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Laryngeal mask airway insertion with remifentanil

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Summary : *Introduction* : We conducted a study to find out the best conditions for LMA insertion with two different doses of remifentanil added to propofol and propofol administered alone.
Methods : Following hospital clinical research ethics committee approval, 60 ASA I-II patients were included in the randomized double-blind study. Following premedication, patients received i.v. 0.25 µg kg^{-1} remifentanil (Group R1), 0.50 µg kg^{-1} remifentanil (Group R2) or normal saline (Group P) in 60 sec. Then following 20 mg lidocaine, propofol 2 mg kg^{-1} were administered in R1 and R2 groups and 2.5 mg kg^{-1} in P group. Ease of insertion of LMA and airway quality at first attempt was assessed. Number of attempts of LMA insertion, apnea time, additional propofol requirement and hemodynamic changes were recorded.
Results : There were no significant differences in demographic data among the patients. Apnea time (mean ± SEM) was significantly shorter in P group (34.09 ± 5.5sec) compared to R1 (82.5 ± 12.7sec) and R2 (87.2 ± 6.6sec) groups ($p = 0.01$ and $p = 0.001$). Ease of LMA insertion was assessed as grade 1 in 100% of patients in R2 group while 65% in R1 and 30% in P groups. Undesirable responses following LMA insertion were observed in 54% of patients in P group.
Conclusion : Propofol given 2.5 mg kg^{-1} alone is not a good agent for LMA insertion. Remifentanil used in both doses combined with propofol provides good and excellent conditions for insertion of LMA with minimal hemodynamic disturbances.

Key words : Laryngeal mask airway ; remifentanil ; propofol.

INTRODUCTION

LMA insertion requires suppression of the upper airway reflexes. Propofol is the commonly used anesthetic agent for the induction of anesthesia for insertion of laryngeal mask airway (LMA) because of its depressant effects on the airway reflexes. When used alone, propofol may be inadequate to blunt undesirable airway responses (1). Increasing the dose to prevent these may cause hemodynamic disturbances (2). We conducted a study to find out the best conditions for LMA insertion with two different doses of remifentanil, a potent short-acting opioid, added to propofol and propofol administered alone.

METHODS

Following hospital clinical research ethics committee approval and informed patient consent, 60 ASA I-II patients undergoing lower abdominal or urologic operations were included in the randomized double-blind study. Patients with a history of gastric reflux, history of allergy to any of the study drugs or suspected difficult airway and those receiving opioids or benzodiazepines were excluded from the study. All patients were premedicated in a standard fashion in our clinic with i.m. midazolam 0.2 mg kg^{-1} for sedation and atropine 0.5 mg for decreasing secretions, given 30 minutes before the operation. Following standard monitoring including Sp02 and baseline hemodynamic measurements, patients were randomly allocated using an envelope system to receive either i.v. 0.25 µg kg^{-1} remifentanil (Group R1), 0.50 µg kg^{-1} remifentanil (Group R2) or normal saline (Group P) prepared in 10 ml syringe and injected in 60 sec. Then following 20 mg lidocaine, propofol 2 mg kg^{-1} were administered in R1 and R2 groups and 2.5 mg kg^{-1} in P group with an equal volume of syringe. LMA insertion was tried 1 minute following the propofol dose by one of the three different anesthesiology residents who has the same experience level.

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Ease of insertion of LMA was graded by 3-point scale :

Grade 1 : excellent, no response to LMA insertion

Grade 2 : acceptable, gagging or swallowing with insertion of LMA

Grade 3 : poor, unable to open mouth or biting upon insertion of LMA (3). Apnea time was assessed as the time from the end of propofol injection to the resumption of a spontaneous breath judged by the manual ventilation balloon and the notch detected in the end-tidal carbon dioxide monitor. Airway quality at first attempt was assessed either good (easy ventilation) or poor (partial or complete obstruction). Propofol 0.5 mg kg^{-1} was injected additionally in inability to insert the LMA and second attempt was tried 30 sec. later. Maintenance of anesthesia was provided with 50% O2 in air with 1.5-2% sevoflurane.

Number of attempts of LMA insertion, apnea time, additional propofol requirement and heart rate, systolic (SBP) and diastolic (DBP) blood pressures were recorded before premedication, pre-induction (PI) and frequent intervals following the induction. Intra- and postoperative side effects were also assessed.

Values are presented as the mean ± SD. The hemodynamic values were analyzed by means of repeated measures of ANOVA. Chi-square test was applied to the numerical ratings such as ; ease of LMA insertion, assessment of airway quality, etc. ANOVA was applied to duration of apnea. Bonferroni test was used among the post-hoc tests. The difference of the hemodynamic data within time in the groups was determined by using Wilcoxon paired test. A value less than 0.05 ($p < 0.05$) were considered statistically significant.

Results

There were no significant differences in demographic data among the patients (Table 1). Apnea time, ease of insertion of LMA, airway quality and additional propofol requirement which indicates the numbers of attempts of LMA insertion were statistically significantly different between the groups and were summarized in table 2.

Hemodynamic variables that change with time were shown in figures 1, 2 and 3. Heart rate, SBP and DBP measured 2 min. following the

Table 1

Demographic data

Group	R1 (n = 20)	R2 (n = 20)	P (n = 20)
Sex (F/M)	4 / 16	3 / 17	3 / 17
Body weight in kg (mean ± SD)	72.8 ±11.5	76.9 ± 9.4	70.7 ± 8.9
Age (mean ± SD)	45 ± 13.8	48.6 ± 15.5	50.5 ± 16.8
Duration of operation in min. (mean ± SD)	40 ± 18.7	52.3 ± 9.7	44.2 ± 16.6

Table 2

Determination of ease of LMA insertion

Group	R1 (n = 20)	R2 (n = 20)	P (n = 20)
Apnea time (sec) (mean ± SEM)	82.5 ± 12.7	87.2 ± 6.6	34.09 ± 5.5 *
Ease of insertion of LMA (# of patients assessed as Grade 1)	13	20	6 (1)
Airway quality (# of patients assessed as good)	16	20	15
Additional propofol requirement	5	0	7 (2)
Undesirable responses during LMA insertion			
Hiccup	4	3	3
Limb movement	5	1	12 (3)

* $p < 0.01$ compared to R1, R2 groups, (1) $p = 0.003$ compared to R2 group, (2) $p = 0.027$ compared to R2 group, (3) $p = 0.012$ compared to R2 group.

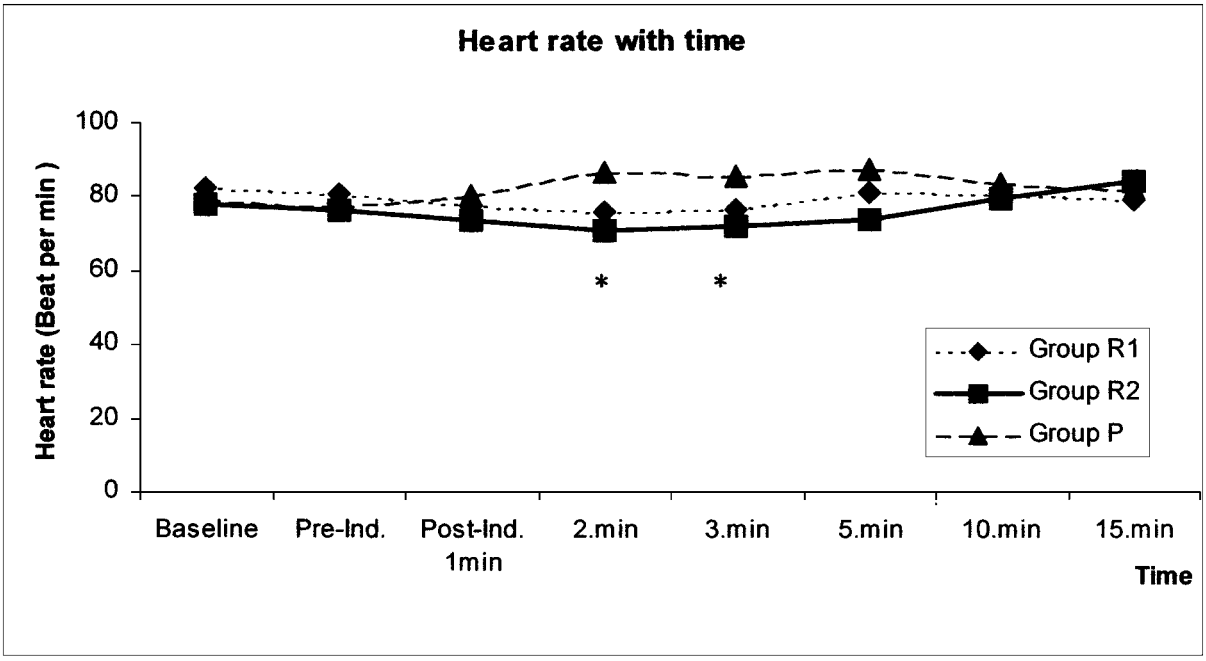

Fig. 1. — Heart rate with time

* $p < 0.001$ in R2 group compared to P group.
Pre-ind. : Pre-induction.
Post-ind. : 1 min-15 min : Post induction 1st, 2nd, 3rd, 5th, 10th, 15th minutes.

induction were significantly lower from baseline (PI) values in the R2 group ($p < 0.05$), but returned to normal values on the third minute ; only 2 patients needed to receive atropine. This was statistically insignificant.

Decrease in heart rate in R2 group recorded 2 and 3 minutes following the propofol infusion was statistically significant compared to P group ($p < 0.001$). The decrease in SBP and DBP 2 min. following induction was significant in R1 and R2 groups compared to P group (Figs. 2, 3). These all were transient, clinically not significant and didn't require any medication.

Discussion

LMA insertion requires suppression of the upper airway reflexes. Propofol is usually the induction agent of choice because of its depressant effects on the airway reflexes. In unpremedicated patients only propofol use for LMA insertion can lead to undesirable responses at induction. Previous studies reported coughing, gagging and laryngospasm during LMA insertion in unpremedicated patients induced with 2-2.5 mg kg^{-1} of propofol (1, 2). Increasing the propofol dose to prevent these reflexes may cause hemodynamic disturbances. Hence it was reported that 2-2.5 mg kg^{-1} of propofol causes cardiorespiratory instability (4, 5, 6).

Opioids are usually added to propofol during induction of anesthesia as they depress upper airway reflexes and potentiate propofol so that propofol dose can be reduced. Previous studies have shown that concomitant administration of opioids reduced the propofol dose requirements for induction of anaesthesia (7, 8, 9).

Remifentanil is relatively new, fast-acting, rapidly metabolized opioid agent. In this study we have demonstrated that remifentanil 0.5 µg kg^{-1} given in 1min. before propofol 2 mg kg^{-1} provided excellent conditions for insertion of LMA (Ease of insertion of LMA was assessed as Grade I in 100% of patients), while remifentanil 0.25 µg kg^{-1} provided good conditions (64.3% of patients were Grade I) but propofol 2.5 mg kg^{-1} failed to provide acceptable conditions (27.3% of patients were Grade I) for LMA insertion. A study with a similar setting found the success rate comparable to our findings (3). Our groups had a higher percentage of success rates during LMA insertion compared to this study. This is probably caused by the premedication that our patients received.

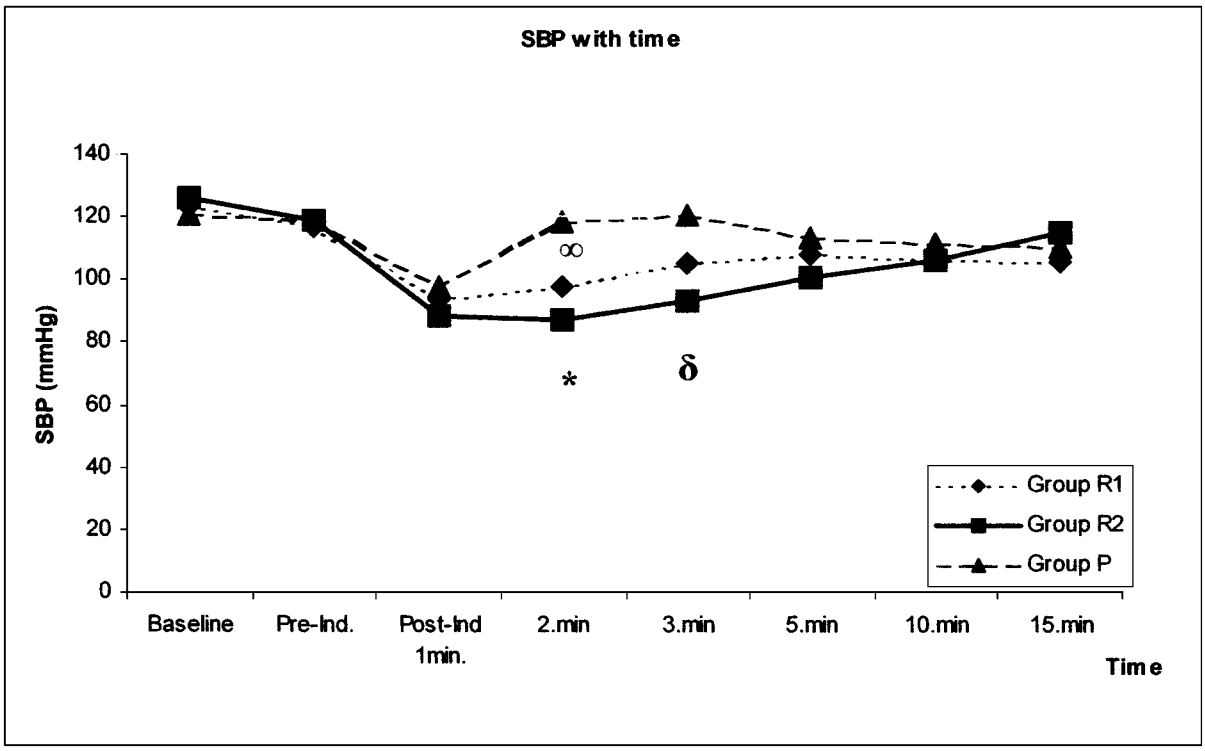

Fig. 2. — Systolic blood pressures (SBP) with time

* p = 0.0001 in R2 compared to P group, ∞ p = 0.027 in R1 compared to P group, δ P = 0.005 in R2 compared to P group.
Pre-ind. : Pre-induction
Post-ind. : 1 min-15 min : Post induction 1st, 2nd, 3rd, 5th, 10th, 15th minutes.

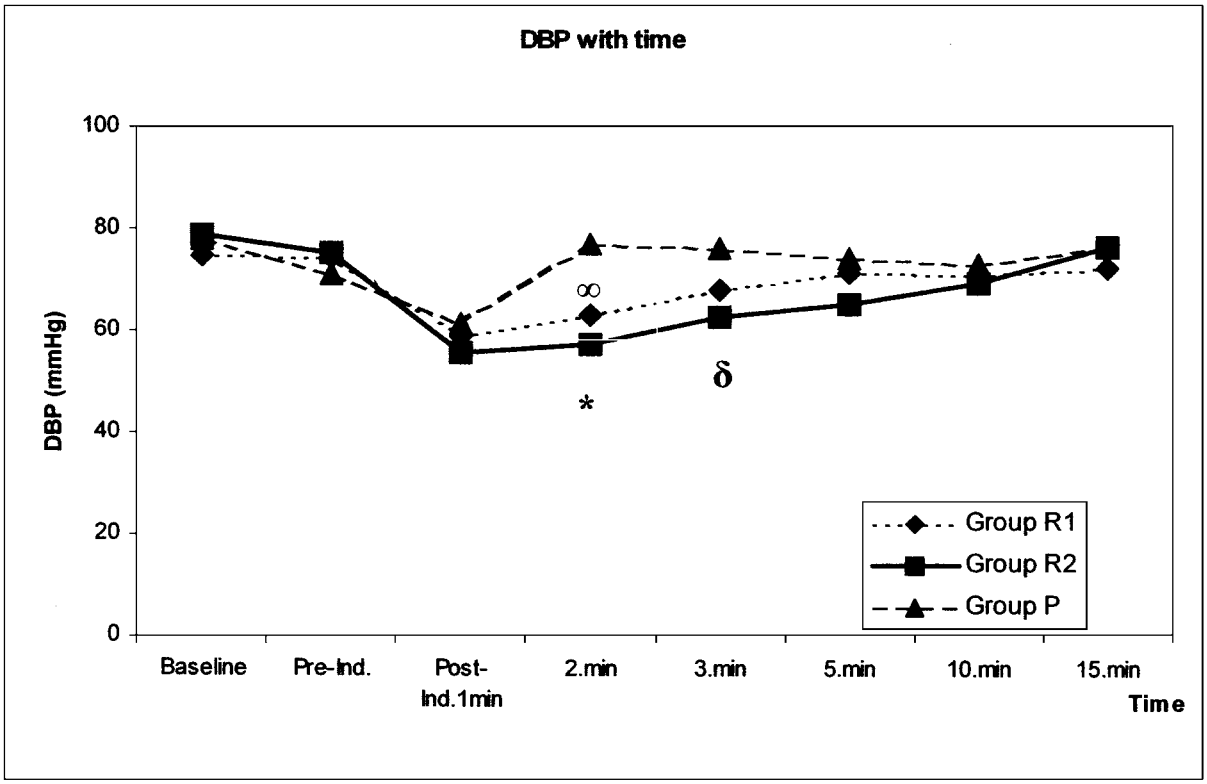

Fig. 3. — Diastolic blood pressure (DBP) with time

* p = 0.0001 in R2 compared to P group, ∞ p = 0.023 in R1 compared to P group, δ p = 0.018 in R2 compared to P group.
Pre-ind. : Pre-induction.
Post-ind. : 1 min-15 min : Post induction 1st, 2nd, 3rd, 5th, 10th, 15th minutes.

Apnea time was statistically shorter in P group (mean ± SEM : 34.09 ± 5.5 sec) compared to R1 (82.5 ± 12.7 sec) and R2 (87.2 ± 6.6) groups. This is related with the apneic property of remifentanil. While muscle rigidity has been reported with the use of potent opioids, remifentanil has been used successfully with propofol to facilitate intubation without neuromuscular blocking agent and that explains why the combination of propofol with remifentanil significantly improves the success of insertion of LMA compared with propofol alone (10, 11).

Airway quality showed no significant differences between the groups. In a study where varying doses of remifentanil (0.5,1 and 2 µkg kg^{-1}) were combined with a standard dose of propofol (which is the same in our study) for assessing intubating conditions without using muscle relaxing agents, no significant difference was found between the groups with respect to ease of ventilation (10). Using only propofol was reported to provide satisfactory intubating conditions (12).

It is not surprising that additional propofol requirement which also indicates the number of attempts of LMA insertion was statistically higher in P group (% 35.7) compared to R2 group (% 0). That explains why undesirable responses during LMA insertion like limb movement, was recorded to be higher in P group (% 57.1) compared to R2 group (% 5.3). Apneic, analgesic and anti-tussive effects of remifentanil increase the success rate when these two drugs are combined together.

In our study both doses of remifentanil prevented the increase in heart rate related to the insertion of LMA that was detected in the P group. Clinically significant bradycardia didn't occur ; only 2 patients received atropine in R2 group. Remifentanil, when given especially i.v. 0.5 µkg kg^{-1} would likely to cause deep bradycardia in more patients if they were not premedicated with atropine. That probability should be considered when using remifentanil for high-risk patients especially when they were not premedicated with anticholinergic agents.

The decrease in SBP and DBP lasting only for 1 and 2 min. in groups R2 and R1 compared to P group was only transient and there were no adverse consequences in ASA I-II patients. Hemodynamic stability with remifentanil and propofol combination, especially when used for ASA I- II patients, was previously reported in many studies (3, 13, 14). Though varying doses of remifentanil (0.5, 1, 2 µg kg^{-1}) in combination with propofol 2 mg/kg for intubations caused statistically significant decrease in MAP, it was reported to be clinically insignificant and transient (10). In our study increasing the remifentanil dose from 0.25 to 0.5 µkg kg^{-1} statistically increased the facilitation of LMA insertion and prevented undesirable hand, arm movements or hiccups compared to propofol. On the other hand 0.5 µkg kg^{-1} remifentanil caused 2 minutes of bradycardia and 2-3 minutes of clinically insignificant and transient but statistically significant decreases in blood pressure compared to propofol. Propofol, when used i.v. 2.5 mg kg^{-1}, was not associated with hemodynamic instability in this study. When using for high risk patients one must be aware of that increasing the remifentanil dose cause greater satisfaction for LMA insertion but could potentially increase the hemodynamic instability.

Our results showed that remifentanil 0.25 µg kg^{-1} and 0.5 µg kg^{-1} added to propofol 2mg kg^{-1} provides good and excellent conditions respectively, for insertion of LMA with clinically insignificant hemodynamic disturbances in ASA I-II patients. More studies should be done to find out the proper dose of remifentanil for high-risk patients with unstable hemodynamics.

References

1. Cheam E. W., Chui P. T., *Randomised double-blind comparison of fentanyl, mivacurium or placebo to facilitate laryngeal mask insertion*, ANAESTHESIA, **55**, 323-6, 2000.
2. Sivalingam P., Kandasamy R., Madhavan G., Dhakshinamoorth P., *Conditions for Laryngeal mask insertion-A comparison of propofol versus sevoflurane with or without alfentanil*, ANAESTHESIA, **54**, 271-6, 1999.
3. Lee M. P. L., Kua J. S. W., Chiu W. K. Y., *The use of remifentanil to facilitate the insertion of the laryngeal mask airway*, ANESTH. ANALG., **93**, 359-62, 2001.
4. Chaudri S., White M., Kenny G. N., *Induction of anaesthesia with propofol using a target-controlled infusion system*, ANAESTHESIA, **47**, 551-3, 1992.
5. Clacys M. A., Gepts E., Camu F., *Haemodynamic changes during anaesthesia induced and maintained with propofol*, BRITISH JOURNAL OF ANAESTHESIA, **60**, 3-9, 1988.
6. Goodman N. W., Black A. M., Carter J. A., *Some ventilatory effects of propofol as sole anaesthetic agent*, BRITISH JOURNAL OF ANAESTHESIA, **59**, 271-6, 1987.
7. Driver I. K., Wiltshire S., Mills P., Lillywhite N., Howard-Griffin R., *Midazolam co-induction and laryngeal mask insertion*, ANAESTHESIA, **51**, 782-4, 1996.
8. Vuyk J., Engbergs F. H., Burm A. G., *et al.*, *Pharmacodynamic interaction between propofol and alfentanil when given for induction of anaesthesia*, ANESTHESIOLOGY, **84**, 288-99, 1996.
9. Short T. G., Plummer J. L., Chui P. T., *Hypnotic and anaesthetic interaction between midazolam, propofol and alfentanil*, BRITISH JOURNAL OF ANAESTHESIA, **69**, 162-7, 1992.
10. Grant S., Noble S., Woods A., Murdoch J., Davidson A., *Assessment of intubating conditions in adults after*

induction with propofol and varying doses of remifentanil, British Journal of Anaesthesia, **81**, 540-3, 1998.
11. Woods A. W., Grant S., Harten J., Noble J. S., Davidson J. A., *Tracheal intubating conditions after induction with propofol, remifentanil and lignocaine*, European journal of Anesthesiology, **15**, 714-18, 1998.
12. Keaveney J., Knell P., *Intubation under induction doses of propofol*, Anaesthesia, **43S**, 80-81, 1988.
13. Grewal K., Samsoon G., *Facilitation of larnygeal mask airway insertion. Effects of remifentanil administered before induction with target-controlled propofol infusion*, Anaesthesia, **56**, 879-9, 2001.
14. Hogue C. W., Bowdle T. A., O'Leary C., *et al.*, *A multicentre evaluation of total intravenous anesthesia with remifentanil and propofol for elective inpatient surgery*, Anesthesia and Analgesia, **83**, 279-85, 1996.