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A Comparison of Midazolam and Mini-Dose Succinylcholine to Aid Laryngeal Mask Airway Insertion During Propofol Anaesthesia

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ABSTRACT

The laryngeal mask airway (LMA) insertion with the use of propofol as a single agent for induction of anaesthesia was not associated with high incidence of success. Many co-induction drugs had been used to improve the insertion condition. This study investigated the use of midazolam (M) or the use of mini-dose succinylcholine (S) as a co-induction agent with propofol to facilitate LMA insertion in 60 patients ASA I-II subjected to out-patient surgery. The patients were divided into three groups: propofol group (P) received intravenous propofol 2.5 mg/kg for induction of anaesthesia, group PM received intravenous midazolam 0.04 mg/kg 3 min before propofol and group PS received intravenous succinylcholine 0.1 mg/kg 30s after propofol. The number of (LMA) insertion attempts and the total propofol dose were recorded. Patients were assessed for jaw relaxation, gagging, coughing, patient movement, laryngospasm and the overall insertion condition. Also, the haemodynamic changes and apnoea were recorded. Fasiculation and myalgia were assessed in group PS. Significant reduction in the induction dose of propofol was observed in PM group (40%). The success rate at first attempt was 60%, 95% and 90% in the three groups, respectively (P, PM, PS). The overall insertion condition was excellent in 20%, 75%, 50% in group P, PM, PS, respectively. The number of patients with no gagging, coughing, patient movement or laryngospasm was significantly higher in group PM and PS compared to group P. Group PM showed less haemodynamic change and a shorter duration of apnoea after LMA insertion. The incidence of fasciculation and myalgia was 20% in group PS. The study showed that propofol, as a single agent, did not produce a satisfactory condition for LMA insertion. This can be improved by the use of midazolam or mini-dose succinylcholine. Midazolam had the advantage of reducing the dose of propofol and providing haemodynamic stability. Mini-dose of succinylcholine had the disadvantage that it cannot be used in patients with plasma cholinesterase deficiency and should be avoided in patients prone to myalgia.

Key Words: *Laryngeal mask airway (LMA) - Midazolam - Propofol - Low-dose succinylcholine - Airway reflexes.*

INTRODUCTION

The laryngeal mask airway (LMA) is an ingenious supraglottic airway device that is designed to provide and maintain a seal around the laryngeal inlet for spontaneous ventilation and allow controlled ventilation at modest level of positive pressure **[1]**. Successful insertion of LMA requires sufficient depth of anaesthesia and depression of airway reflexes to avoid gagging, coughing and laryngeal spasm **[8]**.

The intravent LMA instruction manual specifically recommends propofol for induction of anaesthesia during LMA insertion **[1]**. When used alone in unpremedicated patients, propofol requirements for uncomplicated LMA insertion often exceed 2.5 mg/kg **[13,15]**. However, easy insertion was seen only in about 62% of patients **[15]**. A variety of supplementary drugs were used to find a compound which eases LMA insertion, e.g. midazolam **[6]**, intravenous lignocaine **[15]**, alfentanil **[5]** and recently succinylcholine **[8,15]**.

This study was designed to compare the ease of LMA insertion using propofol alone, propofol in combination with midazolam and in combination with succinylcholine during diagnostic cyctoscopy in out-patient surgery in the National Cancer Institute (NCI), Cairo University.

PATIENTS AND METHODS

The study was done on 60 unpremedicated ASA I-II male patients subjected to elective diagnostic cyctoscopy under general anaesthesia using laryngeal mask airway. The patients were allocated to one of three groups:

Propofol group (Group P): Patients received intravenous (IV) propofol 2.5 mg/kg for induction of anaesthesia.

Midazolam group (Group PM): Patients received intravenous midazolam 0.04 mg/kg, 3 min before induction with propofol 2.5 mg/kg.

Succinylcholine group (Group PS): Patients received intravenous succinylcholine 0.1 mg/kg (mini dose), 30s after propofol 2.5 mg/kg was used for induction [8].

All patients were preoxygenated with 100% oxygen for 3 min, then the initial dose of propofol was injected at a constant rate over 30 seconds. The adequacy of anaesthesia was assessed by the loss of response to verbal command plus loss of eyelash reflex (the desired end-points). If inadequate, further boluses of propofol 0.25 mg/kg every 15s were given as required. LMA insertion was attempted 30s after loss of eyelash reflex in groups P and PM and 30s after succinylcholine injection in group PS, using the technique described in intravent laryngeal mask instruction manual [1]. If more than one insertion attempt was required, the patient was kept adequately anaesthetized with inhalation of isoflurane (2%) and nitrous oxide/ oxygen, using the ordinary face mask. Patients were monitored with electrocardiogram, noninvasive arterial blood pressure device, pulse oximetry and capnogram.

The anaesthetist assessed the condition during LMA insertion as regards: jaw relaxation (good-incomplete-poor) according to the criteria of Young et al. [17], gagging or coughing (none-mild-moderate-severe), patient movement (none-mild-moderate-severe) and laryngospasm (none-partial-total) according to Nimmo et al. [12].

The overall insertion condition was assessed according to the modified scheme of Lund and Stovner [10]:

- Excellent-no gagging, coughing, patient movement or laryngospasm.
- Good-mild to moderate gagging, coughing or patient movement with no laryngospasm.
- Poor-moderate to severe gagging coughing or patient movement with no laryngospasm.
- Unacceptable-severe gagging, coughing, patient movement or laryngospasm.

The total dose of propofol, the occurrence of fasiculation (in group PS), apnoea, desaturation (SaO_2 < 90%) for more than 30s and the number of insertion attempts were recorded, but scoring of LMA insertion was only performed for the first insertion attempt. Following successful LMA insertion, anaesthesia was maintained by isoflurane 1-2% and N_2O/O_2 50:50. Mean arterial blood pressure, oxygen saturation and heart rate were recorded pre-induction, after induction of anaesthesia and after laryngeal mask insertion. Myalgia (in group PS) was assessed at discharge from the hospital.

Statistical methods:

Statistical analysis was performed using analysis of variance (ANOVA) with Bonferroni's *t*-test and chi-square test to compare groups. Fisher's exact test was used to compare insertion conditions. p <0.05 was considered statistically significant.

RESULTS

There were no significant differences between the three groups in demographic data (Table 1).

The total induction dose of propofol was significantly reduced in group PM compared to group P and PS (p <0.01). The difference was insignificant between group PS and group P (Table 2).

LMA was successfully inserted after first attempt in 19 patients (95%) in group PM and in 18 patients (90%) in group PS (p =0.432). Compared to 16 patients (60%) in group P, the difference was significant (p <0.05). The overall insertion condition of LMA was graded excellent in 15 patients (75%) in group PM compared to 10 patients (50%) in group PS (p <0.05). Both numbers were highly significant compared to group P, 4 patients (20%). No significant difference between the three groups in the number of patients graded good (Table 3).

A significant difference in the number of patients with good jaw relaxation was observed between group PM 19 patients (95%) and PS 14 patients (70%) (p <0.05). The difference was highly significant in both groups when compared to group P (p <0.01). The number of patients with no gagging and coughing, laryngospasm or patient movement was significantly higher in group PM and PS compared to group P (Table 4).

In groups P and PS, there was a significant decrease in MAP and increase in HR in post-induction compared to pre-induction levels. Also, there was a trend toward reduction in SaO_2 in post-induction and post-insertion records but insignificant. No significant changes in MAP, HR and SaO_2 was observed in group PM (Table 5).

After LMA insertion, apnoea was observed in 17, 11, 16 patients in group P, PM and PS, respectively. The number was significantly lower in group PM compared to P and PS group (Table 6). The duration of apnoea was 43 (±5.5), 29 (±6) and 45 (±7) seconds in the three groups, respectively. Desaturation occurred only in one patient in group PM compared to 12 and 14 patients in group P and PS (Table 6).

Fasiculation and myalgia were recorded in 20% of patients in group PS.

Table (1): Demographic data, numbers or mean (±SD).

	Group P	Group PM	Group PS
No. of patients	20	20	20
Age (yr)	45 (±5)	42 (±4)	38 (±8)
Weight (kg)	68 (±7)	63 (±6)	59 (±8)
ASA grade; I/II	15/5	13/7	14/6

Table (2): Total dose of propofol in each group, mean (±SD).

	Group P	Group PM	Group PS
Total propofol dose (mg)	198 (±9.5)	119 (±7.5)**	184 (±11.3)
Propofol dose (mg/kg)	3.1 (±0.65)	1.75 (±0.14)	2.9 (±0.54)

** $p < 0.01$ compared to P and PS.

Table (3): The number of patients (%) with first atempt success and overall insertion condition.

	Group P	Group PM	Group PS
First attempt	12 (60%)	19 (95%)*	18 (90%)*
1-2 attempts	5 (25%)	0 (0%)	1 (5%)
> 2 attempts	3 (15%)	1 (5%)	1 (55%)
Overall ins. cond.:			
Excellent	4 (20%)	15 (75%)*	10 (50%)*
Good	6 (30%)	5 (25%)	7 (35%)
Poor	2 (10%)	0 (0%)	1 (5%)
Unacceptable	8 (40%)	0 (0%)	2 (10%)

* $p < 0.05$ compared to P group.

Table (4): Conditions during LMA isnertion, the number of patients.

	Group P	Group PM	Group PS
Jaw relaxation:			
Good	4 (20%)	19 (95%)**	14 (70%)**
Incomplete	8	1	4
Poor	8	0	2
Gagging, coughing:			
None	5 (25%)	18 (90%)**	17 (85%)**
Mild	6	1	2
Moderate	4	1	1
Severe	5	0	0
Patient movements:			
None	9 (45%)	15 (75%)*	14 (70%)*
Mild	1	4	3
Moderate	7	1	3
Severe	3	0	0
Laryngospasm:			
None	14 (70%)	20 (100%)*	19 (95%)*
Partial	5	0	1
Total	1	0	0

* $p < 0.05$ compared to P group.
** $p < 0.01$ compared to P group.

Table (5): Mean arterial pressure (MAP), heart rate (HR) and arterial oxgen saturation (SaO_2) in each group, mean (±SD).

	Group P	Group PM	Group PS
MAP(mmHg):			
Pre-induction	90 (±4.5)	88 (±2.5)	91 (±3)
Post- induction	82 (±3.5)*	86 (±3.5)	81 (±4.5)*
Post -insertion	84 (±4.5)*	84 (±4)	87 (±3.5)
HR (beat/ min):			
Pre- inbuction	81 (±4)	74 (±4)	82 (±3)
Post- induction	89 (±3)*	76 (±3)	89 (±3)*
Post- insertion	95 (±6)*	72 (±3)	78 (±4)
SaO_2 (%):			
Pre- induction	96 (±1.5)	97 (±1.3)	96 (±1.5)
Post- induction	95 (±1)	96 (±1)	94 (±1)
Post- insertion	93 (±3)	95 (±1.5)	93 (±3.1)

* $p < 0.05$ compared to pre-induction levels.

Table (6): Patient response after LMA insertion, number of patients.

	Group P	Group PM	Group PS
Apnoea	17	11*	16
Laryngospasm	0	0	0
Bronchospasm	1	0	0
Desaturation > 30s (SaO2 < 90%)	12	1**	14

* $p < 0.05$ compared to P and PS groups.
** $p < 0.01$ compared to P and PS groups.

DISCUSSION

The use of laryngeal mask airway (LMA) is well established in anaesthetic practice. LMA enables the anaesthetist to keep both hands free and obviates the need for tracheal intubation in some day-case surgeries [7,9,13]. Propofol (2.5-3 mg/kg) is the induction agent of choice for LMA insertion [1]. Problems with this technique include hypotension, apnoea, excessive patient movement and laryngospasm, so a number of co-induction drugs were introduced to overcome these problems [2,6,14,16]. Insertion of laryngeal mask immediately after induction and before introduction of volatile agents is desirable, as it shortens the induction time and improves patient turn-around [15]. The transient high plasma propofol concentration which follows the rapid bolus induction is required to allow LMA insertion without excessive reaction in unpremedicated day-surgery patients [15].

In the present study, despite using a well-recognized end-point for induction of anaesthesia, the use of propofol alone was associated with gagging and coughing in 75% of patients. The residual upper airway reflexes, which may cause gagging and coughing were a major cause of failed LMA insertion in the present study, the incidence of successful insertion at first attempt was only 60%. Coughing and gagging make correct positioning difficult or even impossible [15]. Kinirons et al. [9], recommended delayed insertion after assisted ventilation for 2 min with isoflurane to minimize patient response after LMA insertion.

Benzodiazepines are well known to reduce upper airway reflexes [11]. Midazolam, when combined with propofol, was found to reduce the dose of propofol and improve the condition for LMA insertion [5,6]. Driver et al. [6] used the triple combination of propofol-midazolam-alfentanil with significant reduction in propofol doses and excellent condition for laryngeal mask insertion. In the present study, midazolam was used in a fixed dose (0.04 mg/kg) which represented the every day anaesthetic practice. The combination of propofol and midazolam resulted in about 40% reduction in propofol dose needed for insertion of the LMA. This was associated with less hypotension and more cardiovascular stability which may be useful in elderly patients. Comparing to the other two groups, the use of midazolam was associated with more jaw relaxation, less gagging and coughing and less patient movement resulting in excellent or good insertion condition in all patients with a higher incidence of successful insertion at first attempt.

The patients receiving this combination (PM) could have been more deeply anaesthetized or more likely this combination could depress upper airway reflexes to a greater degree. The use of a recognized and consistent induction end-point and the observed reduction in propofol requirements cannot exclude the possibility of a deeper level of anaesthesia. Following insertion of LMA, in midazolam group, apnoea time was less observed and of shorter duration than the other groups. The apnoea associated with propofol alone was recorded to be in the average of 3 min [4,14].

The use of a rapid onset, short acting neuoromuscular blocking agent such as succinylcholine, may be another choice, as this drug suppresses laryngeal reflexes by depolarization of motor neurone end-plates [3,8,16]. Side effects include prolonged apnoea, true anaphylaxis and the most frequent, although minor, myalgia [8]. The usual dose of succinylcholine required for intubation is 1-2 mg/kg [8]. A small dose, 0.1 mg/kg, had been shown to be effective in abolishing tonic adduction of vocal cords during laryngospasm without causing prolonged apnoea [3]. Succinylcholine has the advantage of having a rapid onset and short duration of action.

In the present study the use of mini-dose succinylcholine facilitated LMA insertion probably by relaxing the laryngeal muscles, thus improving mouth opening and attenuating the gagging and coughing responses. The improvement in overall insertion condition was comparable to that of midazolam (excellent and good). Yoshino et al. [16] used higher doses of succinycholine (0.25-0.5 mg/kg) for insertion of LMA with thiopentone as induction agent. The 0.5 mg/kg dose gave better results but with more side effects (apnoea, fasiculation and myalgia).

In the present study, following LMA insertion, a tendency toward desaturation was observed with the use of succinylcholine and even more than using propofol alone. The duration of apnoea was longer than PM group, but it was not a clinical problem. However, the duration of apnoea may be much longer in those with plasma cholinesterase deficiency and should be

avoided in those patients.

Although myalgia was assessed only at discharge from hospital, the incidence was high (21%), the male sex in the present study may explain this finding. Succinylcholine is not recommended in patients prone to such myalgia **[8,16]**.

Conclusion:

Propofol as a single agent did not produce a satisfactory condition for LMA insertion. This can be improved by the use of midazolam or succinylcholine. Midazolam had the advantage of reducing the dose of propofol and maintaining haemodynamic stability. Mini-dose of succinylcholine had the disadvantage that it can not be used in patients with plasma cholinesterase deficiency and should be avoided in patients prone to myalgia.

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