Use Of Low-Dose Suxamethonium To Facilitate Laryngeal Mask Insertion Under Etomidate Anaesthesia

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Abstract

Despite the popularity of laryngeal masks (LMA) for airway maintenance during general anaesthesia, there is still no optimal induction technique that guarantees good insertion conditions whilst maintaining cardiovascular stability and rapid onset of respiration. The most popular induction agent for LMA insertion continues to be propofol as this agent best obtunds oropharyngeal reflexes1,2. Studies show an incidence of poor insertion conditions ranging from 38 to 60%3,4,5 with standard induction doses (2-3mg kg-1) of propofol. However, its use in doses which allow adequate jaw relaxation and prevent patient reaction to LMA insertion[1,5] i.e., movement & laryngospasm commonly results in hypotension 6,7,8,9,10,11 and prolonged apnoea[12]. Although probably inconsequential in a fit patient, these side effects are undesirable in the elderly or those with cardiovascular disease.

INTRODUCTION

There have been numerous papers that looked into co-induction techniques combining a lower dose of propofol or thiopentone with other agents, including benzodiazepines[13,14,15,16], rapidly acting opiates[3,16] neuromuscular blocking agents4,[17,18,19] and topical[20] or intravenous[5] local anaesthetic agents.

Etomidate is known to have greater cardiovascular stability than the other intravenous induction agents, even in patients with cardiovascular risk factors [11,12,21,23]. In this study, we propose to use the combination of etomidate 0.3mg kg^{-1} with various low doses of suxamethonium so as to obtain good LMA insertion conditions whilst maintaining cardiovascular stability.

METHODS

With Institutional Ethics Committee approval, 60 ASA I & II patients were randomly allocated into 3 groups of 20 patients. We excluded all patients suffering from cardiovascular disorders or taking anti-hypertensive or cardiac drugs that could interfere with normal cardiovascular physiology. The patients age range was 17 to 59 years. All subjects presented to the Singapore General Hospital for surgery under general anaesthesia with spontaneous ventilation through a laryngeal mask airway. Informed consent was obtained from all patients pre-operatively.

All patients were unpremedicated. Non-invasive blood pressure (NIBP), electrocardiogram (ECG) and pulse oximetry were monitored using a Hewlett Packard GMX modular system and intravenous access secured prior to pre-oxygenation. Induction of anaesthesia was performed with a rapid bolus of etomidate 0.3mg kg^{-1}. This was followed immediately by the administration of normal saline in group A, suxamethonium 0.25mg kg^{-1} in group B and suxamethonium 0.5mg kg^{-1} in group C. The study drug was made up to 2ml with normal saline to ensure that the anaesthetist inserting the laryngeal mask was blinded to the treatment given. The laryngeal mask was then inserted 60 seconds after the administration of the drugs in the manner described in the Intravent manual. If jaw relaxation was found to be inadequate to permit LMA insertion, boluses of propofol 50mg were given until adequate relaxation occurred. The position of the LMA was verified by capnography, chest movement and the absence of gas leak around the cuff.

Heart rate (HR) and mean arterial blood pressure (MAP) readings were taken pre-induction, 30 seconds post-induction, and 30 seconds post-LMA insertion. The apnoea time was taken from time of insertion of LMA to resumption of respiration. Inhalational anaesthetic agents were not delivered to the patients until after the resumption of respiration. Ventilation was not assisted unless the patient's oxygen saturation fell below 95%. In that instance, the

apnoea time was abandoned. The number of attempts taken to insert the laryngeal mask was noted together with degree of jaw relaxation and overall insertion conditions. The reaction from the patient was also graded.

Jaw relaxation was graded as 1=good, 2=incomplete or 3=poor according to the classification by Young, Clark and Dundee[21]. Overall insertion conditions were graded in a system modified from Lund and Stovner[22], as 1=excellent (insertion easy, no reaction from patient), 2=good (insertion results in slight cough or movement), 3=poor (insertion possible but with marked patient response) or 4=impossible. Patient response was divided in to coughing, gagging, swallowing, movement (head or limbs) and laryngospasm. Each response was graded as 1=none, 2=mild, 3=moderate or 4=severe. The presence and degree of muscle fasciculation was graded according to the classification by Mingus, Erlich and Eisenkraft[23] into 1=none (no fasciculations), 2=mild (fasciculations of eyes, face, neck or fingers with no limb movement), 3=moderate (fasciculations involving limbs and/or trunk) or 4=severe (vigorous movement of one or more limbs requiring restraint).

During the period of apnoea, no opiates, inhalational agents or induction agents were given. The apnoea time was not recorded in the patients where propofol had to be given as the escape agent to enable laryngeal mask insertion nor in those patients who required assisted ventilation for desaturation below 95%.

Anaesthesia was then maintained with the oxygen (2L min^{-1}), nitrous oxide (4L min^{-1}), isoflurane (1-2%) and fentanyl (1mcg kg^{-1}). Non-steroidal anti-inflammatory agents and anti-emetics were not routinely prescribed.

The patients were reviewed in recovery and by telephone interview on the third post-operative day to assess the incidence of sore throat and myalgia. This was graded by the patients as none, mild, moderate or severe.

The Pearson Chi-Square test was used to compare success rate between the groups. The Kruskall-Wallis test was used to compare the degree of jaw relaxation, overall insertion conditions, patient movement, and incidence of sore throat and myalgia. Control group patients were not included in the analysis of apnoea time, or HR/MAP changes as 16 of the 20 patients required propofol for successful LMA insertion, and we felt that this would complicate the interpretation of cardiovascular and respiratory variables. Thus, the Wilcoxon rank sum test was used to study the cardiovascular variables and the Mann-Whitney U test was used to compare the duration of apnoea in the two groups of patients who received suxamethonium. The statistical package SPSS for windows was used for the calculations. All continuous data was presented as median and range as the data did not conform to a normal distribution. A probability value of less than 0.05 was considered statistically significant.

RESULTS

There were no significant differences in patient characteristics between the 3 groups (Table I). None of the patients suffered any serious adverse events during this study.

Figure 1

Table I: Patient demographics and duration of operation. No significant differences were found between the groups.

	Group A (control) n=20	Group B (0.25mg kg^{-1}) n=20	Group C (0.5mg kg^{-1}) n=20
Age-years (median & range)	30.5 (18-59)	41.0 (26-54)	39.5 (17-59)
Sex Male: Female	12:8	7:13	10:10
Weight-kg (median & range)	60.5 (43-101)	53.0 (41-82)	56.5 40-87)
Length of Operation-min (median & range)	15 (5-150)	20 (10-90)	20 (10-70)

The administration of suxamethonium significantly increased the success rate of LMA insertion as compared to the control group ($p<0.01$)--Table II. Jaw relaxation was significantly better in the patients given suxamethonium as compared to the control group ($p<0.001$)--Table II. Overall insertion conditions were also significantly better in the patients who received suxamethonium (Table II, $p<0.001$). 39 of the 40 patients given suxamethonium had the LMA successfully inserted with excellent or good insertion conditions. In contrast, only one of the four successes in the control group had excellent or good insertion conditions.

Figure 2

Table II: Success rate of LMA insertion, distribution of grade of jaw relaxation and overall insertion conditions.

		Group A n=20	Group B n=20	Group C n=20
Success Rate p<0.01		4/20 (20%)	19/20 (95%)	20/20(100%)
Grade of Jaw Relaxation p<0.001	Good	1	18	19
	Incomplete	4	2	1
	Poor	15	0	0
Overall Insertion Conditions P<0.001	Excellent	0	15	15
	Good	1	4	5
	Poor	5	0	0
	Impossible	14	1	0

There was significantly more moderate to severe coughing ($p<0.001$), gagging ($p<0.01$) and swallowing ($p<0.001$) in group A patients in response to LMA insertion as compared

to groups B and C (Table III). The incidence of head or limb movement (Table III) and laryngospasm (two patients in group A, none in group B and one in group C) failed to reach significance.

Figure 3

Table III: Distribution table of coughing, gagging, swallowing and movement in response to LMA insertion.

		Group A n=20	Group B n=20	Group C n=20
Incidence of Coughing P<0.001	None	13	20	20
	Mild	2	0	0
	Moderate	2	0	0
	Severe	3	0	0
Incidence of Gagging P<0.01	None	13	19	20
	Mild	1	1	0
	Moderate	3	0	0
	Severe	3	0	0
Incidence of Swallowing P<0.001	None	9	15	20
	Mild	5	3	0
	Moderate	2	2	0
	Severe	4	0	0
Incidence of Movement P>0.05	None	9	11	13
	Mild	1	5	6
	Moderate	4	4	1
	Severe	6	0	0

There was no significant difference in the incidence of fasciculations in the 2 groups given suxamethonium (Table IV). Of the three patients who had severe fasciculations, one had no myalgia at all, one complained of myalgia on day 3 and the last complained of myalgia in recovery, but was subsequently lost to follow-up.

Figure 4

Table IV: Incidence of fasciculations (number). P

	Group B n=20	Group C n=20
None	2	3
Mild	10	6
Moderate	6	10
Severe	2	1

The duration of apnoea in group A was not assessed, as 16 of the 20 patients received varying amounts of propofol. We felt that the remaining four subjects would not accurately represent the respiratory effects seen with etomidate anaesthesia alone. The duration of apnoea in group B was 32.7s (range 0-114s) whilst that in group C was 88.7s (range 30-240s), p<0.001.

After LMA insertion, there was a rise in MAP of 27 and 25 mmHg in the patients given suxamethonium 0.25mg kg^{-1} and 0.5mg kg^{-1} respectively. The median change in MAP in the control group was -1mmHg. LMA insertion resulted in a median rise in heart rate of 19 and 15 in groups B and C respectively (Table V).

Figure 5

Table V: Cardiovascular response to induction and LMA insertion

	Group B n=20	Group C n=20
Post Induction ΔMAP	0 -19 to +29	+2.5 -29 to +20
Post LMA ΔMAP	+27 -29 to +40	+25 -36 to +54
Post Induction ΔHR	+7.5 -22 to +35	+16.5 -23 to +44
Post LMA ΔHR	+19 -12 to +57	+15 +1 to +19

(median change, range). P<0.001.

Of the 60 subjects recruited, three were lost to follow-up on the third post-operative day (two from group B and one from group C). We found no significant differences in the incidence of sore throat or myalgia both in recovery and on the third post-operative day (Table VI).

Figure 6

Table VI: Frequency of sore throat and myalgia in recovery and on day 3. P>0.05.

		Group A	Group B	Group C
Incidence of Sore Throat in Recovery	None	12	11	11
	Mild	8	7	5
	Moderate	0	1	1
	Severe	0	1	2
Incidence of Sore Throat on Day 3	None	18	13	12
	Mild	2	4	5
	Moderate	0	1	1
	Severe	0	0	1
Incidence of Myalgia in Recovery	None	20	20	18
	Mild	0	0	1
	Moderate	0	0	1
	Severe	0	0	0
Incidence of Myalgia on Day 3	None	18	16	16
	Mild	2	2	3
	Moderate	0	0	0
	Severe	0	0	0

DISCUSSION

Etomidate as a sole induction agent does not provide adequate jaw relaxation for the insertion of LMAs, and is often associated with marked patient response in terms of coughing, gagging, swallowing, movement and laryngospasm. In this study, the induction dose of 0.3mg kg^{-1} was given to all patients. A higher dose of etomidate was not used as no studies have been done to ascertain safety at larger doses.

Etomidate with the addition of suxamethonium at the doses employed allowed a high insertion success rate with little patient response. With suxamethonium 0.25mg kg^{-1}, a rapid return of respiration occurred, resulting in a period of apnoea not dissimilar to that seen with propofol anaesthesia[3,20,25].

Although suxamethonium 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 and inadvertent administration to patients with pseudocholinesterase deficiency or malignant hyperthermia may occur. These were not problems that were encountered in our study. Our apnoea duration appears to be less than documented with propofol in previous studies[3,4,20], although formal statistical analyses have not been used to compare the significance of the differences.

The incidence of myalgia was not significantly different in the groups treated with suxamethonium when compared to control.

We assumed that the metabolism of suxamethonium would occur prior to the re-distribution of etomidate, thus allowing a deepening of anaesthesia with inhalational agents (isoflurane or sevofluane) prior to the onset of awareness. Our clinical observation was that although this occurred in most patients, there were a few who had jerky movements and lacrimation prior to the onset of respiration. We did not investigate this group any further as a depth of anaesthesia monitor was not available for use in our unit. This deficiency should be reviewed as awareness may become a problem. In routine clinical practice, however, a strict apnoea time would not be monitored, and assisted ventilation with volatile anaesthetic agents can be used to prevent awareness.

Our results also showed no significant difference in the incidence of myalgia post-operatively in the 3 groups. We acknowledge other studies showing myalgia after the use of sub-paralysing doses of suxamethonium[17,18],[27]. It may be that a larger sample size would be needed to demonstrate a difference in the 3 groups.

The paper by Yoshino et al[18] comparing different doses of suxamethonium with thiopentone for insertion of LMA showed significantly better insertion conditions with suxamethonium 0.5mg kg^{-1}. They therefore advocated this as the optimum dose despite the prolonged duration of apnoea and higher incidence of myalgia on the third post-operative day.

In our study, however, the use of etomidate as the induction agent allowed us to have favourable insertion conditions with minimal apnoea or cardiovascular instability when suxamethonium 0.25mg kg^{-1} is administered concurrently.

Etomidate is now most commonly administered to patients with cardiovascular disease, where hypotension secondary to propofol or thiopentone may be a problem. The addition of 0.25mg kg^{-1} of suxamethonium gives us the ability to rapidly and reliably secure such a patient's airway with an LMA. The low incidence of myalgia may result in early ambulation and this combination could therefore be suitable for patients presenting for day surgery. The ability to insert an LMA without mask ventilation using volatile anaesthetic agents also avoids pollution of the theatre atmosphere.

Etomidate is known to be associated with a high incidence of post-operative nausea and vomiting[28,29], pain on injection[30] and excitation phenomena[30] at induction. We did not collect data on the incidence of post-operative nausea and vomiting, but it did not seem to be a major problem in our series despite a significant proportion of our patients undergoing gynaecological surgery, and no use of anti-emetics. The etomidate was supplied as Etomidate-Lipuro (B.Braun), and its rapid injection produced minimal discomfort, which is in direct contrast to the original formulation in propylene glycol. Marked excitation was common in the control patients, but this seemed to be abolished with the addition of small doses of suxamethonium.

CONCLUSION

In conclusion, we feel that etomidate 0.3 mg kg^{-1} plus suxamethonium 0.25 mg kg^{-1} is an effective and inexpensive alternative to propofol for facilitating LMA insertion, with the added advantage of lack of cardio-respiratory depression.

References

1. Scanlon P, Carey M, Power M, Kirby F. Patient response to laryngeal mask insertion after induction of anaesthesia with propofol or thiopentone. Can J Anaesth 1993; 40(9): 816-8.
2. Brown GW, Ellis FR. Comparison of propofol and increased doses of thiopentone for laryngeal mask insertion. Acta Anaesthesio Scand 1995; 39(8): 1103-4.
3. Ang S, Cheong KF, Ng TI. Alfentanil co-induction for laryngeal mask insertion.Anaesth Intensive Care 1999;27(2):175-8.
4. Chui PT, Cheam EW. The use of low-dose mivacurium to facilitate insertion of the laryngeal mask airway. Anaesthesia 1998; 53(5):491-5.
5. Stoneham MD, Bree SE, Sneyd JR. Facilitation of laryngeal mask insertion. Effects of lignocaine given intravenously before induction with propofol. Anaesthesia 1995; 50(5): 464-6.
6. Hickey S, Cameron AE, Ashbury AJ. Cardiovascular response to insertion of Brain's laryngeal mask. Anaesthesia 1990; 45(8): 629-33.
7. Blake DW, Dawson P, Donnan G, Bjorksten A. Propofol induction for laryngeal mask insertion: dose requirement and cardiorespiratory effects. Anaesth Intensive Care 1992; 20(4): 479-3.
8. Acalovschi I, Miclesu A, Bugov L. The effects of

propofol on laryngeal reactivity and the haemodynamic response to laryngeal mask insertion. Eur J Anaesthesiol 1995; 12(4): 351-6.
9. Harris CE, Murray AM, Anderson JM, Grounds RM, Morgan M. Effects of thiopentone, etomidate and propofol on the haemodynamic response to tracheal intubation. Anaesthesia 1988; 43 suppl: 32-6.
10. Boysen K, Sanchez R, Krintel JJ, Hansen M, Haar PM, Dyrberg V. Induction and recovery characteristics of propofol, thiopental and etomidate. Acta Anaesthesio Scand 1989; 33: 689-92.
11. Gill RS, Scott RP. Etomidate shortens the onset time of neuromuscular block. Br J Anaesth 1992; 69(5): 444-6.
12. Gillies GW, Lees NW. The effects of speed of injection on induction with propofol. a comparison with etomidate. Anaesthesia 1989; 44(5): 386-8.
13. Bapat P, Joshi RN, Young E, Jago RH. Comparison of propofol versus thiopentone with midazolam or lidocaine to facilitate laryngeal mask insertion. Can J Anaesth 1996; 43(6): 564-8.
14. Driver I, Wilson C, Wiltshire S, Mills P, Howard-Griffin R. Co-induction and laryngeal mask insertion. A comparison of thiopentone versus propofol. Anaesthesia 1997; 52(7): 698-700.
15. Godsiff L, Magee L, Park GR. Propofol versus propofol with midazolam for laryngeal mask insertion. Eur J Anaesthesiol Suppl 1995; 12: 35-40.
16. Nakaazawa K, Hikawa Y, Maeda M, et al. Laryngeal mask airway insertion using propofol without muscle relaxants: a comparative study of pre-treatment with midazolam or fentanyl. Eur J Anaesthesiol 1999; 16: 550-5.
17. Ho KM, Chui PT. The use of mini-dose suxamethonium to facilitate the insertion of a laryngeal mask airway. Anaesthesia 1999; 54(7): 686-9.
18. Yoshino A, Hashimoto Y, Hirashima J, Hakoda T, Yamada R, Uchiyama M. Low dose succinyl choline facilitates laryngeal mask insertion during thiopental anaesthesia. Br J Anaesth 1999; 83(2): 279-83.
19. Koh KF, Chen FG, Cheong KF, Esuvaranathan V. Laryngeal mask insertion using thiopental and low-dose atracurium: a comparison with propofol. Can J Anaesth 1999; 46(7): 670-4.
20. Seavell CR, Cook TM, Cox CM. Topical lignocaine and thiopentone for the insertion of a laryngeal mask airway; a comparison with propofol. Anaesthesia 1996; 51(7): 699-701.
21. Gooding Jm, Corssen G. Effect of etomidate on the cardiovascular system. Anaesth Analg 1997; 56(5): 717-9.
22. Lund I, Stovner J. Dose-response curves for tubocurarine, alcuronium and pancuronium. Acta Anaesth, Scand 1970 37S: 238-42.
23. Ostwald P, Doenicke AW. Etomidate revisited. Curr Opin Anaesthesiol 1998; 11: 391-8.
24. Scheffer GJ, Ten Voorde BJ, Karemaker JM, Ros HH, De Lange JJ. Effects of thiopentone, etomidate and propofol on beat-to-beat cardiovascular signals in man. Anaesthesia 1993; 48: 849-55.
25. Young HAS, Clark RSJ, Dundee JW. Intubating conditions with AH 8165 and suxamethonium. Anaesthesia 1975; 30: 30-3.
26. Mingus ML, Herlich A, Eisenkraft JB. Attenuation of suxamethonium myalgia. Anaesthesia 1990; 45: 834-7.
27. Nimmo SM, McCann N, Broome IJ, Robb HM. Effectiveness and sequelae of very low-dose suxamethonium for nasal intubation. Br J Anaesth 1995; 74: 31-34.
28. Giese JI, Stockham RJ, Stanley TH, Pace NL, Nelissen RH. Etomidate versus thiopental for induction of anaesthesia. Anaesth Analg 1985; 64(9): 871-6. Holdcroft A, Morgan M, Whitwam JG, Lumley J. Effect of dose and premedication on induction complications with etomidate. Br J Anaesth 1976; 48: 199-205.
29. Schuermans V, Dom J, Dony J, Scheijgrond H, Brugmans J. Multinational evaluation of etomidate for anaesthesia induction. Conclusions and consequences. Anaesthetist 1978; 27(2): 52-9.
30. Spanos A, Chiu HH, Tye CY. Effects of etomidate given in repeat doses. Anaesth Intensive Care 1978; 6(4): 337-41.

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