Original Research Article

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Comparison of Laryngeal Mask Airway Inserted in Prone Position versus Routine Endotracheal Intubation for Prone Surgeries

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Abstract

Background: Providing anaesthesia in prone position is a challenging task for an anaesthesiologist. Although the favourable technique of airway management has been endotracheal tube (ETT), alternative airway management with Laryngeal Mask Airway (LMA) has also been described. In the present study we compared use of LMA and ETT for surgeries in prone position. *Material and Method:* Study includes prospective analysis of 60 patients who underwent prone surgeries and were randomly divided into two groups of 30 each. Group I (LMA) - Patients underwent prone surgeries with classic LMA on spontaneous ventilation Group II (ETT) -Patients underwent prone surgeries with ETT under controlled ventilation. Time from induction of anaesthesia to start of surgery, time of recovery from anaesthesia after completion of surgery, number of complications and the haemodynamic parameters were recorded. *Results:* We observed significant reduction in induction to start of surgery time as well as recovery time in Group I (LMA) as compared to Group II (ETT) which results in decreased anaesthetic exposure duration in group I. There was better haemodynamic stability in Group I (LMA) as compared to Group II (ETT) along with marginal reduction (statistically non significant) in frequency of complications *Conclusion:* LMA minimizes the total time duration of anaesthesia during prone surgeries with better haemodynamic stability.

Keywords: Prone Position; LMA; ETT; Anaesthesia Duration; Recovery Time.

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Introduction

Prone positioning of patients during anaesthesia is required for various types of surgeries such as excision of pilonidal sinus, haemorrhidectomy, varicose veins avulsion, spine surgeries and tumors of the back. It is associated with various physiological changes such as decrease in stroke volume and relative increase in functional residual capacity [1,2]. It is also associated with a myriad of complications related to pressure injuries either by direct pressure on the affected organ or indirectly by impeding vascular supply to the organs [1]. Providing anaesthesia in prone position is a challenging task for an anaesthesiologist. Although the favorable technique of management of airway has been endotracheal tube (ETT), but a variety of problems may occur with the tracheal tube such as bloody secretions, inspissated sputum, kinking of the tube and accidental extubation [3]. Alternative airway management with the use of Laryngeal Mask Airway (LMA) has also been demonstrated successfully [4-9]. LMA can be inserted in the prone

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position also [5]. Patient himself/herself takes prone position when awake. This may decrease the incidence of adverse events such as soft tissue and nerve injury as well as reduce cardiovascular instability [5,10]. This also decreases the time between induction and commencement of surgery and also avoid the necessity of manpower to make the appropriate prone position. The airway can be more easily secured with LMA in prone position along with reduced risk of regurgitation [11].

The technique of surgery in prone position with spontaneously breathing has been done in the past. But there is paucity of studies demonstrating safety and efficacy of LMA with spontaneous ventilation in prone position. LMA on spontaneous ventilation is found to be very useful and it is an easy technique for managing the airway and also eliminates the need of drugs for intubation and their potential side effects and possible complications [12]. Keeping this in mind, in the present study we aim to compare use of LMA with spontaneous ventilation and endotracheal intubation with controlled ventilation for surgeries in prone position in terms of total time duration of anaesthesia, haemodynamic parameters, and number of complications.

Material and Method

The present prospective randomized controlled study was carried on 60 patients belonging to ASA Grade I and II, aged between 15-65 years, including either gender, scheduled for elective surgical and orthopedic procedures less than 120 min duration requiring prone position after approval from the institutional ethical committee and obtaining informed written consent from the patients. Our study is registered with clinical trials registry-India (CTRI/2018/04/013242). Patients were randomly divided into two groups of 30 each using computer generated random numbers.

Group I: Patients underwent prone surgeries with classic LMA on spontaneous ventilation

Group II: Patients underwent prone surgeries with endotracheal intubation under controlled ventilation.

Patients with ASA grade III and IV, predicted difficult airway, morbid obese, requiring surgeries in supine position, undergoing oral or nasal surgery and patients having history of preoperative sore throat were excluded from the study.

In group I, after cannulation of an appropriate vein, patients were asked to adopt the prone position on operation theatre (OT) table. The position consisted of one pillow under the chest and one pillow under the pelvis, allowing free anterior abdominal wall movement and the hands were placed above the patients' s head , which was rotated to the left or right on a soft head ring. When the patient was comfortable, standard monitors (ECG, Pulse oximeter and NIBP) were applied. Patients were given 100% oxygen for 3 minutes via a loosely applied face mask. One stretcher was kept inside O.T to be used for turning the patient in supine position in case of difficulty in securing the airway using LMA. Inj. Glycopyrrolate 0.004 mg/kg, inj ondansetron 0.08 mg/kg and inj butorphanol 2 mg I/V were given as premedication. Induction was done by using a mixture of 66% N_2O with 33% O_2 supplemented with inj. Propofol (1%) 2mg/ kg I/V. After loss of consciousness, the facemask was applied firmly, allowing manual ventilation, if needed. When sufficient depth of anaesthesia was achieved, LMA was inserted with the help of an assistant. The assistant lifted the head slightly above the ring and opened the mouth by holding the tip of the patients chin and the anaesthesiologist inserted the partially inflated LMA. As the LMA crossed the incisors, the patients chin was released.

Photograph 1: Showing LMA Insertion Technique in prone position

After confirming the correct placement, LMA fixed and connected to the circuit.

In group II, all patients were premedicated with injection glycopyrolate 0.004 mg/kg, ondansetron 0.08 mg/kg I/V and Inj. Butorphanol 2 mg I/V before preoxygeneration. All patients were induced with inj. Propofol 1% 2 mg/kg I/V. Endotracheal intubation was facilitated with 0.1mg/kg of vecuronium given 3 min. prior to laryngoscopy.

Laryngoscopy was performed using macintosh laryngoscope, intubation done with appropriate size endotracheal tube and connected to closed circuit. Inj. Vecuronium in maintenance dose of 0.015mg/kg was used as muscle relaxant during surgery.

Maintenance of anaesthesia was by O_2:N_2O: isoflurane. Haemodynamic parameters were recorded during basal period, preinduction, after induction, during intubation and throughout surgery.

At the end of surgery, in group I LMA was taken out in prone position and in group II, routine extubation was carried out after turning the patient to supine position using inj. neostigmine and inj glycopyrrolate I/V. Parameters recorded were time from induction of anaesthesia to start of surgery, time of recovery from anaesthesia after completion of surgery, success rate of each technique, number of complications and haemodynamic parameters.

All data was collected, sampled and analyzed using Chi Square and independent t test.

Result

Sixty patients were included in the study depending upon the inclusion and exclusion criterion. There was no significant difference observed in demographic parameters and the duration of surgeries was comparable in the study groups as shown in Table 1

In group I, prone surgeries were done with LMA inserted in prone position whereas in Group II, prone surgeries were done under endotracheal intubation. The technique success in both the groups was comparable although first attempt success rate was higher in LMA group as compared to ETT group as shown in Table 2.

In Group I, anaesthesia induction to start of surgery time was remarkably less as compared to Group II. In group I this time was 5.97±1.49 as compared to Group II where it was 16.35±2.94. Similarly recovery time after completion of surgery was significantly lesser in group I as compared to Group II. The mean recovery time in Group I was 4.97±1.20 as compared to 10.53±2.84 in Group II. P value for induction to start of surgery time as well as recovery time was statistically significant (p value (<0.05) as shown in Table 3

In terms of haemodynamic variables, in Group II (ET) there was significant rise in BP during induction as compared to Group I (LMA). During intraoperative period and emergence from

Table 1: Demograpic Variables

	Methods used		P-Value
	LMA(Group I)	ETT (Group II)	
Age in years (Mean ± SD)	42.24 ± 2.56	44.56 ± 3.42	0.440
Male (%)	43.3	50	
Female (%)	56.7	50	
Mean duration of surgeries (min)	75.17 ± 3.29	75.6 ± 4.47	0.811

p-value > 0.05 Not Significant

Table 2: Technique Success

	Methods used	
	LMA(Group I)	ETT(Group II)
1st attempt	25	22
2nd attempt	5	8
Failure of technique	Nil	Nil

P-value>.0 05, Not Significant

Table 3: Comparison of induction to surgery start time and recovery time

	LMA (Group I)	ETT (Group II)	P-Value
Induction to start of Surgery time	5.97 ± 1.49	16.35 ± 2.94	0.001
Completion of Surgery to recovery time	4.97 ± 1.24	10.54 ± 2.84	0.001

p-value < 0.05 Significant

anaesthesia, MBP remained on lower side in Group I (LMA) as compared to Group II (ET). p value < 0.05 statistically significant as shown in Table 4

There was no statistically significant difference observed between the heart rate, oxygen saturation and end tidal carbon dioxide in the two groups. p value>0.05 non significant as shown in Table 4.

In terms of complications, there was no statistically significant difference observed between the two groups. Blood on the device observed in three cases in Group I whereas in Group II, there were four cases observed where blood on device was present. Among other complications, in group II there occurred single episode each of hypercarbia, airway obstruction and sore throat whereas none of these complications were observed in group I. Laryngospasm and arterial desaturation was not observed in any of the patient in either group. Results of complications are illustrated in Table 5.

Discussion

Prone position is required for various surgeries like excision of pilonidal sinus, lipomas of the back, varicose vein avulsions and spine surgeries. Providing safe anaesthesia for surgeries in prone position is a challenging task. Conventional method of airway control is endotracheal intubation and then turning the patient to suitable prone position. But this requires a lot of manpower and unnecessary delay in surgeries and also unnecessary exposure of anesthetic agents. This technique has various other disadvantages like risk

Table 4: Haemodynamic Variables

	Basal	Induction	Intra-op				Emergence
Mean Blood Pressure (MBP)							
LMA	90.67 ± 8.74	83.08 ± 9.39	73.67 ± 4.82	76.00 ± 8.34	73.16 ± 6.44	74.36 ± 4.56	87.27 ± 5.66
ETT	92.64 ± 8.05	103.71 ± 10.33	99.91 ± 10.66	97.00 ± 7.96	93.87 ± 6.24	93.68 ± 5.41	103.20 ± 7.64
p- value <0.05 statistically significant							
Heart Rate (HR)							
LMA	90.4 ± 6.34	93.56 ± 8.2	94.7 ± 7.74	90.96 ± 4.76	87.10 ± 2.85	87.93 ± 2.74	93.33 ± 2.44
ETT	90.73 ± 7.09	93.96 ± 8.75	95.73 ± 8.28	96.96 ± 4.80	90.84 ± 5.60	90.93 ± 2.76	93.56 ± 2.35
p- value >0.05 statistically non-significant							
Oxygen saturation (SPO_2)							
LMA	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13
ETT	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13	99.56 ± .13
p- value >0.05 statistically non-significant							
End tidal carbon dioxide ($ETCO_2$)							
LMA	35.63 ± 1.97	35.56 ±1.38	35.83 ± 2.03	36.83 ± 2.57	37.06 ± 3.54	37.53 ± 3.88	38.90 ± 3.43
ETT	35.4 ± 1.8	35.56 ±1.38	35.96 ± 1.90	36.96 ± 2.73	37.13 ± 3.4	37.53 ± 3.89	39.4 ± 3.14
p- value >0.05 statistically non-significant							

Table 5: Complications

	LMA (GroupI)	ETT (GroupII)
Blood on Device at removal	3 (10%)	4 (13.33%)
Displacement of device	Nil	Nil
Laryngospsm	Nil	Nil
Arterial desaturation	Nil	Nil
Hypercarbia	Nil	1 (3.33%)
Airway Obstruction	Nil	1(3.33%)
Regurgitation	Nil	Nil
Gastric insufflation	Nil	Nil
Sore throat	Nil	1(3.33%)

of neurological trauma to patient's neck and peripheral nerves and also various pressure related complications [13]. Alternative method of airway control is Laryngeal Mask Airway (LMA). LMA is less invasive procedure as compared to endotracheal intubation. In the supine position, use of LMA for airway management in adults as well as children is well documented and practiced [14,15]. But there is paucity of literature regarding the safety and use of LMA with spontaneous ventilation in prone position. Some just deny the use of LMA in prone position [16]. There have been reports where LMA has been used as a rescue device for airway control following accidental extubation during prone position[4,17,18,19]

In our study we compared use of LMA with spontaneous ventilation and routine endotracheal intubation with controlled ventilation during prone surgeries in the terms of induction to commencement of surgery, cost effectiveness, feasibility, complications and haemodynamic characteristics. Demographic profile and mean duration of surgery was comparable in both the groups. Duration of surgeries was limited to 120 minutes.

Insertion success rate was higher in LMA group. Though there was no failure of technique in any group but first time success rate was 83.3% in LMA group as compared to 73.3% in ET group. Gravity pulls the tongue forward and creates larger pharyngeal space making LMA insertion and ventilation easy in prone position. There are also less chances of aspiration in prone position because gravity draws any regurgitated fluid away from the airway [20]. Our results were comparable to the study done by Ng et al, Weksler N et al, Lopez et al and Brimacombe J et al where LMA had been successfully placed in all the patients [4,5,16,21].

In our study we found that there was significant reduction between the times required from induction to start of surgery in the LMA group as the mean time required was 5.96 min in LMA group as compared to 16.33 min in ET group. These results were comparable to the study done by Weksler N et al where they found reduction in time from induction to incision in the group in which LMA was placed in prone position [5].

The time required for recovery after completion of surgery was less in the LMA group as we removed the LMA in prone position. In order to reduce the risk of laryngospasm during emergence from anaesthesia, we suggest that LMA should be deflated at the conclusion of surgery and should be slightly dragged away from the glottis opening, now it serves as an oral airway providing conduit for breathing and also reduces the risk of laryngospasm. This may be the reason that laryngospasm is not encountered in our study. Complications rate though comparable but were less in LMA group. There occurred no episode of hypercapnia and hypoxia in LMA group but there occurred one episode of hypercapnia in ET group as the ET got kinked. The incidence of complication reported was similar as compared to the study conducted by Mukul Jain et al. [20].

In terms of haemodynamic parameters there occurred less increase in blood pressure (BP) during induction in LMA group, it might be due to lack of pressor response during LMA insertion as compared to endotracheal intubation. During surgeries, BP remained on the lower side in the LMA group. It might be due to lack of tracheal stimulation and this helped in providing suitable operating conditions.

In our study group we found that LMA with spontaneous ventilation reduces total anesthesia time duration with better haemodynamic stability and marginally reduced complication rate as compared to endotracheal tube during prone surgeries.

Conclusion

LMA can be safely placed in prone position. It minimizes the time required from the induction to start of surgery and also the time of recovery following completion of surgery. Less manpower is required as patient self positioned himself and this leads to less chances of complications related to pressure injury and cardiovascular instability, but it should be performed only by a trained anesthetist and there should be suitable arrangements for turning the patient to supine position in case of LMA insertion failure. Further studies are needed to endorse the use of LMA in prone position.

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