

## Thinking Twice before Using the LMA for Obese and Older Patients - A Prospective Observational Study

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### Abstract

**Introduction:** Laryngeal Mask Airways (LMAs) have traditionally been used for short surgery under general anesthesia with good results. Many studies have reported favourable outcomes in safety profile, complication risk, ease of insertion, recovery of patients and cost analyses. However, there is an under reporting of complications arising during ventilation with this device and the risk factors associated with such complications in adult patients. These include laryngospasm, difficulty with insertion, suboptimal ventilation, bronchospasm, aspiration, desaturation, hypotension and conversion to intubation with ETT. These can be significantly serious and life threatening. Often times it is wrong patient selection for the wrong surgery that results in an undesirable outcome.

**Methods:** By means of this prospective observational study we aimed to audit all general anesthesia cases performed with an LMA at our hospital over six months from February till August 2012. Included in the parameters observed were induction techniques, ventilation strategies and intraoperative problems during LMA ventilation. By means of a data collection form, the Anaesthetist in charge indicated the intraoperative events and outcomes.

**Results:** 1,095 patients were included in the audit. The mean age of the patients was 40 years and mean weight was 66.4kg. The patients were given GA for a variety of procedures. LMA Proseal™ was used in 78.4% of patients while the LMA Supreme™ was favored when the surgeries required a lateral position. 7.1% of patients encountered problems with insertion whilst 7.8% had intraoperative problems related to difficulty with ventilation. This was more prevalent with the LMA Supreme™ ( $p=0.031$ ). Age and BMI of the patient increased the incidence of complications ( $p=0.002$  and  $0.0008$ ). A BMI >30 and an age >46 years are associated with a significant 2-fold increase in the probability of all ventilatory problems intraoperatively.

**Conclusion:** LMA use in our Operating Theatre is generally safe as long as potential problems are recognised and managed accordingly. The risk of problems increases 2-folds with patients with a BMI>30 and age>46 years. LMA Supreme was more problematic compared with Proseal.

**Keywords:** Laryngospasm; Laryngeal mask airways; Bronchospasm

### Introduction

Laryngeal mask airways (LMAs) have traditionally been used for short surgery under general anesthesia with good results. Many studies have reported favorable outcomes in safety profile, complication risk, ease of insertion, recovery of patients and cost analyses [1-3]. In the current healthcare setting worldwide with cost restraints and the advent and popularity of fast track surgery, LMAs have revolutionized anaesthetic care [4-6]. Patient satisfaction surveys have also shown a marked improvement as many side effects of endotracheal intubation are avoided. Difficult airway scenarios are also reduced due to the relative ease of insertion. However, there is an under reporting of complications arising during insertion and ventilation with this device and the risk factors associated with such complications in adult patients [7,8]. Currently there is a dearth of literature pointing towards specific complications in the older age group of patients or higher Body Mass Index (BMI) patients. These complications include laryngospasm, inadequate insertion, suboptimal ventilation, bronchospasm, aspiration, desaturation, and conversion to intubation with ETT [9-12]. These can be significantly serious and life threatening. Often times it is wrong patient selection for the wrong surgery that results in an undesirable outcome [13]. For example, smokers and asthmatics often have a reactive airway and require a deeper level of sedation prior to LMA insertion. Oral or dental surgery with LMAs has been reported to induce laryngospasm. We carried out a prospective observational audit in our Department to investigate the prevalence of such intraoperative complications and the possible risk factors associated with them.

### Methods

Khoo Teck Puat hospital is a 500-bed general adult tertiary care centre in the north of Singapore. Approximately 5,000 elective General Anesthesia (GA) cases are performed in our ten operating rooms yearly. Of these, roughly half are done with LMAs. After obtaining the National Health care Group Domain Specific Research Board approved waiver of patient consent, all consecutive cases undergoing General Anaesthesia with an LMA were enrolled in the audit which spanned from November 2011 to May 2012 (seven-month period). The design of the audit was a prospective, observational, cohort audit of practice. Audit forms were placed in all ten operating rooms and filled contemporaneously. By means of this form the Anaesthetist would indicate the demographics of the patient, type of LMA used choice of volatile agent, position of the patient, intraoperative events and outcomes of each case. At the end of 7 months the data was entered into SPSS version 19 and analyzed.

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The Fisher exact test was used to calculate statistical significance in the analysis of contingency tables so that the exact deviation from the null hypothesis could be calculated. Logistic regression was used to describe the odds of possible associations between variables.

## Results

1,095 consecutive patients were included in our audit between November 2011 and May 2012. None of the patients were missed out for the audit in this period. The demographic, surgical disciplines and anaesthetic techniques are presented in Table 1. 67.9% of the patients were male. The median age was 40 years (interquartile range: 26-54 years). The median weight was 66.4 kg (interquartile range: 57.0-75.0 kg), median height was 1.67 m (interquartile range: 1.60-1.72 m) and median BMI was 24.2 kgm<sup>-2</sup> (interquartile range: 21.5-27.2 kgm<sup>-2</sup>). The patients were given GA for a variety of procedures and they include orthopaedic surgeries (44.3%), general surgeries (30.0%), urological procedures (15.6%), ENT procedures (1.7%), eye surgery (0.9%) and dental surgeries (7.5%). 74.6% of the surgeries were performed in the supine, 18.0% in the lithotomy and 7.4% in the lateral position.

LMA Proseal<sup>TM</sup> was used in 858 (78.4%) patients, LMA Supreme<sup>TM</sup> in 121 (11.1%) patients and other LMAs such as the flexible or classic LMAs in 116 patients (10.5%). LMA Supreme<sup>TM</sup> was favoured when the surgeries required a lateral position. Intravenous induction was used for 98.2% of the patients and Sevoflurane was preferred to Desflurane

	N = 1095
<b>Demographic characteristics</b>	
Median Age (yr)	40 (range: 26–54)
Median Weight (kg)	66.4 (range: 57.0–75.0)
Median Height (m)	1.67 (1.60–1.72)
Median BMI (kgm <sup>-2</sup> )	24.2 (21.5–27.2)
Male	744 (67.9%)
Female	351 (32.1%)
<b>Surgical disciplines</b>	
Orthopaedic Surgery	485 (44.3%)
General Surgery	328 (30.0%)
Urology	171 (15.6%)
Ear Nose Throat (ENT)	19 (1.7%)
Ophthalmology	10 (0.9%)
Dental	82 (7.5%)
<b>Positioning</b>	
Supine	817 (74.6%)
Lithotomy	197 (18.0%)
Lateral	81 (7.4%)
<b>Anesthesia Induction</b>	
IV Induction	1075 (98.2%)
Inhalational Induction	20 (1.8%)
<b>Maintenance gas</b>	
Sevoflurane	900 (82.2%)
Desflurane	192 (17.5%)
Total Intravenous Anesthesia	3 (0.3%)
<b>Mode of ventilation</b>	
VCV	499 (45.6%)
PCV	97 (8.9%)
SIMV	125 (11.4%)
PSV	194 (17.7%)
SV	180 (16.4%)
<b>LMA types</b>	
LMA Proseal <sup>TM</sup>	858 (78.4%)
LMA Supreme <sup>TM</sup>	121 (11.1%)
Others	116 (10.5%)
<b>LMA size</b>	
3	209 (19.1%)
4	691 (63.1%)
5	195 (17.8%)

**Table 1:** Characteristics of patients in terms of demographics, surgical disciplines and anaesthetic management.

	LMA Proseal <sup>TM</sup> (n=858)	LMA Supreme <sup>TM</sup> (n=121)	P value
<b>All problems</b>	<b>61 (7.11%)</b>	<b>16 (13.2%)</b>	<b>0.031</b>
<b>Laryngospasm</b>	<b>20 (2.33%)</b>	<b>7 (5.79%)</b>	<b>0.039</b>
<b>Bronchospasm</b>	7 (0.82%)	2 (1.65%)	0.308
<b>Coughing on insertion</b>	8 (0.93%)	2 (1.65%)	0.356
<b>Desaturation</b>	11 (1.28%)	3 (2.48%)	0.400
<b>Difficulty ventilation</b>	<b>29 (3.38%)</b>	<b>12 (9.91%)</b>	<b>0.003</b>

Fisher's exact test performed P < 0.05 for all problems, laryngospasm and difficulty ventilation

**Table 2:** Occurrence of intra-operative problems comparing LMA ProSeal<sup>TM</sup> and LMA Supreme<sup>TM</sup>.

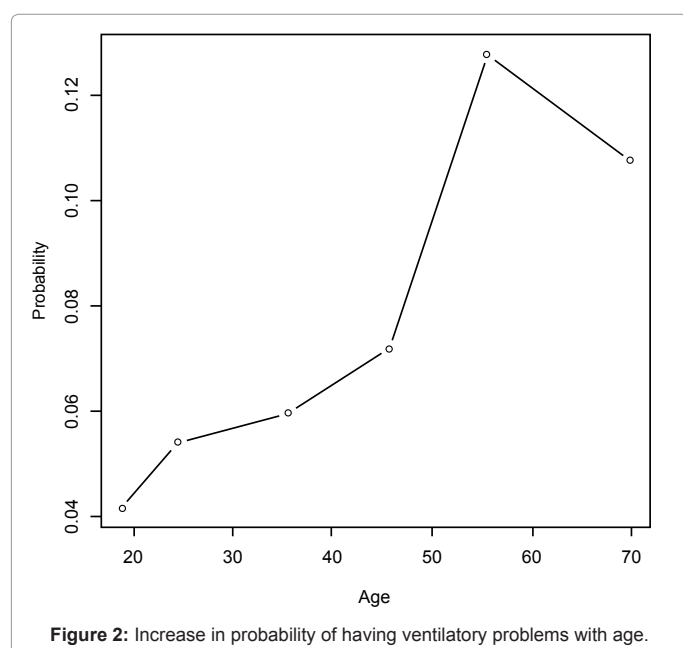
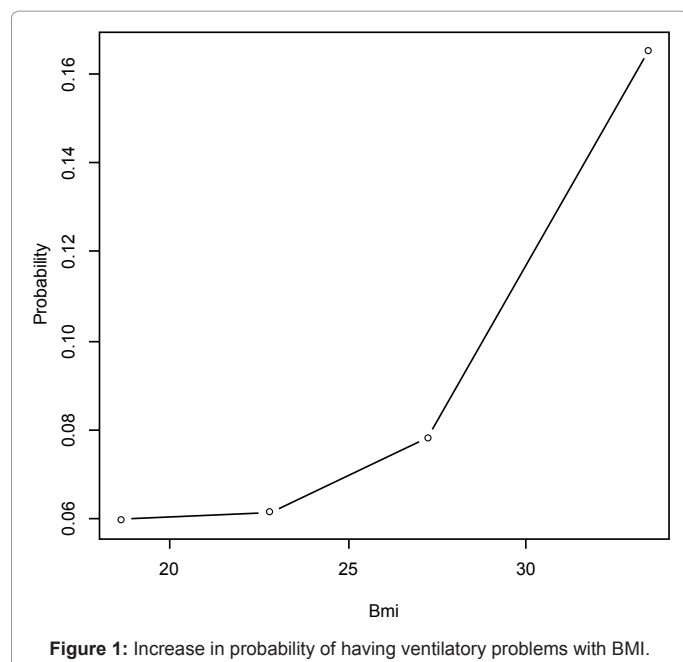
for maintenance of GA. 83.6% of the patients were ventilated using positive pressure ventilation (volume-control ventilation, pressure-control ventilation, synchronized intermittent mandatory ventilation and pressure support ventilation) and 16.4% underwent spontaneous ventilation (Table 1). 81 patients (7.4%) encountered problems with insertion and required additional 2-3 insertion attempts. The incidence of problems with insertion was not different among the LMA types (p=0.073). The increase in number of insertion attempts was associated with blood found on LMA upon removal (p<0.05).

85 patients (7.8%) had intraoperative problems. 31 patients developed laryngospasm, 10 bronchospasm, 1 coughing on insertion, 14 desaturation and 44 difficulty ventilation. All intra-operative problems were managed appropriately and did not result in any significant morbidity. The problems did not result in any increased high-dependency or intensive care unit admission. In general, the occurrence of intraoperative problems was found to be more common with the LMA supreme<sup>TM</sup> when comparing between LMA ProSeal<sup>TM</sup> and LMA Supreme<sup>TM</sup> (p=0.031). More specifically, laryngospasm (p=0.039) and difficulty ventilation (p=0.003) was more common in the LMA Supreme<sup>TM</sup> (Table 2). There was no statistically significant difference in the occurrence of intraoperative problems when comparing the use of Sevoflurane and Desflurane as the maintenance anaesthetic agent. There was no statistically significant difference in the occurrence of intraoperative problems when comparing between spontaneous ventilation and positive pressure ventilation.

Using logistic regression analysis, it was found that the higher the BMI of the patient (p=0.0008) and the older the patient (p=0.002), intraoperative problems occurred more frequently. The increase in BMI >30 increased the probability of having ventilatory problems by 2.5-fold (Figure 1) and an increase in age >46 years also increased the probability 2-fold (Figure 2). The patients were further stratified into groups according to their BMI and analyzed using logistic regression. The patients with BMI ≤ 20, 20<BMI ≤ 25 and 25<BMI ≤ 30 were compared and it was found that the incidence of intraoperative problems was not significantly different between the stratified groups. The same was performed for age and it was found that the groups with age ≤ 46 years were similar in probability of intraoperative problems (Tables 3 and 4).

## Discussion

By means of our audit we could identify the number of cases undergoing anaesthesia using the LMA, the indications of its use in our setting, intraoperative events and difficulties with insertion or ventilation. Generally we can conclude that the use of LMA is safe in our setting. None of the patients who encountered intraoperative problems resulted in significant morbidity or required intensive care unit admissions. We found LMA Proseal to be more widely used



compared to the LMA Supreme or others. Problems with insertion were equal between Proseal and Supreme, contrary to belief that the Supreme LMA is easier to insert [14,15]. However, the problems encountered during ventilation were more when LMA Supreme was used. This could possibly be due to the fact that it has a preformed structure made of polyvinyl chloride and is less malleable, especially in the Asian population with a receding lower jaw. Overall the rate of insertion and intraoperative ventilation problems encountered were 7.4% and 7.8%. We additionally discovered that the type of surgery, choice of induction and volatile agent used as well as the mode of ventilation or the comorbidities of the patient did not make a difference when the incidence of complications was observed. Positive pressure ventilation or PPV was more common than Spontaneous Ventilation

	≤ BMI 20	20<BMI ≤ 25	25< BMI ≤ 30	BMI>30
Mean BMI	18.6	22.8	27.2	33.4
Empirical probability of problems	0.060	0.061	0.078	0.165

**Table 3:** Empiric Probability of ventilatory problems with Increasing BMI, Cut off BMI 30

	≤ 20,	20<age ≤ 30	30<age ≤ 40	40<age ≤ 46	46<age ≤ 60	Age>60
Mean age	18.68	24.36	35.53	43.76	55.55	70.05
Empirical probability of problems	0.0417	0.054	0.060	0.066	0.114	0.107

**Table 4:** Empiric Probability of ventilatory problems with increasing age. Cut off 46 years.

(SV) in our practice. This trend corresponds to what is prevalent in recent literature [16,17]. Our study further reiterates the fact that PPV is safe in the use of LMA as our incidence of problems was similar in both the PPV and SV group.

An interesting and so far undocumented finding of our study was that increasing age and BMI had a significant effect on the occurrence of intraoperative ventilatory problems. The risk of problems increased 2.5-fold when BMI was >30 and 2-fold when age was >46 years. Perhaps airway anatomical issues related to obesity such as increased soft tissue, large tongue small mouth opening and being edentulous and therefore having the LMA not 'sit' properly in the elderly could be the cause of this observation [18,19]. Therefore risk versus benefits of LMA use in these patient groups should be considered.

Limitations of this study include that it was a prospective audit rather than a randomised controlled trial. We found an association between intraoperative ventilatory problems with age and BMI, but a causal relationship cannot be concluded. There could have been a selection bias of the anesthetist towards any particular kind of LMA based on their skill or preference for certain groups of patients. The cost of a Supreme LMA (which is disposable and therefore more costly) could also be a factor. Some potential confounding factors which could affect ventilation intraoperatively were not assessed in our audit. They include the airway assessment of the patient, dentition, underlying respiratory disease or history of smoking.

We therefore conclude that our audit shows that the use of an LMA is safe and effective overall. None of the patients over a 7-month period suffered significant morbidity or required ICU admission. Intraoperative problems were associated with the LMA Supreme, a BMI >30 and age >46 years. However, larger prospective studies may be required to confirm the association between age and BMI with LMA-related problems [20]. We hope to improve our practice by perhaps defining a more accurate patient selection process and anticipating future complications.

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