Original Research Article

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Use of Low Dose Suxamethonium to Facilitate Laryngeal Mask Insertion Under Etomidate Anesthesia

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Abstract

Context: Endotracheal intubation is a routine since the discovery of general anesthesia. Passage of endotracheal tube is not without morbidity, dental damage and sore throat being the commonest and serious complications. An attempt to solve this problem lead to the invention of many oropharyngeal devices. For their successful placement in the larynx, the technique of insertion along with proper insertion conditions- plane of anesthesia and no response from patient are required. *Aims:* To assess patients response for laryngeal mask airway insertion while maintaining hemodynamic stability using appropriate dose of induction agent. *Settings and Design:* A comparative randomised prospective double blind controlled study. *Methods and Material:* Sixty patients who underwent surgery under general anesthesia with laryngeal mask airway were randomized and divided into three groups (20 in each group): Group NS-patients receiving Etomidate plus normal saline, Group S_1-patients receiving Etomidate plus 0.25mg/kg Suxamethonium, Group S_2- patients receiving Etomidate plus 0.5mg/kg Suxamethonium. We compared parameters like heart rate, mean arterial pressure and response from patient while inserting laryngeal mask airway - jaw relaxation, coughing, gagging, swallowing, movement of head and limbs, laryngospasm; among all three groups. *Statistical analysis used:* Pearson Chi-Square test to compare success rate between the groups for all the parameters assessed. Variables were analysed using One way ANNOVA test. *Results:* Low dose of Suxamethonium when combined with Etomidate provides better conditions for laryngeal mask airway insertion than etomidate alone. *Conclusions:* Intravenous 0.5mg/kg Suxamethonium produces better insertion conditions for Laryngeal Mask Airway than intravenous 0.25mg/kg Suxamethonium.

Keywords: Etomidate; General Anaesthesia; Laryngeal Mask Airway; Laryngospasm; Swalloing; Suxamethonium.

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Introduction

Laryngeal Mask Airway (LMA) is a supralaryngeal device invented by *Dr. Archie Brain* in 1983. It is designed to seat around laryngeal inlet for spontaneous ventilation and allow controlled ventilation at modest positive pressure. Smooth insertion of LMA requires attenuation of airway reflexes to avoid sequelae- gagging, coughing or laryngospasm. Etomidate is known to have greater cardiovascular stability than other intravenous induction agents, even in patients with cardiovascular disease [4,5].

Hence we decided to use 0.3mg/kg etomidate combined with various low doses of suxamethonium to obtain good LMA insertion

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conditions whilst maintaining cardiovascular stability.

We aim to assess patients response to LMA insertion using etomidate and different low doses of suxamethonium.

Materials and Methods

This is a comparative randomised prospective double blind controlled study involving 60 patients. The study was approved by the institutional review board of our hospital. Written informed consent was obtained from all patients in the study. Inclusion criteria: ASA physical status I and II, age 17 to 60 yrs, patients undergoing minor surgeries under general anesthesia. (like fibroadenoma excision, suction evacuation, wound debridement, external fixation of lower limb fractures). Exclusion criteria: ASA physical status other than I and II, hypertensive patients on antihypertensives, patients with cardiovascular disorders. (eg: valvular heart disease and coronary artery disease), patients who are on cardiac drugs that would interfere with normal cardiac physiology (eg: beta blockers), mouth opening < 2cm, patients in whom suxamethonium is contraindicated, patients undergoing oral surgery.

Sixty ASA I & II patients scheduled for elective surgery under general anesthesia were included in the study. All patients were visited and evaluated by anesthesiologist on the previous day of surgery. The anesthetic procedure was explained to all the patients and informed consent was obtained. They were randomly allocated by picking of lots into one of the three groups with 20 patients in each group.

Group NS : Normal saline.

Group S_1 : Suxamethonium 0.25mg/kg.

Group S_2 : Suxamethonium 0.5mg/kg.

Both inpatients and day care patients were included in our study. No premedication was given to the patients. On arrival in the operating room electrocardiogram, pulse oximetry and automated non-invasive blood pressure were connected and baseline values are noted.

Peripheral intravenous access was secured using either 18 or 20 gauge venous cannula. All patients were pre-oxygenated for three minutes with 100% oxygen. Fentanyl 2mcg/kg and Midazolam 1-2mg was given intravenously to all groups. Induction of anesthesia was performed with a bolus of etomidate 0.3mg/kg given intravenously. Study drugs were administered after confirmation that the patient had lost consciousness, as assessed by failure to respond to verbal commands and loss of eyelash reflex. Study drug consisting of normal saline in group NS, suxamethonium 0.25mg/kg in group S_1 and suxamethonium 0.5mg/kg in group S_2 was made up to 2ml with normal saline to ensure that the anesthesiologist inserting LMA was blinded to the drug administered. Patients were ventilated for 60 seconds after induction and LMA size 3 or 4 (as appropriate) was inserted by the same anesthesiologist in the standard manner, who was blinded for the study drug and who also assessed the insertion conditions. If jaw relaxation was found to be inadequate to permit LMA insertion, boluses of propofol 20mg up to 0.5mg/kg were given until adequate relaxation occurred. The position of LMA was verified by capnography, chest movement, auscultation for air entry and the absence of gas leak around the cuff.

Heart rate (HR) and mean arterial pressure (MAP) readings were taken at the end of pre-oxygenation, 30 seconds post-induction and 60 seconds post LMA insertion. Inhalational anesthetics were not delivered to the patients until the variables are measured. Anesthesia was then maintained with oxygen (33%), nitrous oxide (66%), sevoflurane (1-2%) and fentanyl (1mcg/kg). Non-steroidal anti-inflammatory agents and anti-emetics were not routinely administered.

Jaw relaxation was graded according to the classification given by Young, Clark and Dundee [6] as

1 = Good

2 = Incomplete

3 = Poor

Patient's response to LMA insertion was divided into coughing, gagging, swallowing, movement (head or limbs). Each response was graded on a four point scale according to Nimmo and colleagues [7] as

1 = None

2 = Mild (if it was transient or minimal)

3 = Moderate (if it lasted more than few seconds but resolved within 20 sec)

4 = Severe (if it sustained or needed propofol to allow LMA insertion)

In case of occurance of above adverse responses (grade 2, 3 and 4) a bolus dose of propofol 20mg up to 0.5mg/kg was given to deepen the plane of anaesthesia to facilitate the LMA insertion.

Overall insertion conditions were graded according to a system modified from Lund and Stovner [8] as

1= Excellent (insertion easy, no reaction from patient).

2= Good (insertion with mild response).

3= Poor (insertion with moderate or severe patient response).

4= Impossible

The incidence of laryngospasm was also noted and graded as

1 = None

2 = Slight

3 = Severe

Statistical analysis was done using Pearson Chi-Square test was used to compare success rate between the groups for degree of jaw relaxation, overall insertion conditions, patient movement and response to LMA insertion. The data were presented as number and percentage and continuous data as mean and standard deviation. Analysis of variables was done using One way ANNOVA test. A probability (*p*) value of less than 0.05 was taken as significant.

Results

All 60 patients included in the study and were randomly divided into 20 patients in each group.

Jaw Relaxation

Significant difference in jaw relaxation is seen in between the groups. Good jaw relaxation was seen in patients who received suxamethonium as compared to the control group. (Table 1, Figure 1).

Coughing

There was significantly more mild coughing in group NS as compared to moderate coughing in group S_1. No coughing seen in group S_2. (Table 2, Figure 2).

Gagging

Gagging with LMA insertion is seen more in group Ns as compared to those who received suxamethonium. No gagging response seen in group S_2 (Table 3, Figure 3).

Table 1: Showing grading of jaw relaxation in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	*P*
Good	2 (10%)	12 (60%)	16 (80%)	0.0001
Incomplete	12 (60%)	8 (40%)	4 (20%)	
Poor	6 (30%)	0 (0%)	0 (0%)	

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

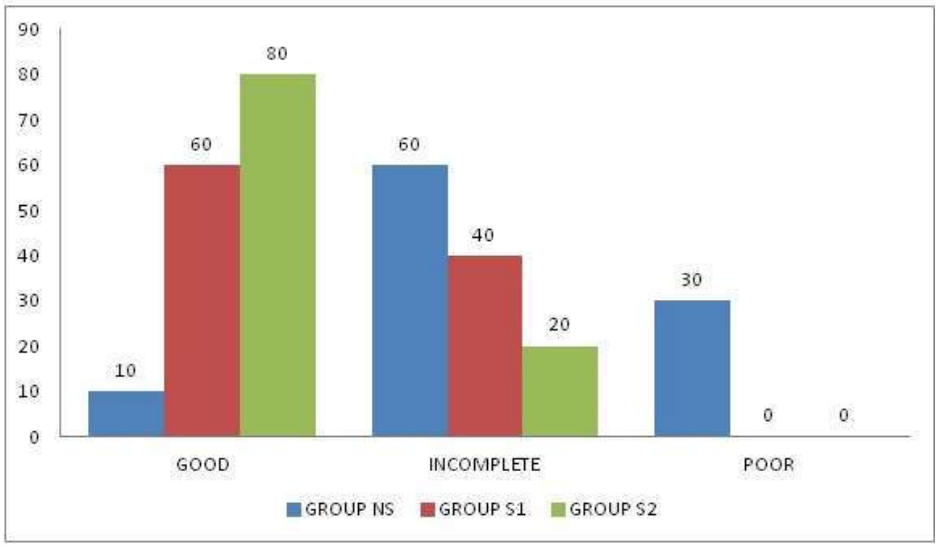

Fig. 1: Comparision of grades of jaw relaxation in between the groups

Table 2: Showing severity of coughing during LMA insertion in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	P
None	12 (10%)	17 (85%)	19 (95%)	0.041
Mild	5 (25%)	1 (5%)	1 (5%)	
Moderate	3 (15%)	2 (10%)	0 (0%)	
Severe	6 (30%)	0 (0%)	0 (0%)	

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

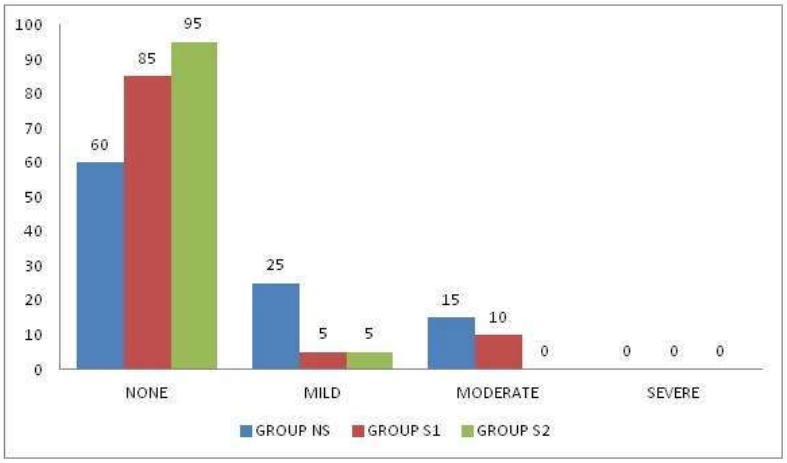

Fig. 2: Comparision of severity of coughing in between the groups

Table 3: Showing degree of gag reflex in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	P
None	14 (70%)	16 (80%)	20 (100%)	0.035
Mild	6 (30%)	4 (20%)	0 (0%)	
Moderate	0 (0%)	0 (0%)	0 (0%)	
Severe	0 (0%)	0 (0%)	0 (0%)	

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

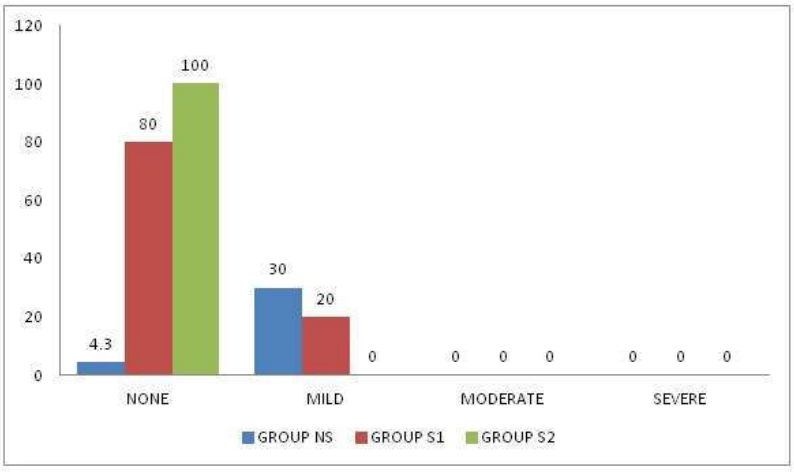

Fig. 3: Comparision of severity of gag reflex in between the groups

Swallowing

There was no significant difference in swallowing between the three groups. Mild swallowing response is seen in group NS and S_1, with no response in group S_2 (Table 4, Figure 4).

Movement of Head and Limbs

The incidence of head and limb movement was significantly less in patients who received suxamethonium compared to control group NS. (Table 5, Figure 5).

Laryngospasm

There was slight laryngospasm seen in group NS. No incidence of laryngospasm was seen in group S_1 and group S_2 who received suxamethonium. (Table 6, Figure 6)

Overall LMA Insertion Conditions

Overall LMA Insertion Conditions were significantly better in suxamethonium groups (p<0.0001; Table 7). 38 of the 40 patients given suxamethonium had the LMA successfully inserted

Table 4: Showing swallowing response in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	P
None	16 (80%)	17 (85%)	20 (100%)	0.165
Mild	4 (20%)	2 (10%)	0 (0%)	
Moderate	0 (0%)	1 (5%)	0 (0%)	
Severe	0 (0%)	0 (0%)	0 (0%)	

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

Table 5: Showing range of movement of head and limbs in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	P
None	6 (30%)	16 (80%)	17 (85%)	
Mild	8 (40%)	2 (10%)	3 (15%)	0.002
Moderate	6 (30%)	2 (10%)	0 (0%)	
Severe	0 (0%)	0 (0%)	0 (0%)	

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

Table 6: Showing severity of laryngospasm in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	P
None	15 (75%)	20 (100%)	20 (100%)	0.004
Slight	5 (25%)	0 (0%)	0 (0%)	
Severe	0 (0%)	0 (0%)	0 (0%)	

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

Table 7: Showing grading of overall LMA insertion conditions in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	P
Excellent	2 (10%)	11 (55%)	17 (85%)	
Good	8 (40%)	7 (35%)	3 (15%)	
Poor	7 (35%)	2 (10%)	0 (0%)	0.0001
Mpossible	3 (15%)	0 (0%)	0 (0%)	

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

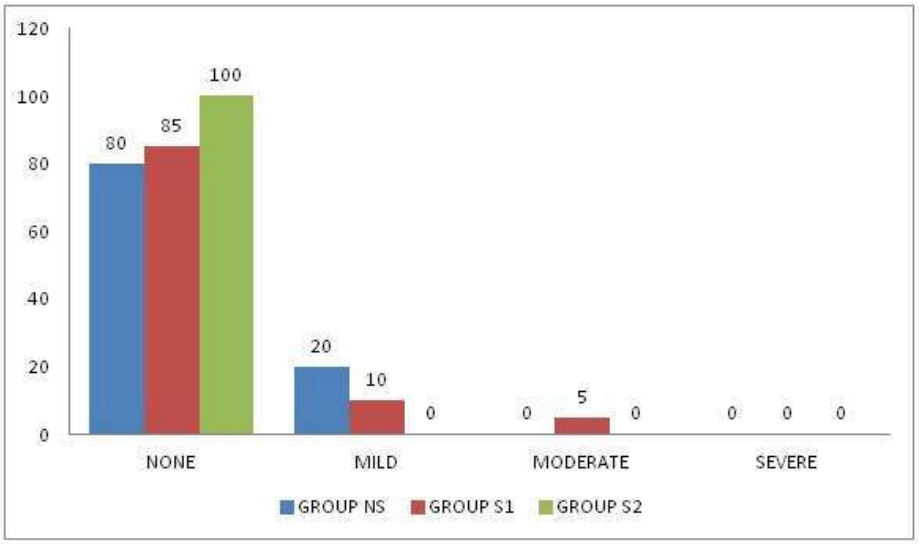

Fig. 4: Comparision of swallowing response in between the groups.

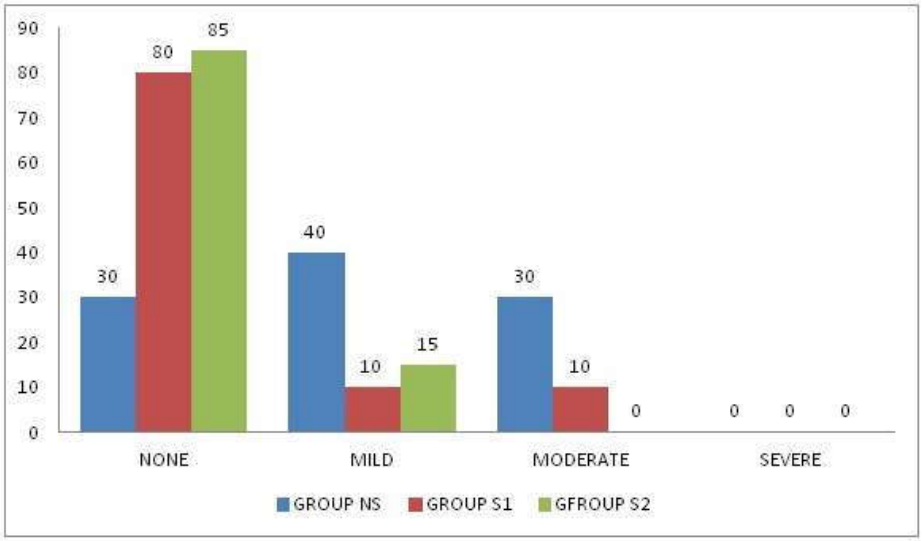

Fig. 5: Comparision of range of movement of head and limbs in between the groups

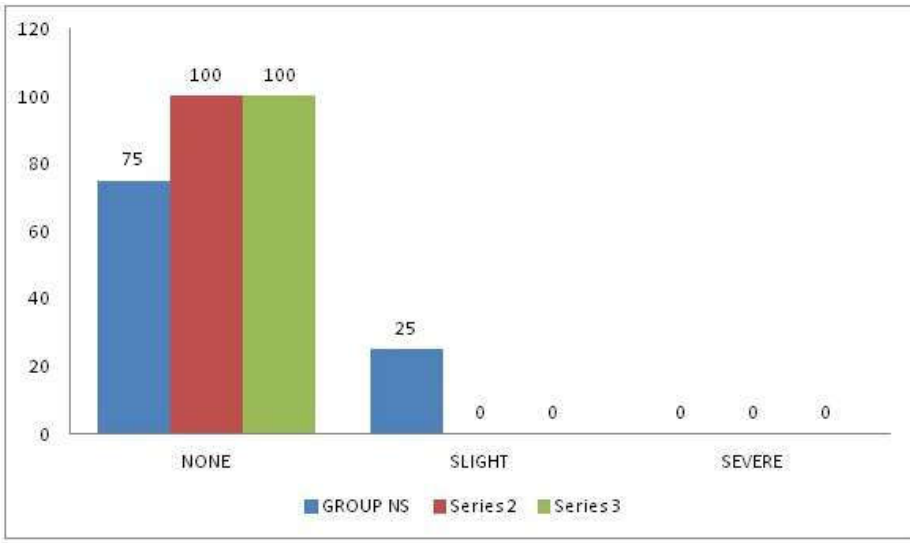

Fig. 6: Comparision of severity of laryngospasm in between the groups

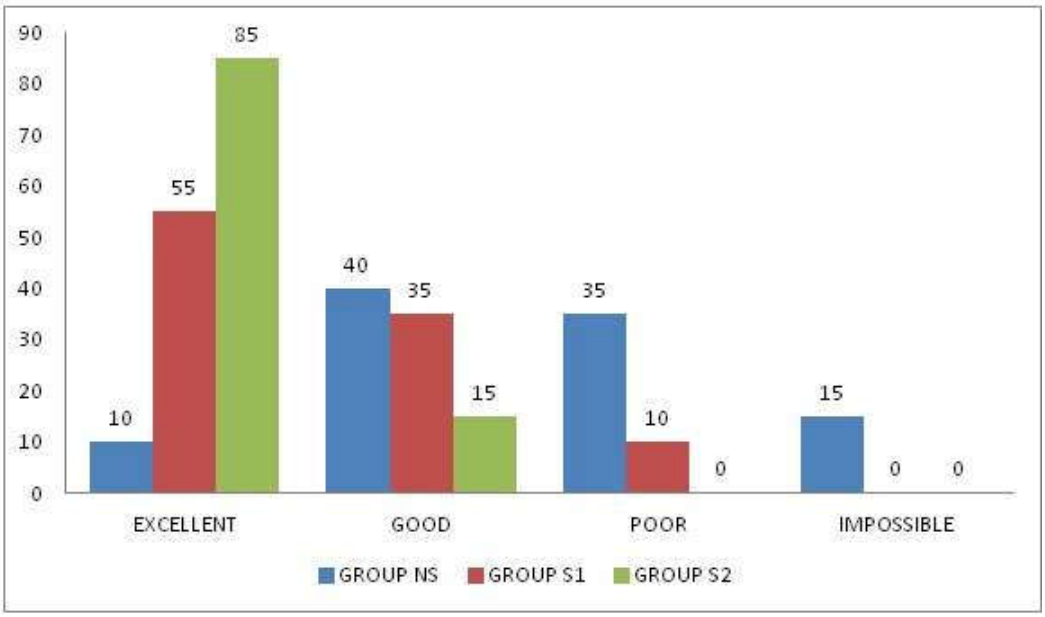

Fig. 7: Comparision of overall LMA insertion conditions in between the groups

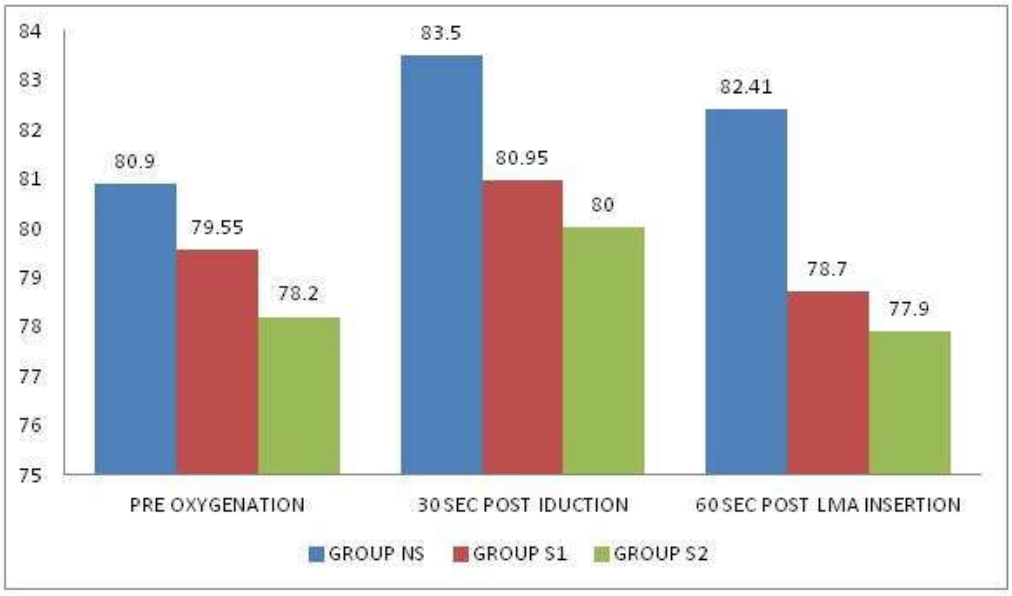

Fig. 8: Comparision of mean heart rate at various interval in different groups

Table 8: Showing Heart rate in different groups at various interval

	Group NS Mean ± SD	**Group S_1 Mean ± SD**	**Group S_2 Mean ± SD**	**P**
Pre Oxygenation	80.90± (13.841)	79.55 ± (9.191)	78.20± (10.061)	0.749
30 sec Post Induction	83.50± (14.099)	80.50± (11.128)	80.00± (13.727)	0.682
60 sec Post LMA Insertion	82.41 ± (9.076)	78.70± (10.692)	77.90± (10.498)	0.372

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

with excellent or good insertion conditions. Better results were seen in group S_2 than in group S_1. In contrast, only 10 patients in the control group had excellent or good insertion conditions with moderate patient response. (Table 7, Figure 7)

Heart Rate and Mean Arterial Pressure

There was no significant variation in Heart rate and Mean arterial pressure values measured before oxygenation, 30 seconds post induction and 60 sec post LMA insertion between the groups. (Table 8 & 9, Figure 8 & 9).

Age and Weight

The mean age and weight of patients were comparable in all three groups with p value of 0.820 and 0.971 respectively (not significant) (Table 10).

Sex

No significant difference in male and female ratio seen in between the groups (Table11).

Table 9: Showing Mean arterial pressure in different groups at various interval

	Group NS Mean ± SD	Group S_1 Mean ± SD	Group S_2 Mean ± SD	*P*
Pre Oxygenation	83.55± (13.709)	87.85± (14.561)	92.20± (11.579)	0.132
30 sec Post Induction	82.85± (11.579)	87.10± (15.967)	92.05± (13.121)	0.076
60 sec Post LMA Insertion	83.53± (16.071)	86.35± (14.529)	89.45± (11.009)	0.438

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

Table 10: Showing mean Age and Weight in all three groups

	Group NS Mean ± SD	Group S_1 Mean ± SD	Group S_2 Mean ± SD	*P*
Age (years)	36.70 ± (9.570)	34.65± (10.494)	35.47± (10.752)	0.820 (NS)
Weight (kgs)	54.40 ± (8.268)	55.05 ± (7.466)	54.65 ± (8.428)	0.971 (NS)

Group NS: Normal saline
Group S_1: 0.25mg/kg suxamethonium
Group S_2: 0.5mg/kg suxamethonium

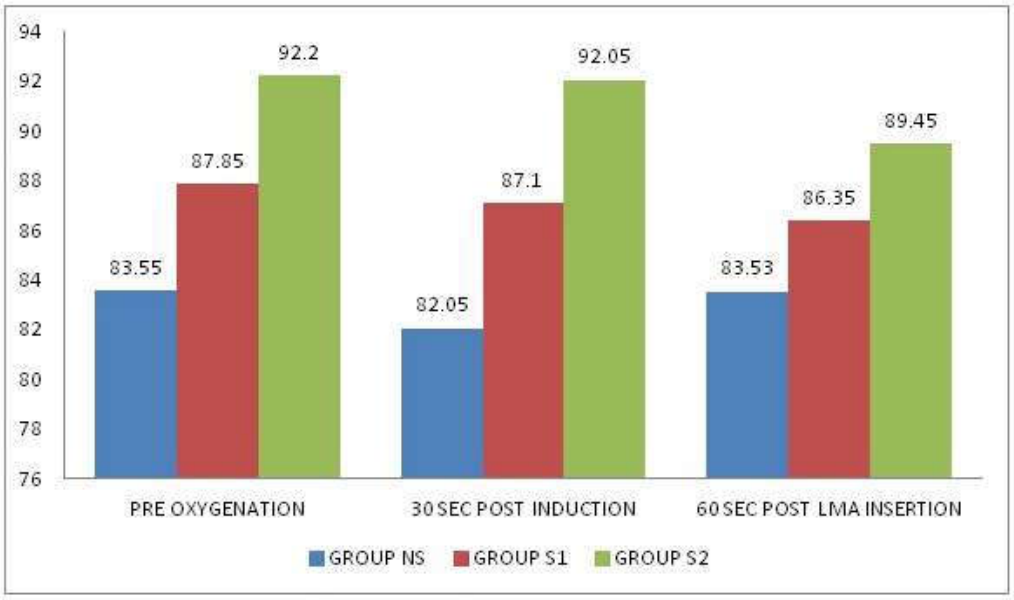

Fig. 9: Comparision of mean arterial pressure at various interval in different groups.

Table 11: Showing percentage distribution of Sex in different study groups

	Group NS Count (%)	Group S_1 Count (%)	Group S_2 Count (%)	*P*
Male	9 (45%)	9 (45%)	9 (45%)	
Female	11 (55%)	11 (55%)	11 (55%)	0.935

Discussion

The use of LMA is well established in anesthesia practice. LMA enables anesthesiologist to keep both hands free and obviates the need for tracheal intubation in some day care surgeries. Insertion of LMA immediately after induction and before introduction of volatile agents is desirable, as it shortens the induction time and improves patient turn around. The adverse response to the insertion of LMA such as gagging, coughing, laryngospasm may make correct positioning difficult or even impossible [2].

The use of low dose neuromuscular blocking drugs is not new. It has been used in priming technique, modification of electroconvulsive therapy and in the treatment of laryngospasm. Brain [9] first described using a small dose of atracurium (0.02mg/kg) with thiopentone induction before LMA insertion. He recognised that improved mouth opening was not essential to LMA insertion. However, the upper airway reflexes must be reduced or even abolished for insertion to be successful.

Etomidate as a sole induction agent does not provide adequate jaw relaxation for the insertion of LMA and is often associated with marked patient response in the terms of coughing, gagging, swallowing, movement and laryngospasm. In our study we used etomidate as induction agent in combination with various low doses of suxamethonium. Etomidate at a dose of 0.3mg/kg was standardised for induction of anesthesia. A higher dose of etomidate was not used as no studies have been done to ascertain safety at larger doses. Etomidate is known to be associated with a high incidence of post-operative nausea and vomiting, pain on injection and excitation phenomena [10,11] at induction. Etomidate used in our study is Etomidate Lipuro in which etomidate is dissolved in lipofundin (medium chain triglycerides). Unlike propylene glycol, etomidate in lipofundin has almost physiological osmolality, devoid of pain upon injection, haemolytic effects, histamine release. Marked excitation was observed in the control patients, but this seemed to be abolished with the addition of small doses of suxamethonium.

Scanlon et al. [1] compared the conditions for LMA insertion after either propofol (2.5mg/kg) or thiopentone (5mg/kg). They showed that thiopentone was associated with higher incidence of adverse response (76%) than was propofol (26%).

Stonhem bree and Sneyd [2] reported that easy insertion of LMA was seen in only approximately 62% of patients with propofol anesthesia, which means that the sole use of propofol does not always guarantee successful insertion of LMA. They suggested that lignocaine 1.5mg/kg given intravenously before induction of anaesthesia with propofol, provides satisfactory insertion conditions for the LMA. In our study etomidate as an induction agent provided acceptable insertion conditions with cardiovascular stability. We also used fentanyl and midazolam prior to induction. At concentrations used clinically etomidate lacks negative inotropic effects. Hemodynamic stability with etomidate may be partly caused by its unique lack of effect on both the sympathetic nervous system and on baroreceptor function. Suppression of cortisol synthesis after single dose of 0.3mg/kg etomidate is only brief and several studies show that cortisol levels are restored after 2-6 hours [12].

In our study we observed significant difference in the incidence of patient response (coughing, gagging, patient movement) during LMA insertion in normal saline group verses other two groups. Jaw relaxation was found to be better in patients who received 0.5mg/kg suxamethonium compared to other two groups.

Yoshino et al. [3] in their study compared different doses of suxamethonium (0.25mg/kg, 0.5mg/kg) with thiopentone for insertion of LMA showed significantly better insertion conditions with suxamethonium 0.5mg/kg similar to our study. They found the incidence of post-operative myalgia to be higher in suxamethonium 0.5mg/kg group. Though post-operative effects were not observed in our study, other studies have shown that the incidence of myalgia was not significantly different between 0.5mg/kg and 0.25mg/kg suxamethonium.

Nimmo SM, Mc Cann N et al. [7] conducted a randomised study to assess the effectiveness and

sequelae of low dose suxamethonium in patients requiring nasal intubation. Anesthesia was induced with propofol and alfentanyl. Patients were divided into three groups who received no suxamethonium or 0.25mg/kg suxamethonium or 0.5mg/kg suxamethonium. They found good intubating conditions in patients who received 0.25mg/kg suxamethonium than other two groups. Unlike the above study, in our study better insertion conditions and relatively stable haemodynamics were seen with 0.5mg/kg suxamethonium than with 0.25mg/kg suxamethonium. The difference may be due to observer bias in the above study which was eliminated in our study as the same anesthesiologist assesses insertion conditions in all sixty patients.

Limitations of the study

No data has been collected on the incidence of post-operative nausea and vomiting associated with etomidate and myalgia associated with suxamethonium.

Conclusion

Low dose of suxamethonium when combined with etomidate provides better conditions for LMA insertion than etomidate alone. Suxamethonium at an intravenous dose of 0.5mg/kg produces better insertion conditions for LMA than suxamethonium 0.25mg/kg given intravenously.

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Conflict of Interest: Nil

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