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Comparison of two doses of succinylcholine to facilitate the Laryngeal mask airway insertion under propofol anaesthesia in adult patients undergoing elective minor surgical procedures

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ABSTRACT

Background: Small dose of succinylcholine combined with propofol facilitates Laryngeal mask airway (LMA) insertion. This study was designed to compare the efficacy of two different small doses of succinylcholine for LMA insertion. **Aims and Objectives**: The aim of our study is to compare the usefulness of two different doses of succinylcholine to facilitate the insertion of laryngeal mask airway under intravenous anaesthesia. **Material and Methods**: Seventy patients of ASA I and II posted for elective day care procedure under general anaesthesia with Laryngeal mask airway (LMA) were randomly allocated into two groups of 35 each. 35 patients in group PS1 received Inj. propofol 2.0 mg/kg + succinylcholine 0.1 mg/kg (diluted to 2 ml). 35 patients in group PS2 received Inj. propofol 2.0 ml/kg + succinylcholine 0.2 mg/kg (diluted to 2 ml). During insertion of laryngeal mask airway jaw relaxation, gagging/coughing, head and limb movements, presence or absence of laryngospasm and duration of apnoea were noted. **Results**: Patients in PS2 had better conditions for LMA insertion, reduced the upper airway responses to the LMA insertion, and reduced the supplement doses of propofol compared to PS1. **Conclusion**: Succinylcholine in 0.2 mg/kg compared to 0.1kg provides optimal conditions for LMA insertion.

Key words: Daycare surgery, Gagging, Laryngeal mask airway, Propofol, Succinylcholine

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INTRODUCTION

Anaesthesia has made major advances in recent years. Considerable efforts have been devoted to airway management by the anaesthesiologist during the past 20 years. A large number of supraglottic airway devices have been introduced recently. The original purpose was to reduce the need for more invasive methods of airway management while offering a more reliable alternative to the facemask. The laryngeal mask airway (LMA) is one such innovative device designed for airway management.[1] Since the LMA is placed directly over the posterior pharynx, it avoids tracheal stimulation and hence the systemic and ocular stress response associated with tracheal intubation. [2]LMA offers distinct advantages over the facemask and the endotracheal tube.[3] Compared to the facemask the LMA maintains a better airway, frees the hands and thereby reduces the fatigue of the anaesthesiologist. The most popular induction agent for LMA insertion continues to be propofol as this agent obtunds oropharyngeal reflexes.[4] Studies show an incidence of poor insertion conditions ranging from 3860% its use in doses which allow adequate jaw relaxation and prevent patient reaction to with standard induction doses (23 mg/kg) of propofol.[5] Although this dose of propofol may be well tolerated by a fit patient, it may not be tolerated by elderly patients and in those patients with cardiovascular disease.

Use of rapid onset neuromuscular blocking agents such as succinylcholine, suppresses the laryngeal reflexes by depolarization of motor - neuron end plates. However their

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use may result in significant myalgia and prolonged apnoea. Nimmo and colleagues suggested that this adverse reactions can be avoided by reducing the doses of succinylcholine substantially.[6] Previous studies had proven the usefulness of mini-dose succinylcholine (0.1mg/kg) for insertion of LMA without significant patient reaction under propofol anaesthesia in patients coming for elective short surgical procedures.[6] In our study we have compared two small doses of succinylcholine (0.1mg/kg and 0.2mg/kg) to assess the ease of LMA insertion.

MATERIAL AND METHODS

After obtaining institutional ethical committee clearance and written informed consent from the patients, a randomized controlled study was carried out on 70 patients undergoing elective surgical procedures lasting less than 45 minutes at tertiary care hospital, who met the study criteria. Patients of ASA I & II under age group 18 to 50 posted for elective day care surgical procedures lasting ≤45 minutes were included for the study. Patients with full stomach, patients posted for emergency surgery, patients with oral or peri oral pathology such as tumours, patients with fixed reduced pulmonary compliance such as pulmonary fibrosis, pregnant patients were excluded from the study.

A computerized random number generator was used for group allocation and codes were stored. 35 patients in group PS1 received Inj. propofol 2.0 mg/kg + succinylcholine 0.1 mg/kg (diluted to 2 ml). 35 patients in group PS2 received Inj. propofol 2.5 ml/kg + succinylcholine 0.2 mg/kg (diluted to 2ml). Preoperative assessment and evaluation was done for all the patients. The anaesthetic management of all the patients was standardized. All the patients were kept fasting for six hours before the surgery. Baseline vitals (heart rate, blood pressure, respiratory rate and SpO2) were recorded. Intravenous access was taken with 20G cannula. Patients were monitored with ECG, pulse oximetry, blood pressure, and end tidal co2 monitor. Patients were preloaded with 500 ml of Lactated Ringer's solution. All patients were premedicated with inj. glycopyrolate 4 microgram/kg iv & inj. fentanyl 2 microgram/kg intravenously (IV) 5 minutes before surgery. Preoxygenation with 100% oxygen was done for 3 mins.

A uniform general anaesthesia technique was used in all patients. Induction of anaesthesia was performed in all the patients with bolus of inj.propofol 2 mg/kg IV over 10 seconds. This was followed immediately by administration of succinylcholine 0.1mg/kg IV (diluted to 2 ml) in group PS1 and succinylcholine 0.2 mg/kg IV (diluted to 2 ml) in group PS2. The study drug was made up to 2 ml with normal saline to ensure that the anaesthetist inserting the LMA was blinded to the drug that was given. Patients are then maintained on assisted ventilation with 100% oxygen over a period of 60 seconds. During that period, fasciculation were observed. Sixty seconds after that well lubricated LMA was inserted by a blind investigator using the standard technique as described in the intravent manual. During insertion of laryngeal mask airway, jaw relaxation, gagging/coughing, head and limb movements, presence or absence of laryngospasm and duration of apnoea were noted. Additional doses of propofol were given where conditions for LMA insertion were poor, or before second attempt and until adequate jaw relaxation occurred. The numbers of attempts were recorded, but ease of insertion was assessed only during the first attempt.

Fasciculation

Fasciculation was graded by Mingus Herlick and Eisenkraft

Grade 1: No fasciculation.
Grade 2: Mild - fasciculation of eyes, face, neck, finger without limb movement.
Grade 3: Moderate - fasciculation involving limb & trunk.
Grade 4: Severe - Vigorous movement of one or more limb requiring restraint.

Jaw relaxation

Jaw Relaxation was graded by Young, Clark, Dundee

Grade 1: Good-adequate jaw relaxation with LMA insertion done without any difficulty.
Grade 2: Incomplete - inadequate jaw relaxation but LMA insertion is possible with difficulty.
Grade 3: Poor - inadequate jaw relaxation and LMA insertion is not possible.

Overall relaxation

Overall Relaxation was graded by lund and stovner.

Grade 1: Excellent - Insertion easy, no reaction from patient.
Grade 2: Good - Insertion results in slight cough or movement.
Grade 3: Poor - Insertion possible with marked pt response.
Grade 4: Impossible - insertion not possible.

Head and limb movements

Grade 1: Absent.
Grade 2: Mild - some movement, but did not affect the positioning of LMA.
Grade 3: Moderate - holding required no need for inhalational anaesthetic.
Grade 4: Severe - additional doses of drug required.

Gagging or coughing on insertion

Gagging or coughing on insertion was graded by Nimmo and colleagues

Grade 1: None.
Grade 2: Mild - some movement, but did not affect the positioning of LMA.
Grade 3: Moderate - holding required no need for inhalational anaesthetic.
Grade 4: Severe - additional doses of drug required.

Correct positioning of LMA was checked by bilateral chest expansion, bilateral air entry by auscultation, capnography and absence of leak around the cuff. The apnoea time was taken from the time of LMA insertion to resumption of spontaneous respiration. The duration of apnoea time was noted. Ventilation was assisted with bag until resumption of spontaneous respiration. Anaesthesia was maintained with oxygen &nitrous oxide in ratio of 34:66 and sevoflurane (0.5% -1%).

The hemodynamic changes (heart rate, blood pressure and spo2) were monitored before premedication, 1 minute prior to induction, 30 seconds after induction and 1 min after LMA insertion and then throughout the procedure. At the end of surgery all the anaesthetic agents were discontinued and 100% oxygen administered.

LMA was removed after the patient had gained adequate level of consciousness and after adequate return of pharyngeal reflexes. After removal of LMA, the patient was observed for any spasm, coughing or vomiting. In the post-operative period patients were observed in the ward for 24 hours.

RESULTS

We have used the Statistical Package for Social Scientists windows version 10.0 software (SPSS.V.10.0 Inc, Chicago, Illinois) for statistical analysis of the data. Results were expressed as mean ± standard deviation. Chi-square test and Fisher's exact test used for attributes. To test the normality of the data for numerical values, One-Sample Kolmogorov-Smirnov test used. Statistical analysis was performed using the independent't' test and Mann Whitney U test for numerical variables. Statistical significance was assumed when $p< 0.05$.

The study was conducted in seventy patients who were divided into two groups of thirty five each.

The mean age in group PS1 was 30.06 + 7.93 years and in group PS2 was 28.57 + 7.52 years (Table 1).

Age in years, sex and weight in kg were comparable between the two groups (Tables 2 and 3).

The various types of surgeries that were included in this study are shown in table.

COMPARISON OF CONDITIONS FOR LMA INSERTION

Jaw relaxation, incidence of swallowing and gagging, head and limb movements, insertion at first attempts and overall insertion conditions were observed and the results were tabulated as follows.

Difficulty in mouth opening was more in group PS1 (44%) compared to group PS2 (8%).The results were statistically more significant (Table 4).

The incidence of swallowing, and gagging was more in group PS1 (48%) compared to 8% in group PS2. There was statistically significant difference between the two groups. There was no coughing in two groups (Table 5).

There was a significant head and limb movements in group PS1 29% compared to 3% in group PS2. p value

Table 1: Age incidence in two groups

Age (in years)	Group		Total
	PS1	PS2	
< 20	7	5	12
21–25	4	12	16
26–30	4	2	6
31–35	11	7	18
36–40	6	9	15
>40	3	0	3
Total	35	35	70

Table 2: Demographic data

Parameters	Group PS1	Group PS2
Mean age (in years)	(30.06±7.93) (18-44)	(28.57±7.52) (18-40)
Sex (M:F)	23:12	23:12
Mean weight (in kgs)	(50.03±7.84) (33-65)	(50.06±7.15) (37-65)

Table 3: Types of surgery

Type of surgery	No. of cases		Total
	Group PS1	Group PS2	
General surgery	13	12	25
Obstetrics & Gynaecology	12	10	22
Orthopaedics	5	10	15
Urology	5	3	8
Total	35	35	70

Table 4: Jaw relaxation

Jaw relaxation	Group		Total	P value	Result
	PS1	PS2			
Good	19 (56%)	32 (92%)	51	0.001	Significant
Incomplete	16 (44%)	3 (8%)	19		
Poor	0	0	0		
Total	35	35	70		

0.006.Group P required more doses of propofol to overcome this problems (Table 6).

Overall insertion conditions were excellent in 94% in group PS2 as compared to only 54% in group PS1. Overall insertion conditions were Poor in 12% of group PS1 compared to none in group PS2. There were statistically significant better Insertion conditions in PS2 group compared to PS1 group (p value – 0.003) (Table 7).

LMA insertion was done in 92% cases in group PS2 as compared to only 71% cases in group PS1. LMA insertion was done in 29% cases in group PS1 as compared to only 8% in group PS2.

Fasciculation was seen in 17% of the cases in both the groups (Table 8).

There was no significant change in mean arterial pressure before premedication and 60 seconds before induction between the two groups. But there was a significant change in mean arterial pressure between two groups 30 sec after induction(p value 0.001) and 60 seconds after LMA insertion (p value 0.001) (Table 9).

There was no significant change in pulse rate before premedication, 60 seconds before induction and 30 seconds after induction between the two groups. But there was a significant change in pulse rate between two groups 60 sec after LMA insertion (p value 0.013) (Table 10).

Table 5: Swallowing, gagging and coughing

Swallowing & Gagging	Group		Total	P value	Result
	PS1	PS2			
None	18	32	50	0.001	Significant
Mild	16	3	19		
Moderate	1	0	1		
Total	35	35	70		

Table 6: Head and limb movements

Movements	Group		Total	P value	Result
	PS1	PS2			
Absent	25	34	59	0.006	Significant
Mild	9	1	10		
Moderate	1	0	1		
Total	35	35	70		

Table 7: Inertion at first attempt

Attempts	Group		Total	P value
	PS1	PS2		
Insertion at 1st attempt	25 (71%)	32 (92%)	57	0.062
Insertion at 2nd attempt	10 (29%)	3 (8%)	13	
Total	35	35	70	

Table 8: Comparsion of Fasciculations

Fasciculations	Group		Total
	PS1	PS2	
No faciculation	35	28	56
Mild	6	6	12
Moderate	1	1	2
Total	35	35	70

DISCUSSION

The laryngeal mask airway introduced in 1983 by Dr. Archie Brain has revolutionized the airway management in many patients who would have otherwise undergone endotracheal intubation or received anaesthesia through conventional face mask.[7] The device with its ease of use helps the anaesthesiologist by keeping his hands free for other work. It also avoids the adverse effects of endotracheal intubation.[8]

Adverse response to insertion of laryngeal mask airway such as gagging, coughing and laryngospasm may make correct positioning difficult or even impossible, so LMA insertion requires suppression of airway reflexes.[9] Although propofol obtunds the upper airway reflexes, previous study reported that easy insertion of the LMA was seen in only approximately 60% of patients with propofol anaesthesia, which means that sole use of propofol does not guarantee successful insertion of LMA.[10] Propofol when given as a sole agent requires to be given in high doses which is likely to cause respiratory depression and hemodynamic instability.[3]

Comparisons have been made between various muscle relaxants in the LMA insertion. Although rapid onset, short and intermediate acting, non depolarizing neuromuscular blocking agents are available, they have yet to completely replace succinylcholine.[11] Succinylcholine is still useful for LMA insertion in patients undergoing elective minor surgeries and body surface surgeries, where in most cases patients are allowed to breathe spontaneously.[12] Hence, our attempts have been made to study the effect of mini dose succinylcholine to facilitate the insertion of LMA under propofol anaesthesia.

Patients were randomly divided into two groups of 35 each. Group PS1 (Inj. propofol 2.0mg/kg +succinylcholine 0.1 mg/kg) and group PS2 (Inj. propofol 2.0 mg/kg + succinylcholine 0.2 mg/kg). Patient's response to LMA insertion was noted and graded. Gagging, coughing, head and limb movements, laryngospasm, jaw relaxation and ease of LMA insertion were graded. Total dose of propofol

Table 9: Comparsion of mean arterial pressures between two groups

MAP	Group	N	Mean±SD	P value	Result
MAP 0	PS1	35	98.4±6.17	0.638	Not significant
	PS2	35	99.11±6.48		
MAP PRE (60 sec preinduction)	PS1	35	94.26±7.55	0.362	Not significant
	PS2	35	95.8±6.46		
MAP (30 sec after induction)	PS1	35	84.29±5.87	0.001	Highly significant
	PS2	35	92.26±5.31		
MAP (60 sec post insertion)	PS1	35	75.49±6.34	0.001	Highly significant
	PS2	35	86.26±7.14		

Table 10: Pulse rate at different time during study

Pulse rate	Group	Mean±SD	P value	Result
PR 0	PS1	92.14±10.68	0.08	Not significant
	PS2	96.91±11.78		
PR PRE	PS1	93.26±8.2	0.126	Not significant
	PS2	96.86±11.02		
PR 30 sec	PS1	90.06±7.97	0.06	Not significant
	PS2	93.66±7.78		
PR 60 sec	PS1	84.83±8.97	0.013	Significant
	PS2	90.09±8.36		

Table 11: Averge dose of Propoful required for LMA insertion

Group	Mean±SD	P value	Result
Group PS1	3.329±0.606	<0.001	Highly significant
Group PS2	2.523±0.059		

P<0.001 indicates that there is a high significant difference between the groups in total dose. The average total dose is less in Group PS2 (2.523 mg/kg) compare to Group PS1 (3.329 mg/kg)

Table 12: Mean duration of apnoea between groups

Group	N	Mean±SD	P value
PS1	35	36.31±4.16	0.12
PS2	35	39.29±7.62	

The average duration of Apnoea in Group PS1 is-36.31 Seconds, compared to Group-PS2 – 39.29 seconds.

used and hemodynamic status (PR, BP, MAP, and SPO2) were compared.

In the present study, jaw relaxation was found to be good in 92% patients PS2 as compared to 56% of patients in propofol group PS1. The difference between the two group was statistically significant (p=0.001). Incidence of swallowing, coughing, gagging was only 8% in group PS2 as against 48% in group PS1. More patients in group PS1 requires additional dose of propofol to overcome these movements. The difference between the two groups was statistically highly significant (p ‹ 0.001). 28% of patients group PS1 experienced limb movements as against only 4% in group PS2. The difference between the two groups was statistically significant (p=0.006) (Tables 11 and 12).

Overall insertion conditions were better in group PS2 as compared to group PS1 (90% vs 54%). The difference between the two groups was statistically significant (p=0.003). In our study total dose of propofol needed to insert LMA was lower in group PS2 compared to group PS1 (2.523 mg/kg vs. 3.329 mg/kg), p value < 0.001 was highly significant. One study shows that the total dose of propofol needed was lower in minidose succinylcholine group when compared to propofol group. The present study results were similar to above study results.

A small dose, 0.1mg/kg had been shown to be effective in abolishing tonic adduction of vocal cords during laryngospasm without causing prolonged apnoea.[13] In the present study there was no incidence of laryngospasm in both the group. Intravenous succinylcholine, in a dose of small as 0.1 mg/kg had been found to be reliable in the treatment of laryngeal spasm.[6]

Although succinylcholine has commonly been employed in low doses in combination with other induction agents for the insertion of LMAs, potential problems such as masseter muscle spasm, prolonged apnoea, myalgia, hyperkalemia and inadvertent administration to patients with pseudocholinesterase deficiency or malignant hyperthermia may occur.[14, 15] These were not problems that were encountered in our study.

The incidence of myalgia was not statistically significant in the groups treated with mini dose succinylcholine when compared to control group. Our results also showed no significant difference in the incidence of myalgia post-operatively in the 2 groups. We acknowledge other studies showing myalgia after the use of sub-paralysing doses of succinylcholine. It may be that a larger sample size would be needed to demonstrate a difference in the 2 groups. There was no significant change in pulse rate before premedication, 60 seconds before induction and 30 seconds after induction between the two groups. But there was a significant change in pulse rate between two groups 60 sec after LMA insertion (p value 0.013). There was no significant change in mean

arterial pressure before premedication and 60 seconds before induction between the two groups. But there was a significant change in mean arterial pressure between two groups 30 sec after induction (p value 0.001) and 60 seconds after LMA insertion (p value 0.001). Induction of anaesthesia with propofol alone was associated with poor hemodynamic stability because of more requirement of propofol but propofol induction with mini-dose succinylcholine was associated with advantage that hemodynamics were better maintained. The relative hypotension associated with propofol may be disadvantageous in elderly and pts with coronary artery disease.

CONCLUSION

Addition of mini-dose succinylcholine (0.1mg/kg) to standard dose of propofol facilitated LMA insertion. It provides better conditions for LMA insertion, reduced the upper airway responses to the LMA insertion, and reduced the supplement doses of propofol needed and thereby lowering hemodynamic instability and with less incidence of post operative myalgia.

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SG- Concept and design of the study, Data collection, Review of literature; **RKP-** Concept and design of the study, Preparation of the manuscript, Statistical analysis.

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