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Re-evaluation of appropriate size of the laryngeal mask airway

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We have assessed 32 males and 31 females in a randomized, crossover study to see if there was any difference in the correct positioning of the laryngeal mask, optimal ventilation (defined as no gas leak around the mask at an airway pressure of 18 cm H_2O) and cuff visibility between sizes 4 and 5 masks in males and sizes 3 and 4 in females. The position of the mask in relation to the glottis was assessed using a fibreoptic bronchoscope. There was no significant difference in correct positioning between the two sizes in either sex. Gas leak was significantly less frequent for a larger than a smaller mask ($P<0.01$ for both sexes), whereas the cuff was more often seen in the mouth with larger masks ($P<0.02$ for males and $P<0.01$ for females). Therefore, larger masks (size 4 in females and size 5 in males) provided a better seal than smaller sizes without worsening the relative position of the mask to the glottis; however, the larger mask came up within the mouth more often, which could interfere with tonsillectomy and could increase the risk of sore throat or lingual nerve damage.

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Studies have shown that a larger sized laryngeal mask (size 4 in females and size 5 in males) is a better choice than a smaller mask (size 3 in females and size 4 in males).[1–3] However, in a previous study,[3] when a larger mask was placed, the cuff was sometimes seen via the mouth. Brain and colleagues claim that the cuff should be positioned caudal to the level of rami of the jaw and tonsils[4 5] and thus if the cuff is seen on opening the patient's mouth, the mask can be considered too large.[6] We re-assessed the criteria for an appropriate size of laryngeal mask by investigating if the cuff could be seen in the oral cavity, in addition to the position of the mask in relation to the glottis and the incidence of gas leak around the mask.

Methods and results

After obtaining approval from the Institutional Research Ethics Committee and written patient informed consent, we studied 31 females (aged 20–73 yr, weight 37–74 (mean 57) kg, height 145–168 (mean 156) cm) and 32 males (aged 18–66 yr, weight 46–95 (mean 64) kg, height 158–183 (mean 168) cm) in whom the use of the laryngeal mask was indicated.

Anaesthesia was induced with propofol 2.5–3.0 mg kg^{-1}, fentanyl 1 μg kg^{-1} and vecuronium 0.1 mg kg^{-1}, and was maintained with sevoflurane in oxygen. In a randomized, crossover design, sizes 3 and 4 masks were inserted in females, and sizes 3, 4 and 5 masks in males. The order was randomized for females by tossing a coin, and for males by choosing a card without replacement from three cards indicating the three sizes.

After placement of the laryngeal mask and inflation of the cuff, the second observer, who was facing away from the patient during placement, opened the patient's mouth as widely as possible to see if the cuff could be seen. The position of the mask was examined using a fibreoptic bronchoscope and judged as correct when the glottis, but not the oesophagus or tip of the epiglottis, was seen.[7] The presence or absence of gas leak was then examined at airway pressures of 10 and 18 cm H_2O,[3] by squeezing the reservoir bag for 10 s for each pressure. Adequacy of ventilation was categorized into three grades: optimal (no gas leak at an airway pressure of 18 cm H_2O), suboptimal (gas leak at an airway pressure of 18 cm H_2O, but not at 10 cm H_2O) and inadequate (failed placement or gas leak at an airway pressure of 10 cm H_2O). The mask was removed, the other size inserted and the procedure repeated. Only one attempt at placement for each size of mask was allowed.

The McNemar test (paired proportion test) was used to compare the proportion of cuffs that were positioned correctly, optimal ventilation and incidence of the cuff being visible, between different sizes of the mask. $P<0.05$ was considered significant. To minimize multiple hypothesis tests, no hypothesis tests were applied to the data obtained for the size 3 in males. The 95% confidence limits were calculated for the incidence of adequate ventilation and the presence of the cuff in the oral cavity.

Table 1 Incidence of optimal (no gas leak at an airway pressure of 18 cm H_2O), suboptimal (no gas leak at an airway pressure of 10 cm H_2O, but at 18 cm H_2O) and inadequate ventilation through each size of the laryngeal mask, and incidence of the cuff of the laryngeal mask being seen in the oral cavity (number of patients (%) [95% confidence limits])

	Adequacy of ventilation				
			Inadequate ventilation		
	Optimal ventilation	Suboptimal ventilation	Airleak at 10 cm H_2O	Failed placement	Cuff seen in oral cavity
Males (n = 32)					
Size 3	5 (15.6) [3.0, 28.2]	14 (43.8)	13 (40.6)	0 (0)	0 (0) [0, 10.9]
Size 4	16 (50.0) [32.7, 67.3]	14 (43.8)	2 (6.3)	0 (0)	0 (0) [0, 10.9]
Size 5	23 (71.9) [56.3, 87.5]	8 (25.0)	0 (0)	1 (3.1)	8 (25.0) [10.0, 40.0]
Females (n = 31)					
Size 3	17 (54.8) [37.3, 72.3]	11 (35.5)	3 (9.7)	0 (0)	2 (6.5) [0.8, 21.3]
Size 4	26 (83.9) [71.0, 96.8]	3 (9.7)	0 (0)	2 (6.5)	14 (45.2) [27.7, 62.7]

From a preliminary study, we estimated that the incidence of the cuff being visible would be up to 5% for a smaller laryngeal mask, whereas it would be 20–30% for a larger mask. Thus approximately 30 patients were required for a power of 90% and $P = 0.05$.[8]

There was no significant difference in correct positioning between the larger and smaller masks in either males (size 5 (26 patients); size 4 (29 patients) or females (size 4 (24 patients); size 3 (28 patients). Ventilation was optimal significantly more often for a larger than a smaller mask ($P<0.01$ for both sexes). However, the cuff of a larger mask was seen more frequently than that of a smaller mask ($P<0.02$ for males; $P<0.01$ for females) (Table 1).

Comment

The current and previous studies[1–3] indicated that a larger sized laryngeal mask (size 5 in males and size 4 in females) provided a better seal than a smaller (size 4 in males and size 3 in females) mask without producing greater pressure on the pharynx or a higher risk of suboptimal positioning of the mask in relation to the glottis. However, the larger mask was associated with a greater risk of the cuff being positioned in the oral cavity, which may interfere with adenotonsillectomy and cause a sore throat[9] or damage to the lingual nerve.[10]

The cuff was often seen, particularly in females, which is surprising. This may be less frequent in patients with larger pharyngeal spaces than the Oriental population we studied. Considering patients of different heights, the incidence is less in taller patients in both males (155–159 cm, one of one patient (100%); 160–169 cm, seven of 18 patients (39%); 170–185 cm, none of 12 patients (0%)) and females (145–149 cm, three of three patients; 150–159 cm, 10 of 19 patients (53%); 160–169 cm, one of seven patients (14%)).

It seems reasonable to suggest that a larger mask should be placed first, and if the cuff is visible in the oral cavity, replacement of the larger mask by one size smaller may be appropriate. If a larger mask was replaced by a smaller one, this could increase the incidence of gas leak around the mask. In the current study, in eight males in whom the size 5 was seen in the oral cavity, gas leaked around the mask at an airway pressure of 18 cm H_2O in two patients (25%). In these patients, gas leaked in five of eight patients (62.5%) when the size 4 was used. In 14 females in whom the size 4 was seen in the oral cavity, gas leak occurred in only one patient (7%). In these patients, gas leaked in three patients (21%) when the size 3 was used. Therefore, when the cuff of the laryngeal mask is seen, the decision to replace the mask with one size smaller depends on several factors. For example, a small mask is preferable when adenotonsillectomy is planned or surgery of a long duration is expected.

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