The Use of Laryngeal Mask Airway during Anaesthesia for Surgery in the Prone Position in Spontaneously Breathing Patients

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ABSTRACT

Background: The prone position is required for many surgical procedures and maintaining and securing the airway in that position is a major concern for the anesthesiologists. The present study was conducted to evaluate the use of the Laryngeal mask airway (LMA) during anaesthesia in prone position in spontaneously breathing patients.

Methods: We describe a prospective study of 40 patients, who ranked in ASA physical status class one and two and required general anaesthesia for surgery in prone position and LMA was used to maintain the airway. Different induction techniques were used and different methods of LMA insertion was used.

Results: In 37 patients the LMA was inserted successfully from the first attempt, while in the other three patients there were malpositioned and reposition done successfully. Additional propofol was given to two patients who required deepening of anaesthesia after the LMA could be inserted. No laryngospasm or bleeding from the mouth was recorded. Only one patient vomited once 5 minutes after Extubation, after the protective reflexes had returned well.

Conclusions: With experience, appropriate patient selection and good preparations, it is possible to induce and maintain anaesthesia using LMA in spontaneously breathing patients in the prone position.

Key words: Anaesthetic techniques, Airway management, Laryngeal mask airway, Spontaneous breathing anaesthesia, prone position.

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INTRODUCTION

Airway management is the stoke in trade of anesthetists i.e. it is one of the most essential skills in the practice of anesthesiology and inability to secure the airway is one of the most common reasons for major anesthesia – related complications. The prone position is required for many surgical procedures and maintaining and securing the airway in that position is a major concern for the anesthesiologists.

The conventional approach for anesthetic management of patients for surgery in prone position is initially to induce anesthesia in supine position.

After tracheal intubation, the patient is turned onto the prone position and positioned carefully so that ventilation is not impeded, venous return is not compromised and all pressure points are protected. Although this method is familial to anesthesiologists and is used for major procedures when muscle relaxation is required, it is time consuming.[1] The alternation to this technique is to ask the patient to position him / her-self in the prone position on the operation table before the induction of anesthesia, then anesthesia is induced and maintained at that position while the patient kept breathe spontaneously on mask ventilation.

This technique has been developed and used successfully for hundreds of patients by one of the authors (W.H.) for nearly twenty years (1978 – 1998) before the introduction of the Laryngeal mask airway (LMA) in Iraq (but unfortunately that work was unrecorded and unpublished).

The idea at that time (1978) came to the author from that many people sleeps with prone or semi prone position and it is one of the position in resuscitation of unconscious or semi conscious patients to take the tongue away from obstructing the airway. He used this technique for any surgery in prone position with spontaneously breathing and he find it very useful and easy to manage so he avoided the use of drugs for intubation and their side effects and all possible complications of endotrachial intubation.

The LMA was first introduced into clinical anaesthetic practice in 1988 as a general purpose airway which was not as invasive

as the endotrachial tube (ETT). The main advantages of using the LMA are the ease of and a decrease in the morbidity associated with intubation such as failed intubation, sore throat and local tissue trauma, as well as improved haemodynamics at induction and increased oxygenation at emergence.

However, the LMA does not secure the airway as effectively as the ETT, giving an increased risk of aspiration if the patient regurgitates. The LMA has gained widespread acceptance for routine surgery and as anaesthetists become more experienced has become increasingly used for cases for which it was not originally intended. [2]

The present study was conducted to evaluate the use of LMA during anaesthesia in prone position in spontaneously breathing patients.

METHODS

The study was carried out in four hospitals (one teaching and three private hospitals). We prospectively studied forty patients, who ranked in ASA physical status class one and two and required general anesthesia in the prone position.

After cannulation of an appropriate vein, most of the patients adopted the prone position on the operation table. This position consists of one pillow under the chest and one pillow under the pelvis, allowing free anterior abdominal wall movement (Figure 1). The hands were placed above the patient's head, which was inclined to the left or right on a soft head ring. For patients with short neck, the head ring was elevated with a pillow to avoid undue neck flexion.

When the patient was comfortable, standard monitors were applied (ECG, Pulse Oximeter and NIBP), with the patient breathing oxygen 100% delivered via a loosely applied face mask, anaesthesia was induced.

Different induction techniques were used:

1. Halothane alone.
2. Halothane with nitrous oxide.
3. Ketamine with halothane.
4. Ketamine with halothane and sodium thiopentone.
5. Halothane with propofol.
6. Fentanyl with propofol.

No neuromuscular blocking agent was required for induction and maintenance

of anaesthesia. After loss of consciousness, the face mask was applied firmly, allowing manual ventilation of the lungs if needed (Figure 2).

When sufficient depth of anesthesia had been achieved, then different methods of LMA insertion was applied:

1. With the anaesthesiologist's non-dominant hand placed on the patient's forehead extend slightly the neck and the anaesthesia assistant opening the mouth by holding the tip of the patient's chin, the LMA was inserted (Figure 3), as the LMA pass the incisors, the patient's chin was released, allowing the tongue to fall forwards thereby opening up the posterior oropharyngeal space for LMA.
2. The same as above but draw the tongue gently with Magill's forceps, which will open the posterior oropharyngeal space (Figure 4), then insert the LMA to proper position then release the tongue.
3. The same as method one above, but the LMA was inserted like Guedle airway insertion i.e. introduce the LMA facing the palate then turn it 180^0 when fully inserted to proper position.
4. The same as method one above, but insert the LMA guided by the index finger as in the classical way of insertion the LMA in supine position, we use this technique especially when using the reinforced LMA (Figure 5).

Then after inflation of the cuff of the LMA with proper volume of air the LMA connected to the breathing circuit (Magill, Bain or Jackson-Rees) and observe the movement of the bag, assist the ventilation manually if needed, until spontaneous breathing was regained. Then patients were allowed to breathe spontaneously with halothane (with or without Nitrous oxide) in oxygen. Extubation was done after the end of surgery after the patient turned to supine position, after the returning of the protective reflexes or during deep anaesthesia in supine or prone positions.

As a safety measure, a spare trolley was immediately available in the event of a significant complication requiring management in supine position. Observation was made for any

problem occurring before induction, at induction, during the maintenance period, on awakening and at 30 minute postoperatively for any difficulty in insertion, traumatic insertion, pattern of breathing and recovery time. This technique was not applied for four patients in this study; two of them were pediatrics. The first one is a 4 years old boy with fracture of upper left radius, for which inhalation induction was given with halothane. When he asleep turned gently to prone position and when he was deep enough LMA#2 was inserted.

The second one was a 6 years old boy for whom induction of anesthesia and insertion of LMA was done in supine then he was turned carefully to prone position. While the other two are adult patients with operation on the back (one for lipoma and the other for foreign body), the operation started while the patients was kept on spontaneously mask ventilation in lateral position, during the operations the surgeons could not localized the lipoma or the foreign body respectively in that position, then decisions were made to put the patients in prone position, so LMA was inserted and the patients turned carefully to prone position.

RESULTS

In this study of 40 patients, there were no exclusions. Patient's characteristics are noted in Table 1. The surgical procedures are shown in Table 2; the duration of surgery was generally less than 60 minutes. Table 3 shows the different induction methods of anaesthesia used in the study, while the methods of LMA insertion and position of the patients during insertion are shown in Table 4. The different types and sizes of LMA used in the study appear in Figure 6, while their uses in different insertion techniques are shown in Table 5. Cardiovascular and respiratory variables were stable throughout the procedure no arterial desaturation, bradycardia or arrhythmia were recorded.

Whenever there is apnoea or breath-holding, manual ventilation through the LMA was successful. All problems were encountered in this study were minor. In 37 patients the LMA was inserted successfully from the first attempt,

while in the other three patients there were malpositioned and reposition done successfully.

No laryngospasm or bleeding from the mouth was recorded. Only one patient vomited once 5 minutes after extubation, after the protective reflexes had returned well. Insufficient depth of anaesthesia was encountered in two patients after LMA insertion; additional propofol was given and no further problem.

Table (1): Patient Characteristics

	Female	**Male**
ASA class I / II	6 / 1	31 / 2
Weight (kg)	53.1	79.3
	(28 - 65)	(20 - 110)
Age (years)	21.6	24.0
	(8 – 47)	(4 – 45)

- **Data expressed as mean and (range)**

Table (2): Operative Details

Surgical specialty	**Operation**	**No.**
General	• Excision of pilonidal sinus • Excision of lipoma in the back • Excision of lipoma in the back of the neck • Removal of foreign body from the back	26 3 1 1
Orthopedics	• Operation in the popletial region (bursa, cyst) • Fixation of fracture radius • Infected diabetic foot • Sacral bone biopsy	4 1 1 1
Plastic surgery	• Release of skin contracture posterior to the anus + skin graft • Bed sore in the buttock	1 1

Table (3): Methods of Induction of Anaesthesia

Induction technique	**No. of patients**
1. Inhalation (Halothane +/- N_2O)	6
2. Inhalation + intravenous:	
i. Ketamine + Halothane	3
ii. Ketamine + Halothane + Thiopentone	11
iii. Ketamine + Halothane + Thiopentone + N_2O	9
iv. Ketamine + Halothane + Propofol	3
v. Halothane + Propofol + Fentanyl	4
3. Intravenous induction (Ketamine + Propofol)	4

Table (4): Methods of insertion of LMA and position of patient during insertion

Patient's position	Methods of LMA insertion				
	Total ETT insertion	Guided by index finger (classical)	Like Guedle airway	Draw the tongue	Straight like insertion
Prone	10	2	13	10	35
Supine	2	2	-	-	4
Lateral	1	-	-	-	1
Total	13	4	13	10	40

Table (5): Types and sizes of LMA used in the study and methods of insertion

Methods of Insertion	Standard LMA			Flexible LMA	
	# 2	# 2.5	# 3	# 4	#4R
Guided by index finger (classical)	-	1	-	6	6
Guedle airway like insertion	2	-	1	1	-
Drawing the tongue with Magill's forceps	-	1	5	3	1
Straight like ETT insertion	-	1	10	-	2

Figure (1): Before induction, the patient lies comfortable with his chest on one pillow and his pelvis on another one.

Figure (2): Face mask applied to the patient's face.

Figure (3): Patient's mandible pulled forward to allow insertion of LMA

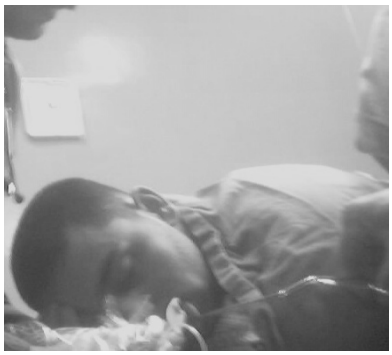

Figure (4): Drawing the tongue with Magell's forceps before the insertion of LMA.

Figure (5): Insertion of the reinforce LMA guided by the index finger.

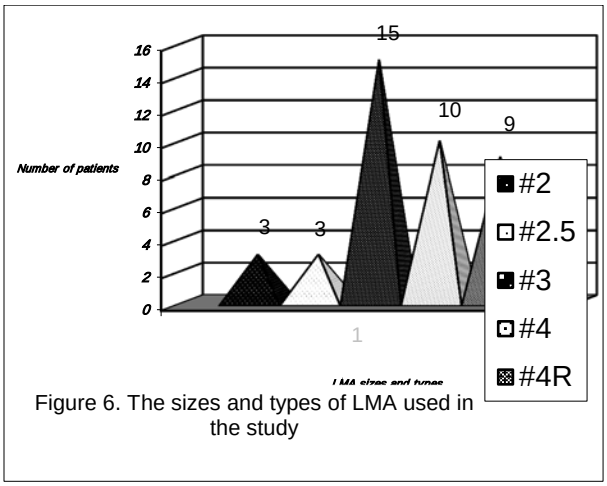

Figure 6. The sizes and types of LMA used in the study

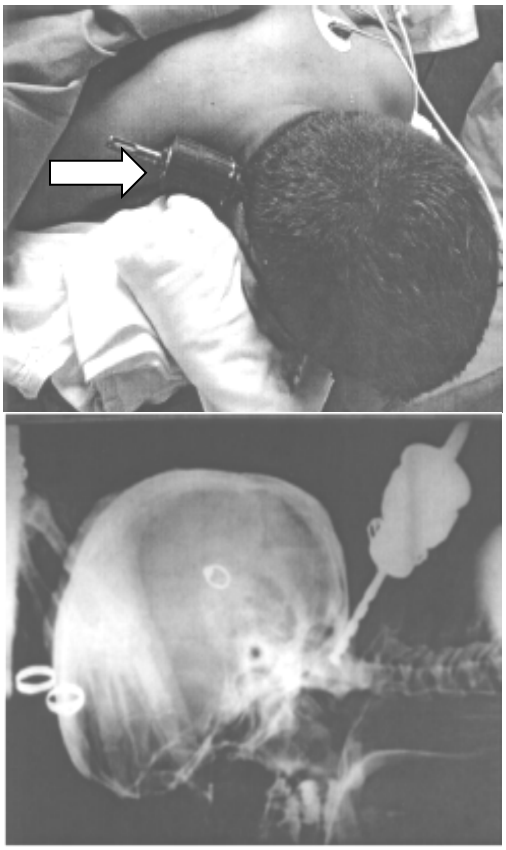

Figure (7): The neck-injured patient in prone position with a 6mm diameter drill bit (arrow) protruding from the right side of the neck (a) and the lateral cervical radiography showed that the drill bit's distal extremity(arrow) had entered the spinal canal(b).(Reproduced from Valero R et al [7],with permission).

DISCUSSION

It has been said that anaesthesia carried out in the prone position should always be administered with the patients being paralyzed, intubated and ventilated. However, this may sometimes be unnecessary for short surgical procedures and this method is not without its own inherent risks. (3)

We describe an alternative method for providing anaesthesia in the prone position for ambulatory surgery in a prospective study of 40 consecutive patients. The essential difference between this method and other techniques is that with the LMA it is possible to induce anaesthesia in the prone position and maintain an unimpeded airway. All complications encountered were minor and were amenable to routine management.

It is clear from respiratory physiology that the functional residual capacity (FRC) in prone position is larger than that in supine position.(4) The reduction in (FRC) with anesthesia in prone position is similar to that seen when the patient in supine position, and the closing capacity also may be reduced. Thus less disturbance of gas exchange may occur during anesthesia in the prone compared with the supine position.(5)

One case in this study (a 47 years old female with history of lung fibrosis {restrictive lung disease} presented for sacral bone biopsy) had difficulty in breathing in supine position while she felt comfortable in prone position, which was a good practical example on the above idea. More over; the prone position generates a transpulmonary pressure sufficient to exceed airway opening pressure in dorsal lung regions, i.e., in region where atelectasis ,shunt and ventilation/perfusion are most severe , without adversely affecting

ventral lung regions thus, improves oxygenation in acute lung injury.[6]

Other point is that after induction of anesthesia, the jaw and tongue fall anteriorly by the effect of gravity away from the posterior pharyngeal wall, making manual ventilation and LMA insertion easier [1, 7].

No problem was encountered with transient apnoea, while in supine position after induction of anesthesia the tongue fall backward by the effect of gravity and obstructs the airway. The technique of spontaneously mask ventilation for surgery in prone position was used by one of the authors (see above) for more than 20 years on the above mentioned principles. This study is complementary to that work, in fact, if the anesthesia was inadequate or the LMA was malpositioned, the LMA could be drawn out and the patient kept on mask ventilation.

The alternative method to the LMA for airway management is the nasopharyngeal airway. This device was evaluated in a study in which anesthesia was induced in prone position for short surgical procedures.

In similar design to that of our study, the nasopharyngeal airway was inserted after induction and patients were allowed to breathe spontaneously.[3]

In comparison with the LMA, the nasopharyngeal airway is tolerated better at lighter levels of anesthesia, without gagging on awakening. However, there is dilution of inhaled anesthesia via oral entrainment and potential for nasal trauma.

In another study, the LMA was used in prone for spontaneously ventilated patient there were two cases (out of 73) of bleeding related to soft tissue trauma to the airway by LMA [1]. With our method, there was no case of bleeding had reported.

In this study great concern had been paid to provide adequate depth of anaesthesia prior to the insertion of LMA to avoid as much as of the possible problems e.g. coughing, breath holding, laryngospasm, difficult insertion …etc.

Some time we insert Guedle airway first, when the patient can tolerate it and breathe well the LMA was inserted. Sometime the surgeon was

permitted to start surgery while the patient on mask ventilation, then when it was clear that the patient was deep enough the LMA was inserted.

Despite allowing patients to breathe spontaneously, oxygenation and ventilation were not adversely affected as would be expected. In the prone position there is potential for a reduction of pulmonary compliance that can affect oxygenation and ventilation, if there is restriction to movement of the abdomen. This effect did not occur with the Jackson table and was attributable to the relatively free abdominal movement provided by its chest and pelvis support.[8] In a similar way, in this study patients were supported with pillows one under the chest and the other under the pelvis, thereby minimizing restrictions in abdominal movement. In another study there was no significant decrease in cardiac index in prone position i.e. cardiovascular stability was maintained.[9] In this study there was no incidence of hypotension or bradycardia. Although the prone position is not the standard position for inducing anesthesia, it is the position in which central venous cannulation,[10] cardiopulmonary resuscitation [11] and awake fibreoptic intubation [12] have taken place. The success of the technique described in this study requires not only skill that comes from practice but also confidence and knowledge that at any time it may be necessary to turn the patient supine for emergency management of any problems.[1] On the basis of our experience in this series and other studies,[1, 3, 7, 13, and 14] we can recommend the technique as an alternative method for anesthesiologists who will practice it on a regular basis.

In fact we think that the anesthesiologists must learn how to insert the LMA in different positions including prone position, so that when they face such a problematic case like that with a drill bit penetrating the spinal canal at C1-C2 (Figure 7. a &b) who present in prone position,[7] so they can be managed successfully as the technique will become familial to

them, or like another case reported when the ETT went out while the patient was in prone position during operation and the anesthetist failed to reintubate the patient,[15] then LMA was inserted and solve the problem and patient's life.

Also, the technique we use offer the advantage of permitting the patients to take the proper comfortable position themselves prior to going off to sleep, so to minimize the risk of any nerve injury and the possibility that the peripheral line going out, that may occur when turning the patient from supine(after induction of anesthesia) to prone position.[15]

With experience, appropriate patient selection and good preparation, it is possible to induce and maintain anaesthesia using LMA in patients in prone position.

REFERENCES

1. Ng A, Raitt DG, Smith G. Induction of anesthesia and insertion of a laryngeal mask airway in the prone position for mino. surgery. Anesth Analg 2002; 94:1194-8.
2. Usher S. Use of the laryngeal mask airway in the prone position. Hospital Medicine 2004; 65, 4:252.
3. Schebesta AGN, Wong TAW. A method of spontaneously breathing anaesthesia in the prone position without endotrachial intubation. Anaesth Intensive Care 1991; 19:88-91.
4. Pelosi P,Croci M, Calappi E, *et al*. The prone positioning during general anesthesia minimally affects respiratory mechanics while improving functional residual capacity and increasing oxygen tension. Anesth Analg 1995; 80:955-60.
5. Dalens BJ, Khandwala RS, Tanguy A. Staged segmental scoliosis surgery during regional anesthesia in high risk patients: a report of six cases. Anesth Analg 1993; 76:434-9.
6. Lamm WJ, Graham MM, Albert RK. Mechanism by which the prone position improves oxygenation in acute lung injury. Am J Respir Crit Car Med 1994; 150:184-93.
7. Valero R, Serrano S, Adalia R, et al. Anesthetic management of a patient in prone position with a drill bit penetrating the spinal canal at C1-C2,

using a laryngeal mask. Anesth Analg 2004; 98:1447-50.

8. Palmon SC, Kirsch Jr, Depper JA, Toung TJK. The effect of the prone position on pulmonary mechanics is frame-dependent. Anesth Analg 1998; 87:1175-80.
9. Wadsworth R, Anderton JM, Vohra A. The effect of four different surgical prone positions on cardiovascular parameters in healthy volunteers. Anaesthesia 1996; 51:819-22.
10. Sunder-Plassmann G, Locker GJ, Muhm M, et al. Central venous catheterization in a patient in the prone position. Crit Care Med 1997; 25:1439-40.
11. Sun WZ, Huang FH, Kung KL, Fan SZ, Chen TL. Successful cardiopulmonary resuscitation of two patients in the prone position using reversed precordial compression. Anesthesiology 1992; 77:202-204.
12. Neal MR, Groves J, Gell IR. A wake fibreoptic intubation in the semi-prone position following facial trauma. Anaesthesia 1996; 51:1053-4.
13. Ngan Kee WD. Laryngeal mask airway for radiotherapy in the prone position. Anaesthesia 1992; 47:446-7.
14. McCaughey W, Bhanumurthy S. Laryngeal mask placement in prone position. Anaesthesia 1993; 48:1104-5.
15. Mirkow M: Letter to the editor: LMA as a life saving device. The internet journal of anesthesiology 1998; 2(4).