

## Laryngeal Mask Airway in Prone Position in Ambulatory Surgery: A Prospective Observational Study

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### Abstract

**Introduction:** The laryngeal mask airway (LMA) is a common airway device used for anesthesia in ambulatory surgery, with a recently new described utilization in prone position. The aim of this study was to evaluate the safety and the effectiveness of the LMA, in prone position for anesthesia in ambulatory surgery, based on our new anesthesia department protocol.

**Methods:** Patients from February 2013 to July 2014 were included in this prospective study. After the patient self-positioning in prone position, general anesthesia was induced and the LMA was placed. Second generation LMA types were used (Supreme™, iGel™ and Proseal™) and all patients were mechanically ventilated. At the end of surgery, LMA was removed in prone or supine position. Number of attempts of LMA insertion, volume leak, airway peak pressure and complications were registered until 2 hours after the procedure.

**Results:** The LMA placement was 85.1% effective in the first attempt and 100% in the second attempt. The need for a second attempt LMA placement was due to non-progression of the aspiration probe, a high leak and impossible ventilation. Mechanical ventilation was considered effective and safe with maximum peak airway pressure of  $17.9 \pm 5.5$  cm H<sub>2</sub>O and maximum leak of  $47.7 \pm 31.2$  ml. Complications were present in 6 patients (9%) with hypoventilation, bronchospasm and laryngospasm. Other "minor" events registered included the presence of blood in the LMA at the end of procedure and gum lesion with the rigid piece of the Supreme™ LMA.

**Discussion and conclusion:** Complications found in our study are similar to those described in literature in supine position and are related to the anesthetist previous experience. Anesthetic depth adjustment improved all complications found. Effectiveness and overall safety of LMA use in prone position was observed, allowing further utilizations in selected patients according to the anesthesia department protocol.

**Keywords:** Laryngeal mask airway; Prone position; Ambulatory surgery; General anesthesia; Complications and anesthetic depth

### Introduction

In the ambulatory surgery, procedures performed in the prone position may represent an obstacle to the fast-track concept. The prone position is required for various surgeries, such as excision of pilonidal sinus, haemorrhoidectomy, varicose veins avulsion and some orthopedic surgeries.

Patients are classically anesthetized and intubated in the supine position prior to turning over to prone, increasing the time required for induction, adequate positioning, recovery and demanding for multiple personnel.

During the last decade, evidence has emerged about the benefits of inducing anesthesia after patients self-positioned in the prone position, assuring airway management and ventilation with a supraglottic device, namely LMA. The technique is reported to be safe and effective, without significant complications. It has been shown to save time and manpower [1]. On the other hand, the self-positioning

in prone before induction of anesthesia reduces cardiovascular instability and pressure lesions [2].

In our ambulatory surgery center a new anesthesia department protocol for induction and maintenance anesthesia in prone position with LMA, was developed and implemented, based on the published literature.

The aim of our study was to evaluate the safety and effectiveness of our anesthesia department protocol.

### Methods

Clinical Governance and Quality Department for clinical audit approval was obtained, with the reference IM.GGC.GER.032/2.

All consecutive patients from February 2013 to July 2014, present for ambulatory surgery that needed prone position were included, according to the inclusion criteria of our protocol: age above 18-years-old, ASA physical status 1 or 2, BMI < 35 Kg/m<sup>2</sup>, and elective ambulatory surgery with expected duration of less than 1 hour. Exclusion criteria included anticipated difficult airway management, limited neck mobility, poor indication to the use of LMA, major respiratory comorbidities and lack of collaboration.

According to the protocol, all patients were clearly informed about the procedure before induction of anesthesia, and informed consent was obtained.

After a venous access has been established, the anesthetist asked the patient to comfortably position him or herself in the prone position on the surgical table, on top of gel pads, to minimize damage to nervous plexus and vascular structures. The patient's head was turned laterally and the arms rested on its both sides, on padded supports. A trolley was always available, standing by outside the operating room and during all the procedure, in case an emergency situation should occur and the patient needed to be rapidly turned to the supine position.

After positioning, patients were monitored according to the ASA standards with five-lead electrocardiogram, peripheral pulse oximetry and non-invasive arterial pressure. Neuromuscular blockade with TOF ratio and anesthetic depth with Bispectral Index™ (BIS) were also monitored. The anesthesia machine used was the GE Datex-Ohmeda Aisys™. The anesthetist chose a second generation LMA (Supreme™, iGel™ or Proseal™) according to patient's features. Preoxygenation was then performed in the prone position for three minutes while obtaining adequate facial mask seal and capnography. Anesthesia was induced with fentanyl 2 µ/Kg-3 µ/Kg, propofol 2 mg/Kg-3 mg/Kg. The administration of muscular relaxant and its dose varied according to the anesthetist clinical judgment. The selected LMA was introduced when adequate anesthesia was achieved, as assessed by vital signs, BIS value and jaw relaxation. Two techniques for LMA insertion were used: a) turn patient's head to central position, causing the lower jaw to fall, or b) keeping the head turned laterally according to the patient self-positioning (Figure 1).



Figure 1: Steps of LMA placement and cuff inflation.

After introduction of Supreme™ and Proseal™ LMA, the cuff was inflated according to the manufacturer indications, and cuff pressure was measured with an analogical manometer and adjusted to obtain pressures less than 60 cm H<sub>2</sub>O. iGel™ LMA has no cuff to be inflated.

Patients were submitted to volume or pressure controlled ventilation (tidal volumes 5-8 ml/Kg), assisted ventilation or spontaneous ventilation, at the discretion of the anesthetist and according to each clinical situation. Anesthesia was maintained with oxygen/air and sevoflurane or desflurane aiming MAC 0.7-1.2, BIS 40-60 and MAP (mean arterial pressure) within 20% variation from the basal value. At this moment, surgeons were allowed to start the procedure.

Number of attempts to insert LMA was registered (complete removal and reinsertion of LMA), as were the maximum airway peak pressure and the maximum leak volume (difference between the inspired and expired volume), from anesthesia induction till the end of the anesthesia. These values are displayed in our anesthesia machine (Aysis GE™) allowing a very accurate and straightforward record keeping.

Complications that occurred were recorded from the induction of anesthesia until 2 hours after the procedure. They were classified as complications (when required some intervention: pharmacological, non-pharmacological or both) and as "minor" events (required only surveillance).

At the end of the procedure the LMA was removed in prone or supine position, at the discretion of the anesthetist and according to the anesthesia emergence. Statistical analysis was undertaken using chi-square test.

## Results

67 patients were included, according to the inclusion criteria. 59.7% were classified as ASA 1 and the remaining as ASA 2. 58.2% were male. The mean age was 36.1 ± 15.5 years. The mean duration of surgeries was 33.6 ± 16.8 minutes. The type surgeries performed are described in Table 1.

Surgeries performed	n	%
Pilonidal sinus excision	39	59.1
Varicose veins avulsion	18	27.3
Haemorrhoidectomy	6	9.1
Achilles tendon repair	2	3
Nape lipoma excision	1	1.5

Table 1: Types of surgeries performed.

All the patients underwent to general anesthesia and muscular relaxants were used in 22.4% of them. The reasons for the use of muscular relaxants were to improve the ventilation (28.6%), to improve the LMA seal (28.6%), for surgical needs (21.4%). LMA Supreme™ was used in 50.7% of patients, LMA iGel™ in 28.4% and LMA Proseal™ in 20.9% (Table 2).

Laryngeal mask airway	n	%
Supreme	34	50.7
iGel	19	28.4
Proseal	14	20.9

Table 2: Laryngeal masks airway used.

Second attempt LMA placement	n
Non progression of the aspiration probe	1
Need to change the LMA	3
Mismatch/volume leak	5
Impossible ventilation	1

Table 3: Reasons for making a second attempt LMA placement.

The LMA placement was effective in 100% after a second attempt; the first attempt was effective in 85.1% of the patients. A second attempt LMA placement was made in 14.9% patients due to non-

progression of aspiration probe; need to change the LMA size, high volume leak or impossible ventilation (Table 3).

All of these cases occurred before the skin incision.

All patients received mechanical ventilation (61.7% controlled volume ventilation and 38.7% pressure controlled ventilation). The maximum airway peak pressure was  $17.9 \pm 5.5$  cm H<sub>2</sub>O and the maximum volume leak was  $47.7 \pm 31.2$  ml.

Complications were observed in six patients (9%) (Table 4); hypoventilation was registered when the tidal volumes were less than 5 ml/ideal weight and occurred in two patients (3%), bronchospasm also occurred in two patients (3%), both of these problems were overcome by increasing anesthesia depth (using propofol and volatile anesthetics), plus bronchodilator therapy for the cases of bronchospasm. Two cases of laryngospasm were registered, with fast desaturation (SpO<sub>2</sub><90%), in which we had to turn the patients to supine position. The laryngospasm was treated with airway positive pressure and increase anesthesia depth. LMA was reinserted in supine position and the patients were turned to prone position again. Surgery went uneventfully. In both cases, complications occurred before skin incision.

	n	%
<b>Complications</b>	6	9
Hypoventilation	2	3
Bronchospasm	2	3
Laryngospasm	2	3
<b>"Minor" events</b>	7	10.5
Blood in the LMA (vestigial or moderate)	6	9
Gum lesion with the rigid piece of the LMA Supreme	1	1.5

**Table 4:** Registered complications and "minor" events with the LMA use.

The observed "minor" events included blood in the LMA and a gum lesion with the rigid piece of the Supreme™ LMA. These events required surveillance in the post-anesthetic care unit with no need of others measures or treatments during the hospital stay. The complications and "minor" events occurred with different LMAs but they were not statistically significant (qui-square test,  $p > 0.05$ ).

At the end of the surgery, the LMA were removed in prone position in 37.9% of the patients; in the remaining patients the removal was performed in supine position.

## Discussion

The use of the LMA as airway device in surgeries performed in prone position has been increasing and the occurrence of complications, compared with the conventional technique, the use of an endotracheal tube, has been studied [1].

The second generation LMA are sophisticated supraglottic devices with gastric access that achieve a better effective ventilatory seal, protect the airway more reliably, and facilitate re- insertion in the event of accidental displacement [3]. The Supreme™ and Proseal™ have

been successfully used in several studies in the prone position, with limited evidence for iGel™ [1].

Comparing our results with the literature, we conclude that LMA repositioning observed in our study (14.9%) follows the published data [4]. Nevertheless, when the LMA replacement was needed, a second attempt was successful in all cases, as described above; there are studies in which more than two attempts were needed to correctly insert the LMA [5]. The number of complications and "minor" events incidence in our study also follow the published literature [4-7]. All complications were solved increasing of anesthetic depth, which demonstrate that an adequate anesthesia depth is essential to the success of this technique and to avoid most of the complications.

The most serious complication observed was laryngospasm in 2 patients. This incidence is within the range described in the literature, which varies between 0.5% and 5.8% [4-6]. The requirement to have the patient's bed available and immediately outside to the operating room door made possible to rapidly turn the patients to supine to solve the laryngospasm. However, in the reviewed literature, laryngospasm was treated without the need to turn the patient to supine [5,6].

Although the both cases of laryngospasm had occurred before the skin incision, all the anesthesia and surgical team should be alert to the possibility of its occurrence during the surgery and immediate treatment is promptly needed.

"Minor" events occurred in 7 patients and only required an expectant attitude. These included the presence of blood in the LMA, vestigial or moderate gum lesion with the rigid piece of the LMA supreme. Literature presents a similar incidence of blood in the LMA to that occurred in our study, although this occurrence was reported as absent in one series [5]. The gum lesion with the rigid piece of the Supreme™ LMA is not described in the literature reviewed. Other complications published like dysphonia, sore throat, regurgitation of gastric contents and bradycardia didn't occur in our study [3-7].

In fact, the complications and treatment occurred in our study are the same described in literature for the use of LMA in supine position and is directly related with the anesthetists experience in LMA management, no matter the insertion position (supine or prone position).

## Conclusion

The low incidence of complications found in our study follows the literature results, on the use of LMA in the prone position.

The safety and effectiveness observed with our results supports the continued application of anesthesia department protocol on LMA use in prone position, which is of major importance for the ambulatory surgery setting and fast-track anesthesia/surgery.

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