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The laryngeal mask in day surgery: a survey of current practices and usage

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A survey of 296 anaesthetists revealed the laryngeal mask airway (LMA) to be a valuable tool in anaesthetic practice for day surgery, used regularly by 88% of anaesthetists. The results show marked regional variation in the use of the laryngeal mask airway in more controversial areas such as anaesthesia for cataract extraction, tonsillectomy, the insertion of grommets, dental and laparoscopic procedures and surgery involving the prone position. Complications reported by anaesthetists using the laryngeal mask airway include dislodgement (69%), laryngospasm (62%), regurgitation and aspiration (22%) and pharyngeal trauma (22%). The most concerning of those reported was that of dislodgement when the airway was not easily accessible.

Key words: Laryngeal mask airway, day surgery, usage, complications

Introduction

The laryngeal mask was invented in 1981 by Brain¹, who described this revolutionary method of airway management in 1983² and subsequently in clinical settings²⁻⁴. It was first produced commercially in 1988 and since then has had a significant impact on the practice of anaesthesia and particularly for day cases because it avoids the need for endotracheal intubation and possible associated problems. Studies have shown that use of the laryngeal mask is associated with few complications⁵⁻⁸. Controversy exists over its use in some situations which involve a higher likelihood of problems occurring, although clinical trials have recommended its use in laparoscopic procedures⁹⁻¹⁰, intraocular surgery¹¹, adenotonsillectomy¹², dental anaesthesia¹³ and paediatric anaesthesia^{8,14}.

Complications occurring with use of the laryngeal mask airway (LMA) include dislodgement, regurgitation and aspiration, laryngospasm and pharyngeal trauma¹, hence use of the LMA in anaesthesia is dependent on the anaesthetist's preference and previous experience. This survey was conducted to audit current opinions and practice among anaesthetists of the use of the LMA in anaesthesia for day surgery.

Methods

A postal questionnaire was sent to 386 anaesthetists from 15 different centres in the UK, which ranged from large teaching hospitals to smaller district general hospitals. Grades from registrar to consultant were included. The questionnaire included details about the number of years experience with the LMA, experience of use in children and adults, use for differing durations of anaesthesia, use in patients with physiological derangements (obesity, lung disease, gastric regurgitation) and use for different operative positioning (prone, Trendelenburg, lithotomy).

Current practice of the anaesthetist was assessed by asking whether the LMA would be used in the following circumstances: cataract extraction, dental surgery, tonsillectomy, insertion of grommets and laparoscopic work. The occurrence and details of complications experienced were sought in the questionnaire, specifically those of dislodgement, laryngospasm, regurgitation and aspiration and pharyngeal trauma. Finally, the questionnaire had a section asking if the anaesthetist had had any experience which led to a change of their practice with the LMA.

Results and discussion

The overall response rate to the questionnaire was 76%. Most anaesthetists had 3-4 yr experience of using the LMA and 88% of all anaesthetists used them regularly

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in adult anaesthesia. There was no difference between consultants or trainees in their use of the LMA.

Paediatric anaesthesia

Seventy nine per cent of anaesthetists used the LMA for preschool children. Brain draws attention to the fact that the paediatric LMA has an advantage over the endotracheal tube since the diameter is larger and provides less resistance to gas flow for spontaneous respiration¹. The LMA is less traumatic than the endotracheal tube which is also a great advantage for day-case surgery. Many anaesthetists reported that the incidence of laryngospasm and dislodgement in children was much higher than in adults and that they did not use the LMA in children for this reason. Fibreoptic assessment of the LMA showed partial obstruction in 10% of adults, compared with 25–50% of children¹⁵. Brain¹ recommends that only experienced anaesthetists use the LMA in children.

In a randomized comparison of the LMA with a face mask Johnston et al.⁸ concluded that the LMA provides superior airway control with less hypoxia in 2–10 yr olds. An open study by Mason and Bingham¹⁴ involving 200 children showed that the LMA can be used successfully in children of 6–30 kg, where only 2.5% of cases experienced problems with the LMA sufficient to necessitate its removal. The LMA is therefore of great value in paediatric day-case surgery.

Duration of anaesthesia

The percentage of anaesthetists who use the LMA for different durations of anaesthesia are shown in Figure 1. The most consistent response is where the duration of surgery is expected to be 10–60 min where 75–100% of anaesthetists would use the LMA. The popularity of the LMA for procedures under 10 min duration varied from 33–83% of anaesthetists in different centres. Although there are many day-case procedures under 10 min duration, the cost (up to £3 per use because of replacement and sterilizing costs) mitigates against its use where the use of the face mask is a reasonable alternative.

Patient physiology

Obesity. Ninety per cent of anaesthetists were happy to use the LMA in moderately obese patients, and 23% in very obese patients. These numbers may seem surprisingly high, but the alternative airway management may prove equally problematic. Difficulty with positioning of the LMA, regurgitation and later dislodgement were problems frequently encountered by anaesthetists. These difficulties highlight the potential unsuitability of very obese patients for treatment as day cases.

Lung characteristics. Patients with poor lung compliance present difficulties when using positive pressure ventilation through the LMA, since its use with pressures less than 20 cm water is recommended¹. Forty per

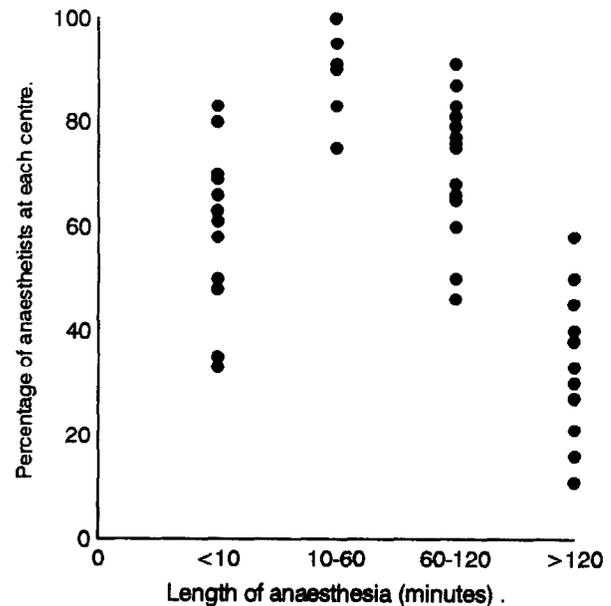


Figure 1. Percentage of anaesthetists at different centres using the laryngeal mask for different durations of anaesthesia. Each symbol represents a separate centre.

cent of the anaesthetists qualified their use of the LMA in this category of patient by only employing spontaneous ventilation. Eighty-two per cent of anaesthetists were happy to use the LMA in asthmatic patients, hence avoiding the stimulus to bronchospasm of tracheal intubation. Many day-case patients suffer with asthma and the LMA is valuable for this reason.

Gastric regurgitation. The LMA is not recommended for use in patients who are at risk of regurgitation, or who have full stomachs. Barker et al.¹⁶ have considered whether the presence of the LMA may increase the incidence of reflux, possibly because of an effect on the lower oesophageal sphincter¹⁷. Therefore it is a surprise that in one hospital 37% of anaesthetists would consider using the LMA in these patients (although some stated that this would only be after prophylaxis with antacids and metoclopramide). At other centres only 15% of anaesthetists would use it in these patients. However, of the reports in the literature of regurgitation, many are unexpected or unpredictable^{7,18,20,21}. Twenty-one per cent of anaesthetists reported further instances of regurgitation in this survey and it is important to be alert when this complication occurs, just as it is when a face mask anaesthetic is being given. Day-case patients are responsible for their preoperative starvation and there is obvious need to check that this has been adhered to before surgery.

Operative positioning

The LMA has been recommended for use in all positions including Trendelenburg and prone, if the anaesthetist is sufficiently experienced¹. Figure 2 shows the percentage of anaesthetists in each centre who use the laryngeal mask in these operative positions. It can be

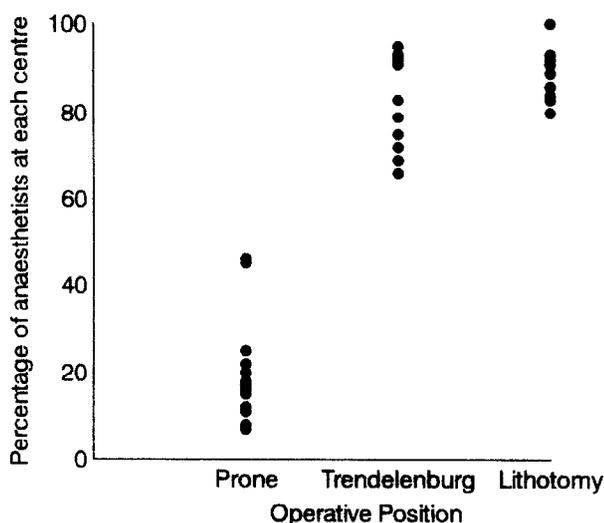


Figure 2. Percentage of anaesthetists in different centres using the laryngeal mask for different operative positions. Each symbol represents a different centre.

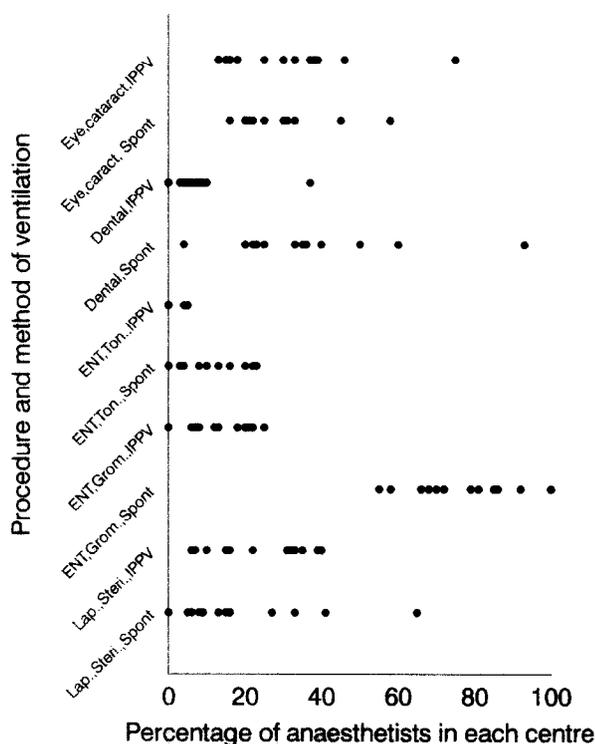


Figure 3. Percentage of anaesthetists in each centre who use the LMA for different procedures. IPPV, Intermittent positive pressure ventilation; Spont, spontaneous respiration; ENT, ear, nose and throat; Ton, tonsillectomy; Grom, grommets; Lap, laparoscopic; Steri, sterilization.

seen that few anaesthetists are willing to use the LMA if the patient is to be placed prone. Dislodgement during either positioning or intraoperatively may be difficult to correct due to the airway not being immediately accessible. This problem was reported by nine anaesthetists in the survey. The regional variation is interesting to note: in one hospital, 46% of anaesthetists used the LMA for prone positioning, compared with a mean of 19% of anaesthetists in all the other centres.

Practice in operative procedures

Figure 3 illustrates the percentage of anaesthetists in each centre who would use the LMA for a particular procedure and whether they would employ positive pressure ventilation or spontaneous breathing. It is interesting to note the large variation in practice between centres, which may be explained by the fact that anaesthetists are often influenced by their immediate colleagues' opinions and experience.

Eye surgery. Only 30% of anaesthetists use the LMA for cataract extraction, because of the risk of dislodgement. They would sympathize with Ripart et al. who write that, from their experiences with dislodgement during ophthalmic operations, they no longer employ the LMA for use in such circumstances²². Indeed eight anaesthetists reported similar experiences which had changed their practice. The LMA has been recommended for use by Brain in eye surgery¹, since it may induce less post-operative coughing and thus prevent an increase in intraocular pressure. Lamb et al. also showed that there was less increase in intraocular pressure when an LMA was used in preference to endotracheal intubation for the procedure¹¹. Brain¹ does add a note of caution that spontaneous ventilation may be preferable to positive pressure ventilation when the presence of the surgeon and drapes make it difficult for the anaesthetist to assess the airway, although the use of a capnogram with graphical display gives an immediate warning of problems. From the survey results, approximately half of the anaesthetists use positive pressure ventilation enabling the arterial carbon dioxide tension to be controlled, avoiding an increase in intraocular pressure.

Dental surgery. The survey results show a wide discrepancy in practice between centres, from 0–37% for positive pressure ventilation and 4–93% for spontaneous ventilation. Eight anaesthetists have experienced problems with airway patency when the surgeon extends the head. Three anaesthetists recommend using the armoured LMA to avoid such problems. Brain suggests that the LMA is useful during short dental procedures, in conjunction with a throat pack¹. Care must be taken by the surgeon to move the mask from side to side without dislodging the airway. The laryngeal mask has been shown to protect the airway from secretions from the oropharynx in a study by John et al.²³ and experience with its use in dental surgery is reported as successful^{4,13}.

Tonsillectomy. Although performing tonsillectomy as a day-case procedure is controversial, this was included because there is increasing pressure to perform such procedures on this basis. The use of the LMA for tonsillectomy is possible, although the large compressible tube can restrict surgical access. Fixation of the LMA is important and a throat pack can be used. The cuff of the LMA is below tonsillar level. Despite a study by Williams and Bailey¹², showing the LMA to be superior

to the use of an endotracheal tube for tonsillectomy in children, the number of anaesthetists using the LMA for this procedure is fewer than 20% in each centre. This is considerably less than the use of the LMA in children for other procedures and reflects the fear of airway contamination, dislodgement and laryngospasm.

Ear surgery. Fifty to one hundred per cent of anaesthetists used the LMA for insertion of grommets with spontaneous respiration since this enables the anaesthetist to stand clear from the area of surgery. Precautions must be taken in case of dislodgement, but at least access to the airway is possible. The study by Johnston et al.⁸ on otological procedures in children aged 2–10 yr showed the LMA to be superior to using a face mask. The LMA is deservedly popular for this day-case procedure.

Laparoscopic surgery. The survey results show that at present 23% of anaesthetists use the LMA for laparoscopic work with positive pressure ventilation and 18% with spontaneous ventilation. The avoidance of the use of the LMA is attributable to the risk of regurgitation induced by the Trendelenburg position, higher abdominal pressures with intraperitoneal gas and gastric distention if positive pressure ventilation is used. Previous studies on techniques of anaesthesia for laparoscopy have shown no difference in outcome whether the patients were ventilated or breathing spontaneously^{24,25}. Brain used the LMA for laparoscopy with positive pressure ventilation and found it to be satisfactory². Goodwin et al. found the LMA to be excellent for day-case laparoscopy work, with the patients breathing spontaneously⁹. Swann et al. compared patients for laparoscopy who were either intubated and ventilated, or breathing spontaneously with assistance via the LMA¹⁰. They showed that both techniques were acceptable, although there was a higher incidence of nausea and vomiting in the LMA group, possibly due to gastric insufflation, but a lesser incidence of sore throat. A study by Malins et al. in which 150 patients were ventilated through an LMA for laparoscopy reported no complications, although obese patients were excluded²⁶.

Complications associated with the LMA

The aim of an anaesthetic technique for day-case surgery is safely and efficiently to produce adequate operating conditions with minimal complications and swift recovery. Complications of the use of the laryngeal mask may compromise safety and hence their occurrence was sought.

Dislodgement. From the survey results, 69% of all anaesthetists admitted to experiencing this complication. Dislodgement was said to occur more frequently during surgical repositioning of the head, application of drapes, repositioning of the patient, obese and edentulous patients and children. Dislodgement was also reported in two patients when facing prone, two

patients during laparoscopy and four patients during eye operations. Reversal of muscle relaxant was also reported to precipitate airway obstruction in three cases, either due to laryngospasm or displacement of the LMA.

There are a number of reasons in addition to dislodgement why obstruction to the airway may occur during LMA anaesthesia. Brain describes how the tip of the LMA may penetrate the larynx on insertion and cause increasing obstruction as the cuff volume expands with diffusion of nitrous oxide intraoperatively²⁸. Collier²⁹ found cuff pressures to be 11 kPa at the beginning of a procedure, increasing to 19 kPa at the end. This may explain the airway obstruction he experienced with three patients on induction, after 45 min and 110 min respectively. The obstruction was relieved in all cases by the aspiration of 10 ml of air from the cuff.

Downfolding of the epiglottis is said to occur in 60% of patients with partial airway obstruction in a fiberoptic study by Payne³⁰. Brimacombe states, however, that only 5% of total airway obstruction is caused by epiglottic downfolding³¹ and that the causes are more usually laryngospasm, closure of the laryngeal inlet by inward displacement of the aryepiglottic folds when the cuff is inflated, kinking of the tube, or cuff overinflation. Changes in practice reported by anaesthetists were to use the armoured LMA for ear, eye and dental procedures; reluctance to use the LMA in operative procedures near the airway, during eye surgery, or prone positioning; to check the position of the LMA with a laryngoscope before surgery; and to ensure good fixation of the LMA preoperatively. Three anaesthetists felt that insertion of the LMA was facilitated by partial inflation of the cuff, although Brimacombe and Berry did not conclude this in their study³². Seventy-seven per cent of anaesthetists were more reluctant to use the LMA in the obese patient and the need to keep the patient deeply anaesthetized when reversing muscle relaxation was emphasized.

Laryngospasm. Laryngospasm was reported by 62% of anaesthetists. It occurred more commonly in children, on induction when the patient was not anaesthetized deeply enough, and also in recovery. Patients who were smokers, asthmatics, unpremedicated day cases and patients who were induced with thiopentone rather than propofol also had a higher incidence of laryngospasm. Six of the cases reported were severe enough to warrant the use of suxamethonium. Studies in adults and children have estimated the incidence of laryngospasm associated with removal and insertion of the LMA to be 2%¹⁴ and 4%⁵. The LMA manual recommends that the LMA remains *in situ* until the patient is fully awake and all pharyngeal reflexes are intact, however this seems to be a cause of laryngospasm and regurgitation in many cases, and many anaesthetists reported choosing to remove the LMA when the patient is still deeply anaesthetized.

Changes in practice to avoid laryngospasm include reluctance to use the LMA in children, to ensure that

the patient is deeply enough anaesthetized for insertion and removal of the mask, to use propofol as the induction agent of choice, or always to increase the depth of anaesthesia with a volatile agent before insertion of the mask. Two anaesthetists reported routine preoxygenation in case laryngospasm occurred.

Regurgitation and aspiration. This was experienced by 22% of all anaesthetists. All but one of the cases of aspiration were entirely unpredictable. This one patient had a history of gastric reflux. No longstanding morbidity subsequent to the aspiration was reported – some patients' lungs were ventilated postoperatively, but all recovered fully. These findings agreed with the literature which does not reveal to date a mortality from aspiration with the LMA. All five patients in the study by Verghese et al.⁶ who regurgitated needed no postoperative intervention. The survey of Australian intensive care units by Brimacombe and Berry⁷ showed the admission of one patient in 1990 and seven patients in 1991 for aspiration occurring with LMA usage, with no fatalities. Even in a study of the use of the LMA for cardiopulmonary resuscitation²⁷, where one might expect a high incidence of aspiration, although 20% of the patients regurgitated only one patient showed signs of clinical aspiration and recovered fully. Other case reports by Wilkinson et al.²⁰, Griffin and Hatcher¹⁸ show aspiration to have occurred during recovery. This correlates with the results of the survey in which three of the patients aspirated postoperatively with the LMA still *in situ*. This brings into question once more whether the LMA should be removed earlier when the patients are still deeply enough anaesthetized. Changes in practice stated by the anaesthetists reveal a reluctance to use the LMA for positive pressure ventilation and laparoscopic work, and a lower threshold to intubate patients with a history of reflux.

Pharyngeal trauma. This was reported by 22% of anaesthetists. Most of the reports were of small amounts of blood seen on the mask at the end of the procedure. However reports were made of pharyngeal haematoma, severe bruising to the pharynx and soft palate laceration. One anaesthetist discovered from postoperative questioning that more patients complained of sore throat than did patients who had conventional mask anaesthesia. Comments were made that care should be taken in children to avoid trauma to the epiglottis and enlarged tonsils and that the LMA should not be used in patients with bleeding problems. Incidence of sore throat postoperatively in the literature varies from 3.9%² to 12%⁵. Severe bruising has been reported by Lee³³. Brain³⁴ stresses that the technique of insertion is important to avoid this complication: the tip of the LMA should always remain flat and never kinked. Thompsett and Cundy report the occurrence of a haematoma above the right vocal cord in a patient with a bleeding diathesis³⁵ but Brain emphasizes the need for cautious insertion to avoid misplacement of the tip into the laryngeal aperture, stressing that the LMA need not

be considered any more traumatic than either a conventional mask or endotracheal intubation²⁸. The occurrence of pharyngeal trauma therefore seems to be negligible and avoidable with correct technique of insertion, and the incidence of sore throat after LMA insertion was only small, suggesting suitability for day-case anaesthesia.

Conclusion

This survey was conducted to see how anaesthetists use the LMA in their practice for day surgery today and what problems they have encountered. It is of interest to report the complications revealed in the survey, although an accurate estimation of the incidence of complications is not possible because of the reliance on memory. Many anaesthetists show considerable caution, avoiding its use in situations where problems may arise. The incidence of serious complications is low, the most worrying one being displacement or obstruction of the LMA in situations where the airway is not accessible.

In a recent Editorial³⁶, Asai and Vaughan warn of the danger of misusing the LMA and the need for trials to establish its place in anaesthetic practice. This survey illustrates the differences between anaesthetists in their use of the LMA and emphasizes the need for recommendations for safe practice. This is all the more necessary in day-case anaesthesia where safety and the avoidance of complications are of prime importance if the patient is to be allowed home.

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