

## Water bubble test to detect malposition of PLMA

Rajesh Mahajan<sup>1</sup> and Yatindra Kumar Batra<sup>2</sup>

<sup>1</sup>Department of Anesthesia, ASCOMS, Jammu, Jammu and Kashmir, India

<sup>2</sup>PGIMER, Chandigarh, India

*To the editor:* The Proseal laryngeal mask airway (PLMA; Intavent Othofix, Maidenhead, UK) is a new supraglottic device. It has two conduits, an airway tube and a drain tube, which enable separation of the respiratory and gastrointestinal tracts during ventilation [1]. The drain tube exits the PLMA at the tip and it is intended to prevent gastric insufflation, providing a channel for the egress of regurgitated fluids and facilitating the passage of an orogastric tube [2]. It is also useful in determining malposition. O'Connor et al. [3] described two means of detecting gas venting from the drain tube; the “thread test,” where a thread drawn from the corner of a gauze pad is suspended above the drain tube and its movements are observed if gas is vented from the drain tube consequent to incorrect placement of the tube. The second technique, the “bubble test,” is to place a nontoxic soap bubble across the proximal end of the drain tube. The formation of the bubble or wild oscillations of the membrane with cardiac rhythm suggest glottic placement of the tip of the PLMA, whereas bubble formation or bursting of the membrane with positive pressure ventilation indicates an insufficient depth of insertion [3].

We report a new method: the “water bubble test” to detect gas venting from the drain tube. A 15-cm-length of an intravenous infusion set is cut towards the patient end. The rest of the set and the flow regulator are discarded. The silicone injection site with a male fitting at the patient end of the intravenous infusion set fits snugly into the drain tube of the PLMA. After inserting the PLMA and inflating the cuff to the recommended pressure of 60 cm H<sub>2</sub>O, the above-mentioned silicone injection site with the male fitting is fitted into the drain tube. The other end of the intravenous set is dipped into an 8-cm column of saline in a glass beaker/normal saline bottle. We observe the saline for any bubbling with positive pressure ventilation between 20 and 30 cm H<sub>2</sub>O. If the PLMA is correctly placed, there is no bubble formation (i.e., zero vent). However, in cases of insufficient insertion or insertion into the glottis, bubbling of the saline can be seen (Fig. 1). If the suprasternal notch is gently tapped there is initial bubbling for 1–2 s (due to the displacement of residual air inside the tubing) followed by movement of the column of air in the infusion set line inserted in the beaker, without any further bubbling; this signifies the correct position of the PLMA behind the cricoid

cartilage. If the PLMA has been folded over, there is no bubbling, nor there is any movement of the air column.

Although the methods described by O'Connor et al. [3] to detect gas venting from the drain tube are sensitive, the soap bubble test needs expertise and soap solution may not be easily available in locations outside the operating room, e.g., in wards or in radiology or endoscopy suites where the PLMA has been now made available as a rescue device for emergency airway management outside operating rooms [4]. Further, the consistency of various soap solutions available on the market is highly variable, and if a thinner solution is used or there is minimal leak, the soap bubble may fail to form a membrane over the drain tube and the soap solution may simply dribble into the drain tube. In regard to the “thread test”, discerning the movements of the thread is highly subjective.

Based on the bubble test and the suprasternal notch test, we utilize the following tests to assess PLMA positioning (modified from the tests described by O'Connor et al. [5] and Brimacombe [2]).

1. Inflate cuff to 60 cmH<sub>2</sub>O
2. Visually assess depth of insertion
3. Test for unobstructed inspiratory and expiratory flow
4. Carry out “water bubble test”; PLMA/esophageal seal
5. Carry out “suprasternal notch test (modified)”; PLMA tip position
6. Pass gastric tube down to the level of the PLMA tip.

First, we inflate the cuff to 60 cmH<sub>2</sub>O pressure. Second, we assess for adequate insertion depth by examining the relation of the integral bite block with respect to the incisors. Usually there should be a bite block of 50% or more in the mouth [2]. Third, we assess for unobstructed inspiratory and expiratory flow. We ventilate the patient and watch chest movements, examine capnography, and evaluate the feel of the anesthesia bag. Fourth, we perform the “water bubble test” to verify zero leak from the drain tube. If there is bubbling, we try to advance the PLMA further. If the bubbling ceases, this means that the PLMA was inadequately inserted and the advancement has corrected its positioning. If there has been glottic placement, ventilation is made worse, with increased airway resistance and airway reflex activation, and further bubbling through the drain tube continues; in such a case, the PLMA needs to be removed and reinserted using a lateral approach or a gum elastic bougie [2]. Fifth, the suprasternal notch test is performed.

If there is regular movement of the air column in the infusion set dipped in saline, this confirms the correct positioning of the PLMA behind the cricoid cartilage. If nothing happens with the suprasternal notch test, we pass a gastric tube down



**Fig. 1.** Bubbling in saline with an incorrectly placed Proseal laryngeal mask airway (PLMA) is seen, indicating incomplete insertion or glottic placement

to the level of the PLMA tip to further confirm whether there is foldover malposition of the drain tube. If the gastric tube fails to pass through the distal end of the drain tube, this virtually confirms foldover malposition, and the PLMA is removed and reinserted with a technique utilizing priming of the drain

tube with a gum elastic bougie, gastric tube, or Trachlight (Laerdal Medical Corporation, New York, NY, USA) wand [2].

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*Address correspondence to:* R. Mahajan, House no F-35, Patel Chowk, Jammu, Jammu and Kashmir, India-180001

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