Original Article

Comparison of I-Gel Insertion Conditions Using Dexmedetomidine-Propofol Versus Fentanyl-Propofol: An Observational Study

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ABSTRACT

Introduction: i-gel insertion requires adequate depth of anaesthesia to prevent coughing, gagging, limb movements. We aimed to compare i-gel insertion conditions with propofol induction after pre-treatment with dexmedetomidine or fentanyl.

Methods: 44 patients of ASAI/II undergoing general anaesthesia were divided into Groups D n = 22 and F n = 22. Group D received 1 μg/kg dexmedetomidine over 10 minutes followed by 5ml of 0.9%normal saline NS over 2 minutes. Group F received 10 ml of 0.9%NS over 10 minutes followed by fentanyl 1 μg/kg over 2 minutes. Thirty seconds after study drugs, propofol 2 mg/kg was given. Ninety seconds after propofol, i-gel was inserted. Overall insertion conditions were assessed by Modified Scheme of Lund and Stovener. Heart-rate (HR), respiratory rate, blood pressure, spo2, mean arterial pressure (MAP), apnoea time were noted at baseline, after study drug given, after propofol induction, 3, 5,10 minutes after i-gel insertion.

Results: Moderately relaxed jaw, coughing, movement was observed in more patients of Group F. Incidence and mean duration of apnoea was significantly higher in group F. MAP after propofol induction was significantly lower in group F. After propofol and i-gel insertion, HR was significantly lower with dexmedetomidine.

Statistical test: Unpaired t-test and chi-square test.

Conclusion: Dexmedetomidine is superior to fentanyl in preserving respiration and provide better jaw relaxation for i-gel insertion.

Key words: I-gel insertion, propofol, premedication, dexmedetomidine, fentanyl.

INTRODUCTION

I-gel is second generation supraglottic airway device. It has easier insertion and lesser airway trauma over other supraglottic airway devices.[1] Due to the difference in structural design and the pressure exerted over pharyngo-laryngeal area, the requirement for insertion of different SGADs varies.[2] I-gel insertion in non-paralyzed patient requires adequate depth of anaesthesia for adequate jaw relaxation and to prevent coughing, gagging and head or limb movements.[3]

Propofol suppress pharyngo-laryngeal reflexes but it can lead to dose-dependent cardio-respiratory depression.[3] Propofol can be use with opioids like fentanyl but, they are associated with delayed anaesthetic recovery, muscle rigidity and post-operative apnoea, particularly after general anaesthesia.[4] Dexmedetomidine is a highly selective, short-acting α2 -receptor agonist with dose-dependent analgesic, sedative, and anxiolytic effects, is a useful adjuvant to general anaesthesia. Dexmedetomidine when used as an adjuvant to propofol has shown to provide satisfactory insertion conditions and better attenuation of pressor response during i-gel insertion.[5,6]

It was hypothesised that propofol-dexmedetomidine combination provide better i-gel insertion conditions as compared to fentanyl-propofol combination. Our primary aim was to compare jaw relaxation and overall i-gel insertion conditions of dexmedetomidine versus fentanyl pretreatment under propofol anaesthesia using the Modified Scheme of Lund and Stovener.[7] Changes in heart-rate HR, mean arterial pressure MAP, duration of apnoea and the total requirement of propofol were also studied as the secondary objectives.

METHODS

For this observational study 44 eligible American Society of Anaesthesiologists class I/II patients of either sex and aged between 18 and 65 years undergoing general anaesthesia for short surgical procedures were included and a written informed consent was obtained from all the participants. Patients with a reduced mouth opening, Modified Mallampati class >3, Body Mass Index >30 kg/m2, thyromental distance kg/m2, thyromental distance<6 cm, upper/lower airway obstruction, on beta blocker, bradycardia and allergy to study drugs were excluded from this study. The blinded investigator with an experience of at least 50 i-gel insertions, insert the i-gel in the sniffing air position.

Patients' baseline parameters such as heart rate, Electrocardiogram ECG, mean arterial pressure, respiratory rate and oxygen saturation were noted upon arrival to the operation theatre and monitored continuously thereafter. Intravenous access was secured with 20G cannula and Ringer's lactate solution at 2 ml/kg/hr was started. Oxygen was administered via nasal cannula at 2L/min to prevent de-saturation during study drug infusion over ten minutes. Premedication with IV Injection Glycopyrrolate 0.004

mg/kg was given. Group D received 1 μg/kg dexmedetomidine diluted to 10 ml with 0.9% normal saline NS over ten minutes by an infusion pump followed by 5 ml of NS over 2 minutes. Group F received 10 ml of NS over 10 minutes by the same infusion pump followed by Injection fentanyl 1 μg/kg diluted to 5 ml with 0.9% NS over 2 minutes. Thirty seconds after the injection of study drugs, anaesthesia was induced with 2 mg/kg of Injection propofol given intravenously over 30 seconds. Ninety seconds after the completion of injection propofol, i-gel insertion was attempted. i-gel was chosen in accordance with the manufacturer's recommendation based on patient's weight.[8] The blinded investigator with an experience of at least 50 i-gel insertions inserted the i-gel in the 'sniffing morning air position. If apnoea cessation of respiration for >30 seconds, ventilation was assisted manually but allowing spontaneous respiration to occur, via facemask before I –gel insertion or via i-gel until regular spontaneous respiration resumed. Anaesthesia was thereafter maintained on oxygen, nitrous oxide 50:50 and isoflurane. No muscle relaxant was administered during the study. Besides i-gel insertion conditions, the respiratory rate and apnoea time time between last spontaneous breath after propofol and occurrence of first spontaneous breath were recorded.

Ease of insertion of i-gel was evaluated by the degree of jaw relaxation achieved by using the "Young's Criteria"[9] [Absolutely relaxed jaw-I, Moderately relaxed jaw-II, Poorly relaxed jaw-III] While the overall i-gel insertion conditions were assessed using the Modified Scheme of Lund and Stovener[7] [Excellent- No gagging or coughing, no laryngospasm, no patient movement, Good- Mild to moderate gagging or coughing, no laryngospasm, mild to moderate patient movement, Poor- Moderate to severe gagging or coughing, no laryngospasm, moderate to severe patient movement, Unacceptable- Severe gagging or coughing, severe patient movement, laryngospasm].

If any of the above were present during the first attempt of the i-gel insertion then a further bolus of 0.5 mg/kg of propofol was administered. After three attempts of failed i-gel insertion, it was decided to abandon the study and the case proceeded under general anaesthesia with endotracheal intubation.

Heart rate, respiratory rate, blood pressure & SpO_2 changes during i-gel insertion were also recorded at intervals of baseline, after study drug given, after propofol induction, and at 3, 5 and 10 minutes after the i-gel insertion. At the end of surgery, i-gel was removed when the patient was able to open mouth on command.

Adverse events such as bradycardia, hypotension, coughing, laryngospasm, bronchospasm, or desaturation if occurred were recorded and treated.

The unpaired t-test was used for intergroup comparisons between HR and MAP at each time point. Intra-group analyses were conducted using t tests with repeated measurements. Categorical data were expressed as percentage. The demographic data analysed using Mann Whitney-test and Fisher-exact test. Ordinal categorical data such as i-gel insertion conditions and number of attempts were analysed by Fisher-exact or Chi-square test. P value <0.05 was accepted as statistically significant.

RESULTS

Airway assessment using demographic variables were comparable in both Groups D and F. None of the patients had a poorly relaxed jaw. Group F had more episodes of coughing and movement during i-gel insertion necessitating additional propofol boluses. No laryngospasm or bronchospasm was observed. Total dose of propofol was significantly P = 0.02 higher with fentanyl 2.21 + 0.39 mg/kg than with dexmedetomidine 2.07 + 0.21 mg/kg. Baseline respiratory rates RR were comparable in both groups P 0.363. Incidence of apnoea was significantly higher P < 0.001 in group F 18/40 than group D 3/40. The mean duration of apnoea in group F 284.5 ± 11.19 sec. was significantly higher P < 0.001 as compared to group D 217.17 ± 16.48 sec. After propofol induction P = 0.003 and i-gel insertion P < 0.001, heart rate was significantly lower with dexmedetomidine than fentanyl. In group D, heart rate was significantly below the baseline after dexmedetomidine infusion P = 0.035, propofol induction 13.7%, P < 0.001 and after i-gel insertion P < 0.001. As against this, in group F, a significant drop from the baseline heart rate was observed after bolus of fentanyl P = 0.010 and propofol induction P = 0.02 but, during i-gel insertion heart rate increased above the immediately preceding values by 7.3% reaching nearly baseline values.

Table 1: Comparison of demographic variables and modified mallampatti test between two groups, data are expressed as mean+-standard deviation

Parameter	Group Dexmedetomidine	Group Fentanyl	P value
Age (years)	31.33±13.56	31.90±10.35	0.832
Sex (M/F)	4/18	3/19	0.762
Body mass index	23.75+-2.67	23.25±1,81	0.39
Modified Mallampatti class (1/2/3/4)	15/7/0/0	11/10/0/0	0.207

Table 2: Comparison of overall insertion conditions by Modified Scheme of Lund and Stovener between two groups, data are expressed as number%

Insertion conditions	Group Dexmedetomidine	Group Fentanyl	Total
Excellent	14 (62.5%)	15 (65.0%)	29 (63.8%)
Good	8 (37.5%)	5 (27.5%)	13 (32.5%)
Poor	0 (0%)	2 (7.5%)	2 (3.8%)

P value 0.162 calculated using chisquare test

Mean arterial pressure MAP was significantly lower in group F P = 0.002 after induction while at 10 mins after i-gel insertion it was lower in group D P = 0.019. Percentage drop in MAP from baseline after propofol induction was more in group F 10.3% than group D 5.6%.

In this study, heart rate and MAP were within 15% from baseline in both groups and statistically significant bradycardia or hypotension did not occur throughout the study. No evidence of trauma or regurgitation during i-gel insertion was found.

DISCUSSION

This study of 44 patients receiving general anaesthesia with i-gel insertion suggests that 1 μg/kg dexmedetomidine with 2mg/kg propofol provides satisfactory i-gel insertion conditions comparable to that provided by 1μg/kg fentanyl with 2 mg/kg propofol. Dexmedetomidine provide better jaw relaxation as assessed by Young's criteria with 97.5% patients having absolutely relaxed jaw as compared to 87.5% with fentanyl. In the fentanyl group, 12.5% patients had moderately relaxed jaw and required additional boluses of propofol to facilitate i-gel insertion. The superiority of dexmedetomidine over fentanyl in providing better jaw relaxation for insertion of the i-gel has been reported by other studies as well.[6,11,12]

Both fentanyl and dexmedetomidine are known to reduce propofol requirement for i-gel insertion. In this study, patients in fentanyl group required more additional boluses of propofol due to inadequate jaw relaxation, coughing and movement. So, mean total dose of propofol was significantly more with fentanyl. Similarly, higher doses of propofol for induction with fentanyl than dexmedetomidine have been observed.

MAP after propofol induction was significantly lower in group F than group D. Incidence and mean duration of apnoea was significantly more with fentanyl than with dexmedetomidine. Higher incidence of apnoea could also be due to more additional boluses of propofol required in fentanyl group. Incidence and duration of apnoea after induction with propofol is dependent upon the dose, speed of injection, and concomitant premedication and is known to be potentiated by opioids. Apnoea with dexmedetomidine was recorded in our patients who required additional supplements of propofol for i-gel insertion. Dexmedetomidine does not potentiate respiratory depression caused by propofol, so shorter mean duration of apnoea observed with dexmedetomidine than fentanyl.

Heart rate decrease from baseline was more with dexmedetomidine than fentanyl. Dexmedetomidine blunt the stress responses to i-gel insertion while fentanyl did not suppress stress response to i-gel insertion adequately. Even 0.5 μg/kg Dexmedetomidine may be more effective than 1 μg/kg Fentanyl in maintaining haemodynamic stability during extubation. This study found more effective attenuation of pressor response to I gel insertion following 1 μg/kg of dexmedetomidine as compared to fentanyl.

In this study we found that pre-treatment with dexmedetomidine at 1 μg/kg intravenously infused over ten minutes prevented overt bradycardia and hypotension, decreased the number and duration of apnoeic episodes and provided satisfactory i-gel insertion conditions with decreased consumption of propofol. Hence, dexmedetomidine may be a suitable co-induction agent with propofol for i-gel insertion without neuromuscular blockade.[15,16]

Our findings are in accordance with study by Lande SA *et al.*[5] who compared dexmedetomidine and fentanyl for LMA insertion and reported 96.6% patients having absolutely relaxed jaw with dexmedetomidine. The superiority of dexmedetomidine over fentanyl in providing better jaw relaxation for insertion of the SGAD has been reported by other studies as well.[5,6,10,12]

Regurgitation or aspiration during i-gel insertion can occur due to inadequate depth of anaesthesia, multiple insertion attempts and patient movement or with use of opioids. However, we found no signs of regurgitation or trauma during i-gel insertion in any of the cases.[13,14]

Dexmedetomidine in a dose of 1 μg/kg is previously reported to blunt the sympatho-adrenal responses to i-gel insertion[24] while fentanyl 1 μg/kg did not suppress sympatho-adrenal response to LMA insertion adequately.[3,6] Even 0.5 μg/kg Dexmedetomidine may be more effective than 1 μg/kg Fentanyl in maintaining haemodynamic stability during extubation.[27] This study found more effective attenuation of pressor response to I gel insertion following 1 μg/kg of dexmedetomidine as compared to fentanyl.

Fentanyl 1 μg/kg has been reported to provide optimal SGAD insertion conditions along with significantly better haemodynamic stability. Prolonged apnoea was observed when higher doses of fentanyl were used.[17,18] The predetermined dose of propofol induction 2 mg/kg along with the timing of administering propofol injection and i-gel® insertion after pre-treatment with fentanyl or dexmedetomidine, were as suggested by previous researchers.[6,19,20,21,22] The aim was to achieve effective synergistic levels of the drug combinations used before I gel insertion.

higher doses of propofol for induction 2.03+/-0.41 mg/kg, *P*: 0.01 with fentanyl than dexmedetomidine 1.40+/-0.48 mg/kg have been observed for lumbar laminectomy cases.[23] Moreover, dexmedetomidine pre-treatment also reduces the half-maximal effective concentration EC50 of propofol for SGAD insertion without muscle relaxants thereby decreasing the total requirement of propofol.[24]

This study has certain limitations. A control group with propofol alone is not included. Propofol thought to be inadequate for i-gel insertion when used alone and higher doses can be unsafe for respiration and haemodynamics, propofol control group was thought to be unethical. Another limitation is that the depth of anaesthesia at the time of i-gel insertion was only assessed clinically and no specific monitor was used due to non-availability.

CONCLUSION

Dexmedetomidine and fentanyl provide comparable conditions for i-gel insertion with propofol without neuromuscular blockade. Both drugs provide stable hemodynamic profile but dexmedetomidine is superior to fentanyl in preserving respiration.

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