Reflux during positive pressure ventilation via the laryngeal mask airway?

Sir.—We read with interest the pilot study by Valentine, Stakes and Bellamy [1] comparing lower oesophageal pH changes in patients managed with either the laryngeal mask airway (LMA) or tracheal tube during intermittent positive pressure ventilation (IPPV). However, we suggest that the following factors in their study design may have had an influence on their results.

(1) The authors probably used the No. 3 LMA in 60% of the LMA cases. The No. 3 LMA is a paediatric size and should not normally be used for adult patients > 50 kg undergoing IPPV. The No. 5 LMA was introduced recently to provide a better mask fit during IPPV and reduce the incidence of leak. Where available, it is commonly used in 20% of adult patients, with the No. 4 used in all other patients exceeding 50 kg in weight. Inadequate mask surface area may have been responsible for mal-positioning and oesophageal insufflation. Recording of LMA position by fluoroscopic visualization might have provided useful information in assessing mask fit.

(2) The results of the study implied that reflux occurred most frequently at antagonism of neuromuscular block and the authors suggested that this was caused by return of tone to the abdominal musculature and an increase in intragastric pressure at this stage. Regurgitation and aspiration with the LMA, as with other forms of airways, are commonly associated with periods of light anaesthesia [2]. The fact that the LMA is tolerated at lighter planes of anaesthesia [3] may have led the investigator to administer a reversal agent at a lighter level of anaesthesia than subjects with a tracheal tube. It would have been useful to know the relationship between depth of anaesthesia and neuromuscular block at the time the pH measurements were obtained. The principles of recovery with the LMA and IPPV differ from those following spontaneous breathing or in patients with an intubated trachea. When using the LMA with IPPV, antagonism of neuromuscular block is best carried out under a continued level of anaesthesia. There is then a smooth transition to spontaneous ventilation which avoids the problem of a semi-reversed patient struggling against partial antagonism. Antagonism of neuromuscular block coincidentally with discontinuation of anaesthesia can cause unco-ordinated reflex responses and airway obstruction. If the airway is obstructed secondary to malposition or reflex cord closure, significant intrathoracic pressures may develop during inspiration and promote gastro-oesophageal reflux. Wang and colleagues have shown in animal studies that partial airway obstruction causes large increases in thoraco-abdominal pressure gradients which may overcome the antireflux barrier even though there is no alteration in LOS tone [4]. Work conducted by O'Mullane in the 1950s found similar results in human subjects [5]. The high incidence of lower oesophageal reflux during antagonism (8 of 10 patients) in the study by Valentine, Stakes and Bellamy implies that anaesthesia should not be discontinued before or coincidentally with antagonism of neuromuscular block when using the LMA with IPPV.

(3) The LMA, unlike the tracheal tube, relies partially on the competence of the upper oesophageal sphincter (UOS) for its seal. A common problem with this and other similar studies is that the presence of the oesophageal pH electrode catheter in the UOS may have reduced UOS competence, leading to increased risk of gastric insufflation when IPPV was used. Graziotti [6] and Devitt and colleagues [7] have shown that IPPV at modest tidal volumes in patients with normal lungs is not associated with clinically relevant gastric insufflation.

(4) The incidence quoted for the presence of the oesophageal opening within the LMA bowl is variable, and data from three adult isolated fiberoptic studies suggested an incidence of none in 170 after the standard insertion technique, in eight of 140 when inserted with the cuff inflated and in three of 30 when inserted like a Guedel airway [8-10]. The much quoted early work by Payne demonstrating a 6% incidence [11] may reflect use of a non-standard insertion technique and high airway pressures. A study on the interaction between the LMA and LOS has been criticized on methodological grounds [12, 13].

(5) The mode of ventilation was unequal in the two groups of patients. In both groups the lungs were ventilated to a peak airway pressure of 16 cm H2O, which implies that in the LMA group the lungs were ventilated with higher tidal volumes—the larger 10-mm bore of the LMA leads to a lower peak inspiratory pressure per given tidal volume. This may be relevant in terms of lower oesophageal opening pressure.

Finally, it is important to note that all regurgitation events were confined to the lower oesophagus and the decrease in pH was small and above the commonly accepted value of 2.5. In a recent study, pharyngeal pH was measured during gynaecological laparoscopy in 30 patients undergoing ventilation to 20 cm H2O with the LMA and the pH remained stable at between 6 and 8 [14]. Similar results have been obtained for the spontaneous ventilation technique in elective peripheral surgery [15]. There is no clinical evidence to suggest that IPPV via the LMA is associated with a greater incidence of aspiration.

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15. Joshi GP, Morrison SG, Okonkwo N, Gajraj NM, Pennant JH, White PF. Continuous hypopharyngeal pH monitoring:

Sir,—We thank Dr Brain and colleagues for their interest in our paper [1] and for their comments. We shall take their points in order.

(1) We confirm that a No. 3 LMA was used in female patients (60%) in our study. The study reflects common practice in anaesthesia. Standard practice in this hospital, as in many others at the time the study was carried out (1992), was to use a No. 3 LMA for female and a No. 4 LMA for adult male patients. While we agree that inadequate mask surface area may be a cause of malpositioning, the No. 5 LMA only became available very recently and hence was not used in our study. We cannot speculate as to what the results might have been using different mask sizes.

(2) A standard dose of vecuronium was used (0.1 mg kg⁻¹), all operations took 30–40 min and neuromuscular block was monitored with a peripheral nerve stimulator using the train-of-four method. Antagonism of neuromuscular block was affected simultaneously with discontinuing volatile agent. A difference in the depth of anaesthesia between the two groups is unlikely. We do not know of any well validated means of measuring depth of anaesthesia, but we were unaware of any clinical disparity. There is no evidence that our patients were partially antagonized. We accept that a Relaxograph would give more quantitative information and further work is indicated to clarify the relationship between degree of neuromuscular block and oesophageal pH. Whatever the physiological explanation of the phenomena, the two groups were treated identically and a significant difference was observed. It is fallacious to argue that the two groups should have been treated differently for the purposes of the study.

(3) It would seem unlikely that an oesophageal probe measuring less than 1.5 mm in diameter would have a significant effect on the upper oesophageal sphincter although the theoretical risk exists. We are not sure what methodological modification Brain and colleagues would suggest. For the LMA to even partially rely on oesophageal pressures, it would be necessary for oesophageal pressures to be representative of those expected in the whole adult Saudi population. The mean interincisor gap of my patients (2.92 cm) was indeed smaller than that found by Bellhouse and Dore and by Savva's patients undergoing various types of surgery, they can be taken to be representative of those expected in the whole adult Saudi population. The mean interincisor gap of my patients (2.92 cm) was indeed smaller than that found by Bellhouse and Dore and by Wilson and colleagues in their studies. Perhaps this difference was caused by racial factors.

Nevertheless, I agree that interincisor gap is a useful test provided that a measurement of less than 2 cm is taken as being predictive of difficult tracheal intubation. Its specificity would thus be very high but its sensitivity would be very low. However, if it is used with sternomental distance (≤12.5 cm) and assessment of jaw protrusion (position C) as a composite examination, the sensitivity is almost 85%, and the specificity is still around 90%.

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Heparin and platelet function

Sir,—I read with interest the paper by Boldt and colleagues [1] on heparin and platelet function. I am concerned however that heparin reversal was not adequately confirmed.

Protamine was given in a 1 to 1 ratio with the initial dose of heparin; thus groups 1 and 2 would have received the same dose of protamine even though group 2 had received an infusion of heparin throughout the period of cardiopulmonary bypass. The authors stated that all activated clotting times (ACT) after administration of protamine were less than 150 s, thus excluding excessive circulating heparin as a cause of bleeding. However, in a review article in 1989, Aren [2] stated that the ACT method is not suitable for determination of the completeness of heparin reversal as it is insensitive to low plasma heparin concentrations. He referred to work by himself [3] and Esposito and colleagues [4]. Hooper and colleagues [5] measured residual plasma heparin concentrations after cardiopulmonary bypass, and finding no correlation with ACT measurements reached the same conclusion. Furthermore, in relying on ACT, Boldt and colleagues cannot exclude the occurrence of rebound heparinization, particularly in the high-dose groups.

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References


Prediction of difficult tracheal intubation

Sir,—In his recent study [1], Savva established by sensitivity and specificity analysis that sternomental distance, thyromental distance and modified Mallampati tests (in that order for his data) were useful individual predictors of difficult tracheal intubation. He found that the interincisor gap by itself was not related to the view on laryngoscopy. This latter finding is consistent with the data published by Bellhouse and Dore [2], where the interincisor gap was measured on lateral radiographs of patients whose mouths were fully opened. However, Wilson and colleagues showed that the interincisor gap was significantly smaller in those patients in whom laryngoscopy was difficult [3]. Subsequent unpublished work by Bellhouse and Dore using bedside tests has shown that interincisor gap is a particularly useful test to add to modified Mallampati and an assessment of head extension on neck, providing a composite examination with good sensitivity and specificity.

Whereas most patients in my experience have an interincisor gap in excess of 4 cm, the average in Savva's patients was 2.92 cm, with 55% of his patients being less than 3 cm and only 12%, 4 cm or more. One cannot help questioning either the characteristics of Savva's patients or his method of measuring and recording interincisor gap.

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4. Hooper and colleagues [5] measured residual plasma heparin concentrations after cardiopulmonary bypass, and finding no correlation with ACT measurements reached the same conclusion. Furthermore, in relying on ACT, Boldt and colleagues cannot exclude the occurrence of rebound heparinization, particularly in the high-dose groups.