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Use of the laryngeal mask airway in the prone position

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Key points

1. Following its introduction into the practive of clinical anesthesia in the 1980s, the clinical use of the LMA has expanded both within the operating room and beyond, being used for both elective and emergent airway management.
2. Reports from the literature outline the use of the LMA for prone surgical procedures in more than 1000 patients with a limited adverse effect profile.
3. Although spontaneous ventilation is feasible and assisted ventilation possible, the prolonged need for positive pressure ventilation should be considered an indication for placement of an ETT.
4. There must be a plan to control the airway if problems are encountered including access to a bed should it be necessary to turn the patient supine.

Abstract

The laryngeal mask airway (LMA) is a supraglottic medical device used to maintain a patent airway during surgery or a medical emergency. Its initial use was as a means of providing general anesthesia without an endotracheal tube (ETT) while avoiding the need to hold an anesthesia mask in place. As clinical experience has developed with the device, the LMA has been used for a wider range of surgical procedures. Although endotracheal intubation is generally used for airway management during prone surgical procedures, there is accumulating clinical experience with the use of the LMA for prone surgical procedures. We present a 6-year-old child who presented for bilateral hamstring tendon releases and Achilles tendon lengthening. General anesthesia was provided using an LMA in the prone position. Previous reports of the use of the LMA for prone surgical procedures are reviewed and its applications in such situations are discussed.

Keywords: Laryngeal mask airway, prone position, supraglottic airway,

Introduction

The laryngeal mask airway (LMA) is a supraglottic medical device used to maintain a patent airway during surgery or a medical emergency that was developed by Dr. Archie Brain of England and first introduced into clinical use in the 1980s.[1-3] Its initial use was as a means of providing general anesthesia without an endotracheal tube (ETT) while avoiding the need to hold an anesthesia mask in place. When compared to an ETT, placement is easier, quicker, and does not require direct laryngoscopy which also results in fewer hemodynamic

changes. Following its introduction into the operating room, its use has expanded both within the operating room and beyond, being used for both elective and emergent airway management.[4-7] As clinical experience has developed with the device, the LMA has been used for a wider range of surgical procedures including airway procedures such as adenotonsillectomy.[8-11] Although endotracheal intubation is generally used for airway management during prone surgical procedures, there is accumulating clinical experience with the use of the LMA given its potential advantages over an ETT.[12-15] We present a 6-year-old child who required bilateral hamstring tendon releases and Achilles tendon lengthening during a surgical mission trip to San Miguel, Mexico. General anesthesia was provided using an LMA while the child was in the prone position. Previous reports of the use of the LMA for prone surgical procedures are reviewed and its applications in such situations are discussed.

Case report

Institutional Review Board approval is not required at Nationwide Children's Hospital (Columbus, Ohio) for the presentation of single case reports. This patient was cared for during a surgical mission trip to San Miguel, Mexico sponsored by Kids First Orthopedic Group (Nashville, Tennessee). The patient was a 6-year-old, 19 kilogram boy with a history of diplegic cerebral palsy presenting for bilateral hamstring and heel cord tendon lengthening. The patient was held *nil per os* (NPO) for 6 hours. A peripheral intravenous cannula was placed the morning of surgery. He was transported to the operating room where routine American Society of Anesthesiologists monitors were placed. Anesthesia was induced with propofol (4 mg/kg) and a #2 LMA was placed without difficulty and secured in place. Anesthesia was maintained with sevoflurane (expired concentration 2-4%) in oxygen. The patient was turned prone and positioned with chest rolls in place and pressure points padded (figure 1). Following positioning in the prone position, a caudal epidural block was placed with 20 mL of 0.25% bupivacaine with epinephrine 1:200,000 and 1 µg/kg of clonidine.

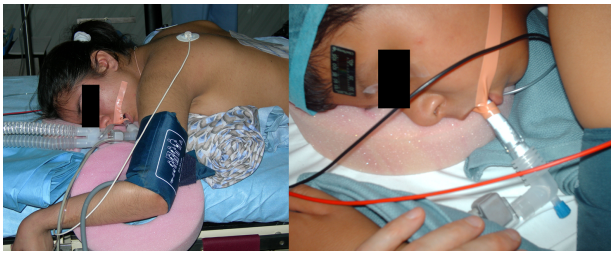

Figure 1. Patients positioned prone in the operating room with a laryngeal mask in place.

Spontaneous ventilation was maintained throughout the surgical procedure in the prone position. There was no response to surgical incision while breathing 2% sevoflurane in oxygen. The surgical procedure was completed without difficulty, lasting approximately 50 minutes. There was minimal blood loss. The patient was turned supine and the LMA was removed. The patient was transported to the post-anesthesia care unit. His postoperative course was unremarkable. This case is illustrative of the anesthetic care during 100 such procedures which have been performed in the prone position using an LMA during 20 orthopedic surgical trips by Kids First to various locations in South and Central America. We have provided care for more than 1000 orthopedic surgical procedures during this time. Our quality assurance records have revealed only 3 intraoperative problems during the use of the LMA in the prone position. One patient developed laryngospasm after positioning in the prone position which was treated with the administration of succinylcholine while prone. A second patient developed bronchospasm intraoperatively, which was treated with the administration of albuterol using a metered dose inhaler through the LMA. The third patient was positioned prone and had emesis which was later revealed to be related to an NPO violation. This patient was returned to the supine position, the LMA removed and an ETT placed. There was no evidence of aspiration and the patient had an uncomplicated intraoperative and postoperative course.

Discussion

Although used commonly for many different types of surgical procedures, there are a limited number of reports outlining the use of the LMA for prone surgical procedures (table 1). Reports from the literature outline the use of the LMA for prone surgical procedures in more than 1000 patients. Adverse effects have generally been mild, including the need to assist ventilation due to hypoxemia or hypoventilation, laryngospasm treated with propofol, regurgitation without aspiration, and the need to reposition the supraglottic device. None of the publications reported the need to turn the patient into the supine position.

Table 1. Reports of LMA use during prone surgery
LMA= laryngeal mask airway; ETT= endotracheal tube; ASA= American Society of Anesthesiologists; BP= blood pressure; HR= heart rate; pLMA= LMA ProSeal™; sLMA= LMA Supreme™

Author and reference	Study design and patient demographics	Outcome
Ng A et al.[12]	Prospective audit of 73 adult patients (ASA I-II status).	Patients positioned themselves prone followed by the induction of anesthesia and placement of an LMA. LMA successfully placed in all patients. LMA had to be held in place in one patient during the procedure. Manual ventilation required in 4 patients during to hypoxemia or hypoventilation.
Dingeman RS et al.[13]	5-year-old girl undergoing a decompressive craniectomy and cervical laminectomy.	Emergent ventilation and reintubation was performed using an LMA within 6 minutes following accidental tracheal extubation. The patient remained in the prone position.
Weksler N et al.[14]	Prospective audit of 50 ASA I-II patients.	In the first 25 patients, the LMA was placed in the supine position and turned prone. In the second 25 patients, the LMA was placed while the patient was prone. In the second group, there was a reduction in the time between induction to incision, the manpower required for positioning, the change in systolic BP, diastolic BP, HR at ten minutes after induction, and the incidence of sore throat.
Brimacombe JR et al.[15]	A retrospective audit of 245 adult patients.	Patients positioned themselves in the prone position with the head rotated to the side, the operating table was tilted 15° to further increase access to the face. The LMA ProSeal™ (pLMA) was successfully placed in 237 patients on the first attempt, with the remaining eight patients having the LMA placed on the second attempt. Ventilation was successful in all patients. There were no episodes of hypoxia or other complications.
López AM et al.[16]	A prospective audit of 40 adult patients.	Patients positioned themselves prone and rotated the head to the side followed by induction and placement of the LMA Supreme™ (sLMA). Insertion and ventilation were successful in all patients with no airway management-related complications.
Sharma V et al.[17]	Prospective audit of 205 adult patients (ASA I-III status) who were anesthetized using the sLMA.	Patients positioned themselves in the prone position before the induction of anesthesia and placement of the sLMA. The sLMA was repositioned in 13 patients. Regurgitation of gastric contents was noted in four patients without aspiration. Six patients required a different size sLMA. No patient required rotation back into the supine position.
Samantaray A[18]	Case report of 50-year-old male with knife wound in the back.	Due to the location of the injury, endotracheal intubation in the supine position was not feasible. The airway was established in the prone position initially with a LMA-Fastrach™. An ETT was passed through the LMA and secured.
López AM et al.[19]	A prospective study of 120 adult patients (ASA I-III status).	All patients were induced in the prone position followed by the placement of either the sLMA or pLMA. All patients were easily ventilated in the prone position. The pLMA was placed on the first attempt in all 60 patients, and the sLMA in 59 patients with reinsertion in one patient. In both groups, complications included laryngospasm, displacement, ventilation leak, and laryngospasm. No patient was turned supine.
Olsen KS et al.[20]	A prospective audit of 140 adult patients	Patients were either positioned in the prone position followed by the induction of anesthesia and

	in a randomized controlled trial of an LMA versus an ETT (ASA I-II status).	placement of the LMA or anesthetized in the supine position followed by intubation of an ETT. The LMA group was ready 5 minutes sooner than the ETT group.
Sharma B et al.[21]	A prospective randomized study of 70 adult patients (ASA I-II status).	Patients were either positioned in the prone position (group P) followed by the induction of anesthesia and placement of the pLMA with the head lifted midline or turned to the side, or anesthetized in the supine position (group S) followed by intubation of a pLMA. Results showed that Group P required fewer personnel for position and shorter surgical readiness time than Group S.
Whitacre W et al.[22]	Review of 6 publications (a randomized controlled study, 2 descriptive studies, a case series, and 2 case reports) involving 526 patients.	None of the authors described having to turn a patient supine to manage the airway. The authors cautioned that the risk of publication bias was possibly high and that the evidence, mostly from lower level sources, supported the use of the LMA in this setting. They cautioned that experienced providers should carefully select patients and procedures, there must be a plan to control the airway if problems are encountered, and that additional rigorous studies are needed before widely adopting the technique.

Our report is the first outlining the use of the prone LMA in a large cohort of pediatric patients undergoing lower extremity orthopedic procedures. Our experience is similar to what has been reported in the adult literature with rare adverse effects including laryngospasm treated with succinylcholine, the need to assist ventilation to maintain adequate oxygenation and ventilation, the need to reposition the LMA, and regurgitation. In the latter instance, it was necessary to turn the patient supine, suction the airway, and proceed with endotracheal intubation. In three patients, intraoperative bronchospasm was treated by the delivery of albuterol through the LMA while still in the prone position. In the majority of patients, spontaneous ventilation was adequate to provide effective oxygenation and ventilation during general anesthesia with sevoflurane. Reports from the adult literature outline placement of the LMA while the patient is supine or placement of the LMA after the patient has positioned themselves in the prone position. The latter technique may limit the potential for positioning injuries and also decreases the manpower needed for turning adult patients prone. The advantages of the technique are those that have been previously reported when compared general anesthesia with an LMA versus an ETT. Additionally, the time from anesthetic induction to surgery start has been uniformly shorter when using an LMA versus an ETT. Most importantly, the use of an LMA should be considered the primary technique applied should inadvertent tracheal extubation occur when a patient is positioned prone. Despite the uniform success that has been reported in the adult population in the literature, we believe that certain caveats must be maintained when using an LMA for prone surgical procedures:

1. To date, there is still limited data from prospective and randomized trials regarding the technique. Additional rigorous studies are needed before widely adopting the technique.
2. Patients and procedures should be carefully selected. The majority of experience in the literature has been limited to ASA I and II patients.
3. Although spontaneous ventilation is feasible and assisted ventilation possible, the prolonged need for positive pressure ventilation should be considered an indication for placement of an ETT.
4. There must be a plan to control the airway if problems are encountered including access to a bed or stretcher should it be necessary to turn the patient supine. Turning supine may be significantly easier in the pediatric sized patient.
5. There are anecdotal reports of regurgitation with no reports of aspiration as there may be protection added by prone positioning.

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