an LMA to less than or close to 60 cmH2O in a preclinical study.

Both the preset intracuff pressure and static friction between the plunger and the barrel may affect the stick pressure of the syringe (i.e., a steady pressure at which the plunger of the syringe stops). For example, when the preset intracuff pressure was 70 cmH2O, the plunger may not rebound automatically. To adjust the intracuff pressure more effectively, the syringe was warmed up before use. In addition, 1 mL of air was withdrawn routinely to break the seal between the plunger tip and the barrel if no rebound of the plunger was observed. We found that this modified syringe technique could be used to adjust the LMA intracuff pressure effectively. It is suggested that when the cuff is deflated excessively, contamination of the larynx with oropharyngeal secretions may be possible and the fiber–optic position of the LMA may be suboptimal. Therefore, only 1 mL of air was withdrawn if by any chance the initial intracuff pressure was <60 cmH2O.

Rice et al. reported that some brands of syringes (30-mL and 60-mL BD and B. Braun syringes) can be used to adjust the LMA cuff pressure to <60 cmH2O. Because the characteristics of commercially available syringes may differ, the results obtained in their study may not be applicable to other syringes. Therefore, we provided a modified syringe technique that can be used to adjust the intracuff pressure of an LMA when other brands of syringes are used. A preclinical test is usually required to evaluate the characteristics of a syringe and additional modification will allow this technique to be used more effectively. For example, for other syringes, which have a lower steady pressure, additional volume of air may be added routinely to the LMA cuff after adjustment to avoid excessive deflation of cuffs. It should be noted that air leakage may occur after adjustment in clinical practice. We suggest that an additional volume of air (3 mL) can be added to the LMA cuff if air leakage is audible around the mouth after adjustment.

Using the cuff volume as a guide and digital palpation of the pilot balloon are alternative methods to adjust the intracuff pressure of an LMA to less than the recommended maximum value. When using the cuff volume as a guide, the clinician should know that there is a greater variability in intracuff pressure between patients when a fixed volume of air is added to the cuffs. In addition, the digital palpation technique may lack accuracy without adequate training and may not be applicable to nonreusable LMA. There are several limitations in this report. First, other commercially available syringes were not evaluated in this in vitro study. The characteristics of these syringes may differ, and the results obtained from this study may not be applicable to other syringes. Second, there may be a difference in stick pressure among the same-brand 20-mL syringes because the products are of uneven quality. The initial intracuff pressure and dynamic friction of the syringe may also influence the stick pressure of the syringe. These confounding factors may lead to a variation in the performance of this syringe technique. Third, there are differences in design, stiffness of the tubes, and properties of the cuffs between LMAs. Whether this modified syringe technique can be used effectively with other supraglottic airway devices is also unknown.

In conclusion, after evaluating the characteristics of syringes in the preclinical study, this modified syringe technique may be used effectively to adjust the LMA intracuff pressure to less than or close to 60 cmH2O.

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References