เปรียบเทียบการนำสลบด้วยยา Propofol และยาผสมระหว่าง propofol - thiopentone กับประสิทธิภาพในการใส่หน้ากากครอบกล่องเสียง *Proseal*™

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Abstract: **Comparison of propofol and propofol/ thiopentone admixture for Proseal™ insertion**

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Background: **The *Proseal*™ is commonly used for airway management during general anesthesia in Ratchaburi Hospital. Intravenous propofol (1%) has been used as an induction of choice for LMA insertion. However, the recommended dose of propofol 2.5 mg.kg^{-1} given intravenously could be associated with cardiovascular and respiratory depression.** ***Objectives:*** **to assess insertion condition and hemodynamic responses by comparing propofol (1%) and an admixture of propofol 0.5% and thiopentone 1.25% (1:1) during induction of anesthesia.** ***Methods:*** **In a prospective, randomized controlled study, 190 nonpremedicated patients undergoing elective surgery were allocated into two groups: Group P received propofol 1%. Group PT received an admixture of propofol 0.5% and thiopentone 1.25% (1:1), both at a dose of 0.25 ml.kg^{-1}. The insertion condition, ease of insertion, apnea time and hemodynamic responses between the two groups were assessed.** ***Results:*** **The incidences of resistance to mouth opening, resistance to insertion and coughing were significantly higher in the PT group than the P group (P = 0.017). There was no difference in terms of swallowing, movement and apnea time between the two groups. None of patients developed laryngospasm. Decrease in MAP and HR during administration of Propofol - thiopentone admixture was significantly less than administration**

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of Propofol alone. *Conclusions:* In nonparalyzed patients, propofol provides better conditions and easier *Proseal*^{TM} insertion, but has greater hemodynamic instability than an admixture of propofol 0.5% and thiopentone 1.25% (1:1).

Keywords:* *Propofol, thiopentone, Proseal, laryngeal mask airway

Introduction

A newly developed reusable laryngeal mask airway, the *Proseal*^{TM} is an advanced form of the classic^{TM} laryngeal mask airway (cLMA) with modifications designed to separate the respiratory and gastro - intestinal tract, improve airway seal, improve safety and efficacy of controlled ventilation, and enable diagnosis of misplacement[1]. These design features are expected to prevent regurgitation, aspiration and reduce gastric insufflations when compared with the cLMA[1].

Intravenous propofol (1%) has been used as a drug of choice for LMA insertion. It provides smooth induction with suppression of pharyngeal and laryngeal reflexes, allowing easier LMA insertion with a reduced incidence of adverse effects such as coughing, gagging or laryngospasm. However, the recommended dose of propofol 2.5 mg.kg^{-1} given intravenously could be associated with cardiovascular and respiratory depression[2].

An admixture of propofol and thiopentone are physic - chemically compatible and stable[3,4,5,6] due to its bactericidal properties. An additive effects has been reported when two drugs are admixtured[7,8].

The objective of the study was to assess the *Proseal*^{TM} insertion condition and hemodynamic responses compare propofol (1%) and an admixture of propofol 0.5% and thiopentone 1.25%(1:1) during induction of anesthesia.

Method

The study was approved by institutional research ethics committee and written informed consent was obtained. One hundred and ninety patients with ASA physical status 1and 2 in age group of 15 - 65 yrs. scheduled for elective surgical operations in which the use of *Proseal*^{TM} was indicated were included in this study.

Patients with risk of regurgitation, pharyngeal pathology, low pulmonary compliance (BMI $\geq$ 30 kg.m^2), anticipated or known difficult airway, limited mouth opening (less than 2 cm), high airway resistance (bronchospasm), known allergy to either agents were excluded.

Patients were prospectively, randomly allocated by the sealed envelope method to receive either propofol 1% or an admixture of propofol 0.5% and thiopentone 1.25% (1:1), both at a dose of 0.25 ml.kg^{-1}. All the patients were fasted for 8 hours and no premedication was given. In the operating room, noninvasive blood pressure (NIBP), heart rate (HR), electrocardiography

(ECG) and oxygen saturation (SpO_2) were monitored. After 3 minutes of pre - oxygenation, propofol (1%) were injected to patients in propofol group (P) with the dose of 2.5 $mg.kg^{-1}$ and propofol - thiopentone (1:1) admixture were injected to patients in propofol - thiopentone group (PT) with the dose of 0.25 $ml.kg^{-1}$ over 30 seconds through intravenous cannula without muscle relaxant. The patient remained unventilated throughout the induction period. A fully deflated, appropriate sized *Proseal*^{TM} (based on patient's body weight as suggested by the manufacturer's instruction manual, size 3: 30 - 50 kg, size 4: 50 - 70 kg, size 5: 70 - 100 kg) was inserted by an experienced anesthetist, who was unaware of which group the patient was in, using an index finger technique assisted by a catheter guide 30 seconds later. The cuff was inflated with air of the recommended maximum volume (size 3:20 ml, size 4:30 ml, size 5:40). If the *Proseal*^{TM} insertion was unsuccessful on the first attempt, the patient received an additional dose of induction agent 0.05 $ml.kg^{-1}$ in both groups. During attempted, the patient's lungs were ventilated using a facemask. The number of attempts was noted. Failed insertion was defined as removal of the device from the mouth. Unsuccessful insertion after three attempts was regarded as a failure. After insertion, the *Proseal*^{TM} was connected to a breathing circuit. Successful insertion and ventilation defined as chest expansion and normal wave form of capnography during gently manual ventilation. Apnea time was assessed as the time from the end of induction agent injected to the resumption of a spontaneous breath judged by the manual ventilation balloon and the notch detected in the end - tidal carbon dioxide monitor. If ventilation was appropriate, then the *Proseal*^{TM} was fixed. Patients were kept on spontaneous ventilation. Anesthesia was maintained with 2% sevoflurane and FiO_2 0.5 of air - oxygen mixture.

The study investigator assessed the condition during *Proseal*^{TM} insertion such as

1. resistance to mouth opening (no, significant or undue force required)
2. resistance to insertion (no, significant or undue force required)
3. swallowing (nil, slight or gross)
4. coughing or gagging (nil, slight or gross)
5. head or limb movement (nil, slight or gross)
6. laryngospasm (nil, partial or Complete).

The ease of insertion was graded as[6]:

1. Excellent : insertion easy, no reaction from patient.
2. Satisfactory : adverse response to airway manipulations, but not affecting the insertion.
3. Poor :
   a) moderate to severe adverse responses requiring additional boluses of drugs.
   b) more than two attempts were required for insertion.

The ease of insertion was only assessed during the first attempt of *Proseal*^{TM} insertion .

The patient's blood pressure and heart rate were recorded before induction of anesthesia, and 1 min, 3 min, 5 min after successful *Proseal*^{TM}

insertion.

Statistical analysis was performed using SPSS. The data were analysed using Student's t test, Chi - square test with Fisher exact test as appropriate. The 5% level of probability ($P < 0.05$) was considered significant.

Result

One hundred and ninety patients were randomly divided into two groups. There was no significant difference between the two groups in demographic data (table 1).

Table 1 Demographic data

	P group N = 95	PT group N = 95	P - value
Age (year)	45.24 ± 16.05	45.13 ± 17.30	0.962
Sex (female/male)	40(42) / 55(58)	49(52) / 46(48)	0.191
BW (Kg)	61.75 ± 11.50	60.38 ± 11.11	0.405
ASA (I/II)	60(63) / 35(37)	53(56) / 42(44)	0.301

Data presented as Mean ± SD or number of patients, figures in parentheses are in percentages

The incidences of resistance to mouth opening, resistance to insertion and coughing were significantly higher in the PT group (P = 0.017, 0.000, 0.044 respectively) (table 2). There was no significant difference in terms of swallowing and movement between two groups. Ninety - one patients (96%) in P group and eighty - seven patients (92%) in PT group were successfully inserted in first attempt. These were no statistically significant. The *Proseal*^{TM} was inserted in all patients in P group within two attempts. Three attempts of insertion occurred in one patient in PT group. None of patients failed insertion and developed laryngospasm. Seven patients in P group and ten patients in PT group required additional dose of induction agent for successful insertion. There was no significant difference in apnea time between groups. The *Proseal*^{TM} insertion was graded as excellent in P group compared to PT group (P = 0.011) (table 2).

Table 2 The insertion characteristics

	P group N = 95	PT group N = 95	P - value
Condition during insertion			
1. resistance to mouth opening			
No/significant/undue force required	93(98)/2(2)/0(0)	85(89)/10(11)/0(0)	0.017
2. resistance to insertion			
No/significant/undue force required	85(90)/6(6)/4(4)	63(67)/26(27)/6(6)	0.000
3. cough			
Nil/slight/gross	79(83)/12(13)/4(4)	67(71)/22(23)/6(6)	0.044
4. swallowing			
Nil/slight/gross	83(88)/3(3)/9(9)	74(78)/7(7)/14(15)	0.095
5. movement			
Nil/slight/gross	70(74)/16(17)/9(9)	59(62)/26(27)/10(11)	0.119
6. laryngospasm			
Nil/partial/complete	95(100)/0(0)/0(0)	95(100)/0(0)/0(0)	
Number of attempts			
1^{st} / 2^{nd} / 3^{rd}	91(96)/4(4)/0(0)	87(92)/7(7)/1(1)	0.229
Additional dose of induction agent			
No / Yes	88(93)/7(7)	85(89)/10(11)	0.446
Ease of insertion			
excellent / satisfactory/poor	61(64)/27(29)/7(7)	43(45)/41(43)/11(12)	0.011
Apnea time (sec.)	124.16 $\pm$ 60.21	111.83 $\pm$ 47.23	0.118

Data presented as Mean $\pm$ SD or number of patients, figures in parentheses are in percentages

Hemodynamic changes during induction was showed in table 3. MAP (Mean Arterial Pressure), and HR (heart rate) were decreased in both groups following induction compared with baseline. Decreased in MAP and HR in the PT group was significantly less than the P group.

Table 3 Hemodynamic change during *Proseal*™ insertion

	P group N = 95	PT group N = 95	P - value
MAP (mmHg)			0.000
Baseline	93.08 ± 10.48	93.55 ± 12.62	
Post - insertion			
1 min	82.00 ± 13.75	86.98 ± 16.71	
3 min	78.98 ± 12.64	82.87 ± 15.72	
5 min	78.43 ± 12.07	79.45 ± 13.63	
HR (beat.min^{-1})			0.000
Baseline	81.82 ± 14.85	79.31 ± 16.04	
Post - insertion			
1 min	84.21 ± 14.54	85.58 ± 15.81	
3 min	81.58 ± 14.38	83.24 ± 15.96	
5 min	78.59 ± 15.73	80.85 ± 15.78	

Data presented as Mean ± SD or number of patients, figures in parentheses are in percentages

Discussion

The *Proseal*™ is designed to provide additional benefit over the classic™ LMA. It has a double tube arrangement, with a flexible wire reinforced airway tube and a drain tube. With the property of better airway sealed *Proseal*™ is suitable for controlled ventilation. Insertion of *Proseal*™ should be appropriate in nonparalysed patients provide adequate depth of anesthesia.

Many induction agents have been used for LMA insertion. Thiopentone can also be used to facilitate LMA insertion. Scanlon et al[9] compared equipotent dose of propofol (2.5mg.kg^{-1}) and thiopentone (5mg.kg^{-1}) and reported that thiopentone was associated with adverse response in 76% of cases as opposed to 26% for propofol group. It did not provide good Jaw relaxation and can cause coughing, gagging and laryngospasm when used alone for LMA insertion. Ti LK et al[10] showed that none in propofol group had inadequate jaw relaxation as opposed to 12% in thiopentone group. These findings were different from that of Talwar et al[11] who did not find any significant difference in the incidence of jaw opening, coughing, gagging, laryngospasm, and patient movement between thiopentone and propofol group. Propofol is an induction agent of choice for LMA insertion because of their property of pharyngeal and laryngeal reflexes suppression. Mckeating K et al[12], Brown et al[13] found that propofol was superior to thiopentone in depressing pharyngeal and laryngeal reflexes. Several studies reported that *Proseal*™

insertion is more difficult than classic LMA[14,15]. There were more complications such as coughing, gagging or laryngospasm during *Proseal*^{TM} insertion than with the classic LMA. To avoid undesirable airway responses, increasing dose of propofol 2.5 $mgkg^{-1}$ may be helpful. However, higher dose of propofol can cause adverse effects like hypotension, bradycardia and apnea. Combination or co-induction agents with propofol may be effective for LMA insertion and adverse effect reduction.

An admixture of propofol and thiopentone is compatible and stable[3,4,5,6] due to its bactericidal properties.[16] Jones et al6 and Vinik et al[8] reported an additive effect when given propofol together with thiopentone. Yeo et al[6] reported that the incidences of gagging, inadequate jaw relaxation and coughing were higher in the propofol - thiopentone admixture group but there was no statistical difference. Satisfactory to Excellent conditions for insertion were achieved with the propofol - thiopentone admixture, which was comparable to propofol (73% vs 85%, $P > 0.05$). The duration of apnea was not different between the propofol - thiopentone admixture and propofol group. An admixture induction produced less hypotension. Sinha et al[17] reported that propofol - thiopentone admixture is cheaper, safer and more effectiveness alternative to propofol alone, for LMA insertion in children. The condition for LMA insertion was excellent in 68% of the patients in propofol - thiopentone admixture group as compared to 52% in propofol group, but this difference was not statistically significant. The incidence of adverse responses to airway reflexes were similar in both groups. Shah et al[18] reported that there was no statistical difference in the incidence or severity of gagging, coughing, inadequate jaw relaxation and laryngospasm. The incidence of hypotension was statistically significant lower in the propofol - thiopentone admixture group. The duration of apnea was not different between the groups.

In the present study, similar to Yeo et al and Shah et al, incidence of swallowing and movement were higher in the propofol - thiopentone admixture group but there was no statistical difference. Although there was a higher incidence of adverse responses in the propofol - thiopentone admixture group, this did not cause failure of *Proseal*^{TM} insertion. None of patients in propofol and propofol - thiopentone admixture group developed laryngospasm. Decrease in systolic blood pressure during propofol induction has been consistently reported in literature[19]. In the present study, fall in MAP in the P group was significantly higher than the PT group. This finding showed that the attenuation of fall in blood pressure with the admixture is statistically significant. Propofol and thiopentone are negative inotropes. Propofol, with a dose - dependent result, is more pronounced afterload reduction than thiopentone. The additive hypnotic effect of the propofol - thiopentone admixture resulted in a decrease of propofol thus a decreased effect on afterload and the myocardium[19].

Unlike previous studies, this study used *Proseal*^{TM} instead of classic LMA. The incidence of

resistance to mouth opening and resistance to insertion were statistically significant higher in the propofol - thiopentone admixture group. This problem was due to large cuff, rigid and lack of a backplate making the cuff more likely to fold over at the back of the mouth. Moreover, more mouth opening is needed. It is suggested that propofol (1%) provided greater depth of anesthesia than an admixture of propofol 0.5% and thiopentone 1.25% (1:1). In the present study, incidence of coughing was significantly higher in the propofol - thiopentone admixture group. Apart f rom large cuff and rigidity of device, this may be due to properties of thiopentone. Thiopentone alone increases airway irritability because of the relatively greater depressant effect of the drug on the sympathetic than on the parasympathetic reflex arch[20]. Yasser and Amin[21] reported that 7 $mg.kg^{-1}$ produced comparable I - gel insertion conditions with that of 2.5 $mg.kg^{-1}$ propofol. This suggested that to avoid hypotension, the admixture may increase dose of thiopentone and decrease dose of propofol in ratio. However, there is no evidence of optimum ratio of admixture for *Proseal*^{TM} insertion. Combined opioids with or without benzodiazepines have been used as co - induction agents to improve insertion conditions. However, these techniques may be associated with cardiorespiratory depression and delayed recovery.

The limitation of the present study is the *Proseal*^{TM} was inserted by anesthetists who has difference in experience with *Proseal*^{TM} insertion.

Conclusion

In nonparalysed patients, propofol provides better conditions for *Proseal*^{TM} insertion, but has greater hemodynamic changes than an admixture of propofol 0.5% and thiopentone 1.25% (1:1).

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