

Original Research Article

Study to assess the effect of mini-dose Succinylcholine for ease of laryngeal mask airway insertion

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ABSTRACT

Background: Propofol as sole induction agent is often insufficient for the laryngeal mask airway insertion and higher doses are at times required. The present study proposes to assess the effectiveness of 0.25mg/kg mini dose succinylcholine towards facilitation of laryngeal mask airway (LMA) insertion.

Methods: In a single blinded randomized controlled trial, 68 patients posted for elective general and orthopaedic surgery were equally assigned to two groups during LMA insertion: Group S (Study group)- patients received a bolus of succinylcholine 0.25mg/kg diluted in 2 ml of 0.9% sodium chloride. Group C (Control group)-patients received a bolus dose of 2 ml of 0.9% sodium chloride. The number of attempts required and ease of LMA insertion, hemodynamic parameters and adverse responses were noted and compared between the groups.

Results: The LMA was inserted in first attempt in 32 (94.11%) patients in group S and in 24 (70.58%) patients in group C. The control group had 67.62% grade 1, 32.38% grade 2 and 0% grade 3, while succinylcholine group had 73.53% grade 1, 26.47% grade 2 and 0% grade 3. Hemodynamic parameters didn't differ significantly between the two groups at any point, but significant difference was observed between occurrence of fasciculation, head and limb movements, sore throat and coughing.

Conclusions: Succinylcholine does seem to help in insertion of the laryngeal mask airway but the results could not gain the level of statistical significance, partly attributed to small sample size.

Keywords: Facilitation of laryngeal mask airway insertion, Induction agent, Mini-dose Succinylcholine

INTRODUCTION

Ambulatory surgery has come up in a big way recently, as it offers discount on the stay in hospital and saves for the patient the much desired commodity called time! Anaesthesia takes the high seat in this regard. Given the setting, general anaesthesia through the laryngeal mask airway (LMA) is widely used now-a-days, since it fills the gap between the face mask and tracheal tube and is purported to cause minimal disturbances in cardiovascular and respiratory parameters.^{1,2} Further, it

ensures better control of the airway leaving the anaesthesiologist's hands free throughout surgery.

LMA insertion is usually accomplished using Propofol, as it helps blunt the laryngeal reflexes well when compared to other induction agents, though it has been seen that Propofol as a sole agent is often not sufficient to prevent patient movement, coughing and gagging.³⁻⁵ Additional doses of propofol are then required to prevent these undesirable airway reflexes and multiple insertion attempts may also be needed, which can be associated with adverse hemodynamic changes and airway trauma.¹

These undesired effects can be mitigated by the use of “co-induction” technique, where a small dose of sedative or other anaesthetic agent is administered to reduce the total dose of the induction agent.⁶ A variety of supplementary drugs such as midazolam, ketamine, low-dose muscle relaxants, opioids, sevoflurane and recently succinylcholine have been advocated to further improve the LMA insertion conditions.

The use of succinylcholine to aid insertion of the LMA is advantageous in theory, as it is a quick-onset, short-acting drug that avoids depression of the respiratory centre and has no influence on consciousness. Researchers have been dwelling upon usage of mini-dose of succinylcholine, i.e. 0.1mg/kg, 0.25mg/kg or 0.5mg/kg, to aid LMA insertion. The present study proposes to assess the effectiveness of 0.25mg/kg mini dose succinylcholine towards facilitation of laryngeal mask airway (LMA) insertion.

METHODS

The present study, a single blinded randomized controlled trial, was carried out in department of anaesthesia at a tertiary care teaching hospital from January 2017 to September 2018 (18 months). The study population consisted of patients of 18-55 years age posted for elective general and orthopaedic surgery under general anaesthesia with classic LMA. Sample size was determined considering coughing as the outcome for the study. Following assumptions were made on the basis of study finding reported by Aghamohammadi et al.²

Assumption 1: Proportion with coughing in control group (P1) = 33%,

Assumption 2: Proportion with coughing in study group (P2) = 1%,

Assumption 3: Effect size (Difference in proportion) = 32%,

(Power = 84%, Beta = 0.16, Alpha = 0.01)

Required sample size (n) = 34 in each group.

Therefore, a total of 68 subjects were equally assigned to two groups for the present study.

Inclusion criteria

- American society of anaesthesiologists (ASA) physical status I and II.⁷
- Age: 18-55 years of both gender
- Weight: 30-65 kgs.
- Electively posted patients of general/orthopaedic surgery, requiring supine position.
- Planned surgeries lasting for not more than 1 hour.

Exclusion criteria

- Any anatomical abnormality of mouth, pharynx and larynx.

- Risk of aspiration (history of gastroesophageal reflux or upper gastrointestinal surgery).
- Anticipated difficult airway.
- History of chronic obstructive airway disease.
- Previous history of hypersensitivity to any of study drugs.
- Family history and previous history of malignant hyperthermia.
- Family history of plasma cholinesterase deficiency or other neuromuscular disorders.
- Massive trauma and burns patient.
- Unwilling to consent.

After obtaining Institutional Research Ethics Board approval for the study and written informed consent from all the participants, 68 patients fulfilling the mentioned selection criteria were enrolled. Randomization was done by computer generated randomization table. The patients were divided into 2 equal groups for intervention allocation:

- GROUP S (Study group) - Patients received a bolus of succinylcholine 0.25mg/kg diluted in 2 ml of 0.9% sodium chloride.
- GROUP C (Control group) - Patients received a bolus dose of 2 ml of 0.9% sodium chloride.

Allocation concealment was achieved using opaque envelopes with serial numbers. Only the patients were blinded to the study drug.

Careful pre anaesthetic check-up was carried out in all patients with detailed clinical history, thorough clinical examination-both general and systemic with vital parameters, particular attention being paid to evidence of gross renal and liver disease. Investigations like Complete blood count, blood group, renal function test, liver function test and ECG were noted in all patients. In the operation theatre, monitors like non-invasive blood pressure (NIBP), three lead electrocardiogram (ECG), pulse oximetry for peripheral oxygen saturation (SpO₂) and end tidal carbon dioxide (EtCO₂) were attached and monitored.

Procedural details

Intravenous access was secured prior to preoxygenation. Aspiration prophylaxis with injection Ranitidine 50mg and injection Ondansetron 4mg was given and patients were preoxygenated for 3 minutes before induction. Premedication was given with injection Glycopyrolate 0.004mg/kg, injection Midazolam 0.01mg/kg and injection Fentanyl 1mcg/kg and induced with injection Propofol 2mg/kg. The adequacy of depth of anaesthesia was assessed by the loss of eyelash reflex. Thirty seconds after induction, patients were given 2 ml of 0.9% sodium chloride in the patients of control group (Group C) or a bolus dose of succinylcholine 0.25mg/kg diluted in 2ml of 0.9% sodium chloride in the patients of

succinylcholine group (Group S). Thirty seconds after that, LMA was inserted using classical LMA technique. When there were airway reflexes preventing LMA insertion, inability to ventilate after insertion of the LMA or head and limb movement requiring restraint in the patient, another dose of Propofol 0.5mg/kg bolus were given, followed by another attempt at LMA insertion 30 seconds later. This cycle was repeated until the LMA was successfully inserted. The position of the LMA was verified by capnography, chest movement and the absence of gas leak around the cuff.

The number of attempts were noted. Ease of insertion was assessed only during first attempt. The ease of insertion of LMA was graded as 'excellent' (No/adverse responses subsided within 5 seconds), 'satisfactory' (Mild adverse response to airway manipulations, but not affecting the insertion of LMA) and 'poor' (Moderate to severe responses or more than two attempts required for insertion).

The hemodynamic parameters like heart rate, mean arterial pressure and SpO₂ were assessed at baseline, after induction and LMA insertion at 1, 2, 3, 5, 7, 10, 15 and 20 minutes were recorded. During and just after the insertion of LMA, episodes of fasciculations, coughing, laryngospasm and head and limb movement were noted. The above adverse responses to airway manipulation were graded as 'absent', 'mild' (transient and minimal lasting < 5 seconds), 'moderate' (lasted > 5 seconds, but

resolved spontaneously within 20 seconds) and 'severe' (sustained > 20 seconds or required additional boluses of Propofol). Post operatively, within 24hrs in recovery room or in ward, complaints like sore throat and myalgia were noted. The data was analysed using EPI info (version 7.2). The difference between two proportions was tested using chi square test or fisher's exact test and the difference between two means was tested using student t test.

RESULTS

The All the 68 participants were retained for the final analysis. Both the groups were distributed equally in terms of age, gender, ASA status, weight and duration of surgery (Table 1).

Table 1: Demographic details of the participants.

Demographic factors	Group C	Group S	P-value
Number of patients	34	34	-
Age (years)	34.18±13.11	34.76±13.45	0.543
Gender (F/M) (%)	76.47/23.53	70.58/29.41	0.779
ASA I/II (%)	82.35/17.64	79.41/20.58	0.323
Weight (kgs)	55.76±9.38	51.88±7.50	0.064
Duration of surgery (mins)	40.68±12.41	43.29±11.63	0.373

Table 2: Progression of hemodynamic parameters at various intervals.

	Heart rate(Mean ± SD)			Mean Arterial pressure(Mean SD)			SpO ₂ (Mean ± SD)		
	Group C	Group S	P value	Group C	Group S	P value	Group C	Group S	P value
Baseline	83.74±13.91	80.24±7.98	0.208	91.23±8.94	87.85±9.28	0.131	99.11±0.89	99.27±0.92	0.528
Induction	84.41±12.24	80.79±7.78	0.150	85.84± 9.53	84.44±9.84	0.552	99.14±0.89	99.31±0.89	0.480
After LMA insertion									
+ 1 min	83.50±11.78	80.56±7.55	0.224	84.41±10.61	83.96±10.92	0.863	99.14±0.89	99.31±0.89	0.480
+ 2 min	83.68±10.36	83.94±6.56	0.900	85.28±10.36	84.17±10.25	0.656	99.33±0.68	99.45±0.74	0.546
+ 3 min	84.88±10.71	82.18±7.39	0.229	88.24±11.25	83.13±9.82	0.050	99.11±0.89	99.29±0.90	0.472
+ 5 min	83.47±11.63	80.09±8.77	0.180	86.41±9.84	83.11±10.53	0.185	99.11±0.89	99.27±0.92	0.528
+ 7 min	83.32±9.60	80.68±7.55	0.210	85.34±10.11	82.31±11.08	0.243	99.14±0.89	99.31±0.89	0.480
+ 10 min	82.94±11.55	79.85±7.95	0.204	87.15±9.63	83.10±10.59	0.103	99.33±0.68	99.45±0.74	0.546
+ 15 min	82.26±9.15	78.82±8.60	0.130	82.72±10.01	81.62±11.27	0.615	99.33±0.68	99.45±0.74	0.546
+ 20 min	80.97±9.54	80.53±9.11	0.846	84.09±10.11	83.51±11.40	0.825	99.11±0.89	99.27±0.92	0.528

The LMA was inserted in first attempt in 32 (94.11%) patients in group S and in 24 (70.58%) patients in group C, while two attempts were required in 2 patients in group S and 10 patients in group C; the difference being significant (p=0.011). With respect to the grades of insertion conditions, control group had 67.62% grade 1 (excellent), 32.38% grade 2 (satisfactory) and 0% grade 3 (poor), compared with succinylcholine group which had

73.53% grade 1 (excellent), 26.47% grade 2 (satisfactory) and 0% grade 3 (poor). No significant difference was observed between the ease of LMA insertion during first attempt between the groups (p=0.595).

Vital parameters were assessed and compared between the groups. The baseline heart rate was 83.74±13.91 in

Group C and 80.24 ± 7.98 in Group S and the difference was not significant. The difference remained insignificant throughout various intervals (at baseline, after induction and LMA insertion at 1, 2, 3, 5, 7, 10, 15 and 20 minutes). The baseline mean arterial pressure was 91.23 ± 8.94 and 87.85 ± 9.28 among Group C and Group S respectively and this difference was not statistically significant and remained insignificant at all levels. The baseline SpO₂ was 99.11 ± 0.89 and 99.27 ± 0.92 among Group C and Group S respectively and the difference was not statistically significant. Among both the groups the SpO₂ levels fluctuated around the baseline and at all levels, the SpO₂ difference were not statistically significant. (Table 2).

The baseline systolic blood pressure was 123.82 ± 11.12 mmHg and 122.50 ± 9.49 mmHg and the baseline diastolic blood pressure was 77.56 ± 8.87 mmHg and 77.15 ± 7.58 mmHg among Group C and Group S respectively and the differences remained insignificant throughout intervals ($p < 0.05$). The baseline EtCO₂ was 31.59 ± 2.11 and 31.38 ± 2.17 among Group C and Group S respectively and this difference was not statistically significant. Among both the groups the EtCO₂ levels fluctuated around the baseline and the difference were not statistically significant at all levels.

Table 3 details the occurrence of various complications among both the groups during and just after the insertion of LMA. Significant difference was observed between occurrence of episodes of fasciculation, head and limb movements, sore throat and coughing between the two groups.

Table 3: Comparison of complications between the groups.

Complications	Group C		Group S		P value
	No ^r	%	No ^r	%	
Fasciculation	0	0	22	64.71	<0.001*
Myalgia	8	23.53	12	35.29	0.2870
Head and limb movements	15	44.11	3	8.82	0.0111*
Sore throat	12	35.29	5	14.71	0.0499*
Coughing	7	20.59	0	0	0.05*
Laryngospasm	0	0	0	0	---

*- Denotes significance

Further grading of adverse responses to airway manipulation revealed majority of the episodes of coughing (n=4) and laryngospasm (n=11) to be mild in nature, while 2 out of 3 participants with head and limb movements during LMA insertion were graded as mild. (Table 4).

Table 4: Grading of adverse responses to airway manipulation.

	Absent		Mild		Moderate		Severe		Total		P value
	No ^r	%	No ^r	%	No ^r	%	No ^r	%	No ^r	%	
Coughing											
Group C	27	79.4	4	11.7	2	6.00	1	2.83	34	100	0.05
Group S	34	100	0	0	0	0	0	0	34	100	
Laryngospasm											
Group C	34	100	0	0	0	0	0	0	34	100	-
Group S	34	100	0	0	0	0	0	0	34	100	
Head and limb movements											
Group C	19	55.8	11	32.3	3	8.80	1	2.94	34	100	0.011
Group S	31	91.0	2	6.00	1	2.94	0	0	34	100	

The extra Propofol doses required were 22.06 ± 14.73 mg and 16.76 ± 13.87 mg among Group C and Group S respectively ($p = 0.1314$) and the apnoea time was 14.59 ± 10.91 seconds and 10.24 ± 7.06 seconds among Group C and Group S respectively ($p = 0.0551$); the differences being statistically insignificant.

DISCUSSION

Pressor response to endotracheal intubation have been studied from the past and have shown that epipharyngeal and laryngeal stimulation caused by laryngoscopy have led to transient significant increase in heart rate, blood pressure and increase in levels of plasma catecholamine.⁸ Laryngeal mask airway (LMA) is a noninvasive supraglottic airway device which has the advantage of being less stimulating than the tracheal intubation, as

visualization of cords and entry into larynx is not required.⁹ Hence the cardiovascular response to insertion of LMA is presumably much lower and there is an ease of insertion without a laryngoscope. The larger aim of the present study was to determine means of improving provider ease and patient safety in improving this process.

Various co-induction agents such as midazolam, opioids like fentanyl, alfentanil, remifentanil and butorphanol,

muscle relaxants such as mivacurium, atracurium, and rocuronium and drugs such as clonidine, dexmedetomidine, ketamine, and lignocaine, sevoflurane and succinylcholine are in use to aid propofol in LMA insertion. Since relaxation of the muscles of the airway is what would enable smooth insertion, a muscle relaxant would be the best agent to serve this purpose in theory. Muscle relaxants like Succinylcholine are still widely used because of its quick onset, short duration, and excellent intubating conditions; apart from being easily available and relatively inexpensive.¹⁰ The use of succinylcholine seems further advantageous in ambulatory anaesthesia, as it avoids depression of the respiratory centre and has no influence on consciousness; unlike opioids, α_2 agonists and benzodiazepines.¹⁰

The objective of the present study was to assess the effectiveness of Succinylcholine towards facilitation of laryngeal mask airway (LMA) insertion. There is no consensus on the dosage of Succinylcholine to be used. Most of the previous studies used a single arbitrary dose and did not compare two doses to get an ideal dose. Else, they used larger doses that resulted in significant postoperative myalgia. Monem et al, compared Succinylcholine 0.35 mg/kg with atracurium 0.06 mg/kg under thiopentone induction with no preinduction narcotic and found no failure in the succinylcholine group compared with 17% failure rate with atracurium. Postoperative myalgia was comparable in each group.¹¹ Yoshino et al compared 0.25 with 0.5 mg/kg of succinylcholine and found that 0.5 mg/kg of succinylcholine was required to blunt adverse airway reflexes associated with LMA insertion. The induction agent used was thiopentone without an opioid. Unfortunately, this dose was also coupled with more myalgia and a longer duration of apnoea.¹² Two different doses of succinylcholine 0.1mg/kg and 0.25mg/kg were compared by Leah George et al for LMA insertion and observed that overall insertion conditions were better in 0.25mg/kg group than 0.1mg/kg group.¹ After much deliberation, the dose of 0.25mg/kg of succinylcholine was chosen for the present study.

A total of 68 participants (34 in each group) were studied. The demographic data of patients (age, gender, body weight and ASA grade) were comparable in both the groups. Analysis of the grades of insertion conditions showed that Succinylcholine does help in ease of insertion of LMA, but the results could not attain the level of significance, partly attributable to propofol and midazolam co induction. Relatively small sample size may have played adverse role as well. The results are comparable with the findings of Leah George et al where he divided 283 patients into three groups to receive either normal saline, 0.1mg/kg succinylcholine or 0.25mg/kg succinylcholine and found that 84.9% patients had excellent overall insertion conditions in the 0.25 mg/kg group.¹ The results are also in correlation with the study conducted by Korula S et al, where he used low dose succinylcholine (0.35mg/kg) for insertion of LMA during

thiopental induction in comparison with atracurium (0.08mg/kg). He found the inserting conditions and ease of insertion to be better in the succinylcholine group.¹³ Overall insertion conditions were clearly better in the group S than group C. In group C, 32.38% patients had satisfactory ease of insertion compared to 26.47% patients in group S. One explanation could be that there was more patient movement in the group C during attempts to open the jaw; hence an additional dose of propofol was given before attempting insertion itself.

In the present study, addition of midazolam to propofol attenuated the physical responses to LMA insertion, providing excellent to satisfactory conditions in 100% of patients in group S & group C and successful insertion at first attempt in 94.11% patients in group S and 70.58% patients in group C. This is similar to the observations of Aghamohammadi et al, where they found successful LMA insertion in first attempt in 90% patients in group S whereas this rate was 46.6% patients in group C.² K.M. Ho and P.T. Chui in their study had also concluded that correct positioning of LMA after the first attempt was much more likely in the suxamethonium group.¹⁴

Haemodynamic stability was similar in both the groups; heart rate, mean arterial pressure and SpO₂ didn't differ much between the two groups at any point in time. Though a large drop in blood pressure was expected in the group C because they required extra Propofol, but they were found to be stable. The explanation could be the usage of midazolam, which also provides better insertion conditions and helps in reducing dose of propofol. The findings related to hemodynamic parameters are in agreement with previous similar studies.^{14,15}

With respect to complications, significant difference was observed between occurrence of episodes of fasciculation, head and limb movements, sore throat and coughing between the two groups. These findings are consistent with those by Aghamohammadi et al and Korula et al.^{2,13} The statistically significant difference in occurrence of fasciculations and sore throat ($p = 0.0499$) between the two groups is similar to observations of Yoshino et al.¹² The higher incidence of postoperative sore throat in control group than succinylcholine group could be because of more number of attempts required to insert the LMA in control group.

Waters et al, hypothesized that post succinylcholine myalgia is due to the shearing of soft tissues by the asynchronous muscle contractions. So a lesser dose of the drug will cause less myalgia. In this study the degree of fasciculations were only mild to moderate in 64.71% patients in group S. Mild post-operative myalgia was seen in 23.53% patients in group C. So it is possible that factors other than succinylcholine may have caused postoperative muscle pain.

Total propofol consumption was more in the control group, but there was no statistically significant difference between the two groups and the explanation to this could be the use of midazolam and fentanyl in both the groups. The duration of apnoea was more in controls. The control group though expected to have a shorter duration of apnoea had duration more than succinylcholine group. This is probably explainable because of the increased propofol consumption. These results are similar to those found by George et al and by K.M. Ho et al, where they found no significant difference in apnoea time and extra propofol consumption between the two groups.^{1,14}

CONCLUSION

In conclusion, mini dose succinylcholine does seem to help in insertion of the laryngeal mask airway but in combination with propofol and midazolam. The statistical insignificance in results could be partly attributed to smaller sample size.

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