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Original Research Article

Comparison of Dexmedetomidine Combined with Propofol versus Fentanyl Combined with Propofol for I-GEL Insertion in Elective Surgeries Performed under General Anaesthesia: A Double Blinded Randomised Study

Aditya Kumar Kejriwal[1], Ajay Kumar[2], Hari Damodar Singh[3], Satyeshwar Jha[4], Sushil Kumar[5]

[1]Senior Resident, Department of Anaesthesiology, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar.
[2]Assistant Professor, Department of Anaesthesiology, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar.
[3]Associate Professor & Head, Department of Anaesthesiology, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar.
[4]Associate Professor, Department of Anaesthesiology, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar.
[5]Assistant Professor, Department of Anaesthesiology, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar.

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Corresponding author: Dr Ajay Kumar
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Abstract

Background: Before inserting the I-GEL, the appropriate level of anaesthesia is necessary to prevent laryngospasm, choking, or limb movements. We compared the circumstances surrounding I-GEL implantation to propofol induction after dexmedetomidine or fentanyl pretreatment.

Methods: Eighty patients with ASA I/II underwent general anaesthesia and were randomly assigned to Groups D (n = 40) and F (n = 40). After receiving 1 μg/kg of dexmedetomidine over the period of ten minutes, Group D received 5 ml of 0.9% normal saline (NS) over the course of two minutes. 10 ml of 0.9%NS were given to Group F over a period of ten minutes, followed by two minutes' worth of 1 μg/kg fentanyl. Two mg/kg of propofol was given after the research drug. I-GEL was inserted 90 seconds after propofol. The Modified Scheme of Lund and Stovener was used to evaluate the overall insertion circumstances. Heart rate (HR) and mean arterial pressure (MAP) measurements were made at baseline, following propofol induction with the study medication, and 1, 3, 5, and 10 minutes after IGEL insertion. Apnea times and respiratory rate were noted.

Results: Both groups insertion conditions were comparable. There were more patients in Group F who had a moderately relaxed jaw, coughed, and moved body. Group F (18/40) had a considerably higher incidence of apnoea than did group D (3/40) (P<0.0001). Group F had a significantly longer mean apnoea duration than group D (217.17±16.48 sec; 284.5±11.19 sec). In comparison to the baseline, group F MAP decreased by a higher proportion (10.3%) than group D's (5.6%) after propofol. Although the response to I-GEL insertion was identical at 1, 3, 5, and 10 minutes after insertion, group F's post-induction MAP was significantly lower than group D's (P = 0.002) (group

F). After propofol and I-GEL insertion, the HR was significantly lower with dexmedetomidine (P = 0.003 and P <0.001, respectively).

Conclusion: When combined with propofol, dexmedetomidine and fentanyl offer similar I-GEL insertion circumstances.

Keywords: Anaesthetics IV, Dexmedetomidine, Fentanyl, I-GEL Insertion, Premedication, Propofol.

Introduction

I-GEL, a second-generation supraglottic airway device (SGAD), not only has a simpler insertion than prior SGADs with an inflated cuff, but it has also been reported to produce reduced airway morbidity. [1]

Because SGADs vary in structural design and pressure on the pharyngo-laryngeal region, varying quantities of anaesthetic must be injected.[2] In order to insert an I-GEL into a patient who is not paralysed and achieve enough jaw relaxation as well as avoid adverse effects as coughing, choking, laryngospasm, and head or limb movements, proper anaesthesia depth is necessary. Despite its well-known ability to significantly inhibit pharyngo-laryngeal reflexes, propofol may cause dose-dependent cardio-respiratory depression when used as the only induction drug during SGAD insertion. [3] Co-induction medicines like opioids have been used with propofol to ease device implantation, reduce the dose of propofol, and reduce related side effects. [3]

Opioids may help with I-GEL insertion conditions, but they are also linked to postoperative apnea, delayed anaesthetic recovery, and muscle rigidity, especially following general anaesthesia. [4]

Due to its highly selective, short-acting α2 receptor agonist characteristics and dose-dependent analgesic, sedative, and anxiolytic effects, dexmedetomidine is an efficient adjuvant to general anaesthesia. Dexmedetomidine has shown to provide favourable insertion conditions and better pressor response attenuation during SGAD insertion when given as an adjuvant to propofol.[5,6]

It was proposed that dexmedetomidine and propofol provide superior I-GEL insertion circumstances than fentanyl and propofol. Our major objective was to compare the effects of dexmedetomidine versus fentanyl pre-treatment on jaw relaxation and overall I-GEL insertion circumstances using the Modified Lund and Stovener Scheme.[7] Secondary objectives included looking into variations in heart rate (HR), mean arterial pressure (MAP), duration of apnea, and total amount of propofol used.

Material and Methods

80 suitable ASA class I/II patients, of either sex, with ages ranging from 18 to 60, could be enrolled in the study after providing a signed and informed permission.

Lower or upper airway obstruction, use of beta blockers, bradycardia (heart rate less than 60 beats per minute), reduced mouth opening, burns to the neck and face, Modified Mallampati class greater than three, body mass index greater than thirty kilogrammes per square metre, thyromental distance less than six centimetres, upper or lower airway obstruction, and known allergies to study drugs were excluded from the trial.

When patients first entered the operating room, baseline measurements of their heart rate, electrocardiogram (ECG), mean arterial pressure, respiratory rate, and oxygen saturation were made. These measurements

were then continually tracked. Ringer's lactate solution was begun at 2 ml/kg/hr after a 20G cannula was used to establish the intravenous access. To avoid desaturation during the ten-minute study medication infusion, oxygen was given by nasal cannula at a rate of 2 L/min. Glycopyrrolate 0.004 mg/kg IV injection was administered as a premedication. Using an infusion pump, Group D was given 1 μg/kg dexmedetomidine diluted to 10 ml with 0.9% normal saline (NS) over the course of ten minutes, followed by 5 ml of NS over the course of two minutes. The identical infusion pump administered 10 ml of NS to Group F over a 10-minute period, followed by an injection of 1 μg/kg fentanyl diluted to 5 ml with 0.9% NS over a 2-minute period.

Anesthesia was induced with 2 mg/kg of injectable propofol given intravenously over 30 seconds following the administration of the research medications. I-GEL insertion was tried 90 seconds following the end of the propofol infusion. According to the manufacturer's advice based on the patient's weight, I-GEL was selected. [8] The blinded investigator, who has inserted at least 50 I-GELs, placed the device in the "sniffing morning air" position. The square wave capnogram, bilateral symmetrical chest movement, auscultation of equal breath sounds, and normal saturation all supported an effective airway using I-GEL. Failure was defined as the lack of any of the clinical signs indicated above after I-GEL injection.

It was noted if bradypnoea (respiratory rate <12/min) happened. In cases of apnoea (breathing halt lasting more than 30 seconds), ventilation was manually assisted while allowing spontaneous breathing to occur, either using a facemask (before to the insertion of I-gel) or through I-GEL, until normal spontaneous breathing was restored. Sevoflurane 1.5 to 2 volumes percent, nitrous oxide (50:50), and oxygen were then utilised to keep the patient unconscious. Throughout the investigation, no muscle relaxants were taken.

Using the "Young's Criteria," the degree of jaw relaxation was used to gauge how easy it was to insert the I-GEL.[9] [Flawlessly relaxed jaw I, Slightly relaxed jaw II, and Slightly tension-filled jaw III] While the Modified Lund and Stovener Scheme was used to evaluate the overall I-GEL insertion conditions[7], [Excellent- No gagging, coughing, or laryngospasm, and no patient movement. Good: No laryngospasm, minimal to minimal patient movement, minimal to minimal gagging or coughing Poor: No laryngospasm, patient movement ranges from mild to severe, and gagging or coughing ranges from mild to severe. Laryngospasm, severe coughing or gagging, and a lot of patient movement are intolerable].

A second bolus of 0.5 mg/kg propofol was administered if any of the aforementioned elements were present during the initial I-GEL insertion attempt. The trial was stopped after three unsuccessful efforts to inject the I-GEL in order to move forward with the case while under general anaesthesia and endotracheal intubation.

Software SPSS version 16.0 was used to analyse the data. The mean and standard deviation were used to represent continuous data. The unpaired t-test was used for intergroup comparisons of HR and MAP at each time point. For the intragroup analysis, we employed t-tests with repeated measurements. Categorical data were shown as a percentage. The Mann Whitney test and Fisher's exact test were applied to analyse the demographic data. Ordinary categorical data were analysed using the Fisher's exact or Chi-square test, such as I-GEL insertion circumstances and the number of attempts. Statistical significance was defined as a P value <0.05.

Results

In terms of demographic variables and MMT airway assessments, Groups D and F were comparable [Table 1]. Five out of forty patients in Group F and one out of forty in Group D had a significantly relaxed jaw during I-GEL insertion (P = 0.08). Jaw relaxation was complete in every patient. However, due to greater instances of coughing and movement during I-GEL insertion, group F required more propofol boluses [Table 2].

There were no signs of bronchospasm or laryngospasm. The total dose of propofol for fentanyl (2.21 + 0.39 mg/kg) was significantly (P = 0.02) higher than the total dose for dexmedetomidine (2.07 + 0.21 mg/kg).

Table 1: Comparison of demographic variables and modified mallampati test between group D and F

Parameter	Group D (40)	Group F (40)	P value
Age (yrs.)	31.33±13.56	31.90±10.35	0.832
Sex M/F	7/33	6/34	0.762
Body mass index	23.75±2.67	23.25±1.817	0.39
Modified Mallampatti class I/II/III/IV	26/14/0/0	19/20/1/0	0.207

Data are expressed as mean±standard deviation or number (%). Group D – Dexmedetomidine group, Group F – Fentanyl group

Table 2: Comparison of overall insertion conditions by modified scheme of Lund and Stovener between group D and F

Insertion conditions	Group D (40)	Group F (40)	Total	Chi-square test P
Excellent	25(62.5%)	26(65.0%)	51(63.8%)	0.162
Good	15(37.5%)	11(27.5%)	26(32.5%)	
Poor	0(0%)	3(7.5%)	3(3.8%)	

Initial respiratory rates (RR) for both groups were comparable (P = 0.363). In comparison to group D (3/40), group F (18/40) had a significantly higher incidence of apnoea (P<0.001). The mean apnoea duration in group F was significantly longer (284.5±11.19sec) than in group D (217.17±16.48 sec) (P<0.001). In comparison to fentanyl, dexmedetomidine exhibited a significantly reduced HR following propofol induction (P = 0.003) and I-GEL insertion (P<0.001) [Figure 1].

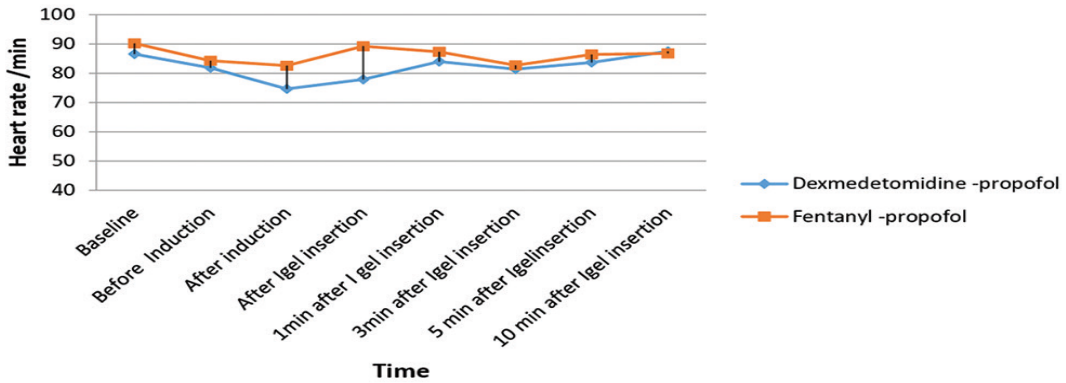

Figure 1: Comparison of heart rates between group D and Group F

Group D HR was significantly lower than the starting point with dexmedetomidine infusion (P = 0.035), propofol induction (13.7%, P <0.001), and I-GEL insertion (P <0.001) [Figure 2]. In contrast, when boluses of propofol and fentanyl were administered, the heart rate in group F significantly decreased from baseline (P = 0.010) and increased during the insertion of the I-GEL by 7.3%, approaching baseline (P = 0.02) [Figure 2].

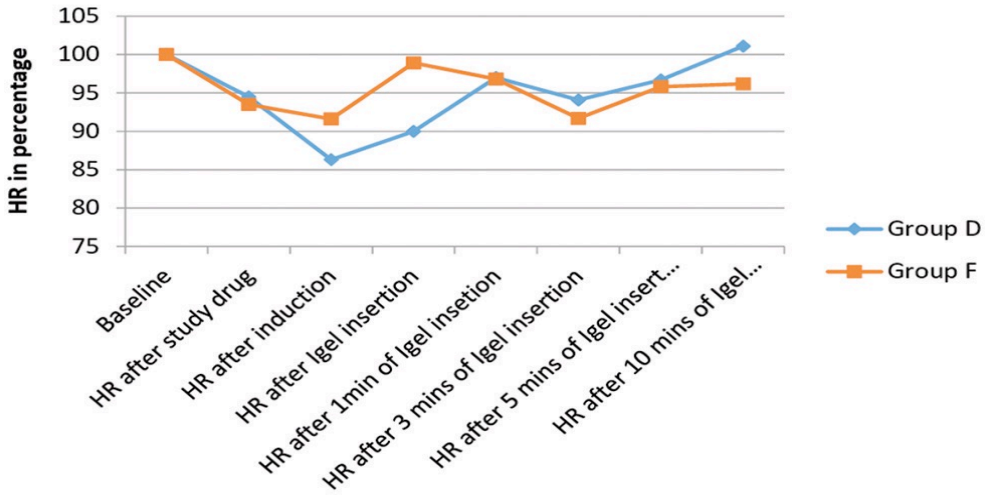

Figure 2: Comparison of percentage drop in heart rates from baseline in groups D and F

After induction, MAP was considerably lower in group F (P = 0.002) than it was in group D (P = 0.019) after 10 min after I-GEL insertion. (Figure 3)

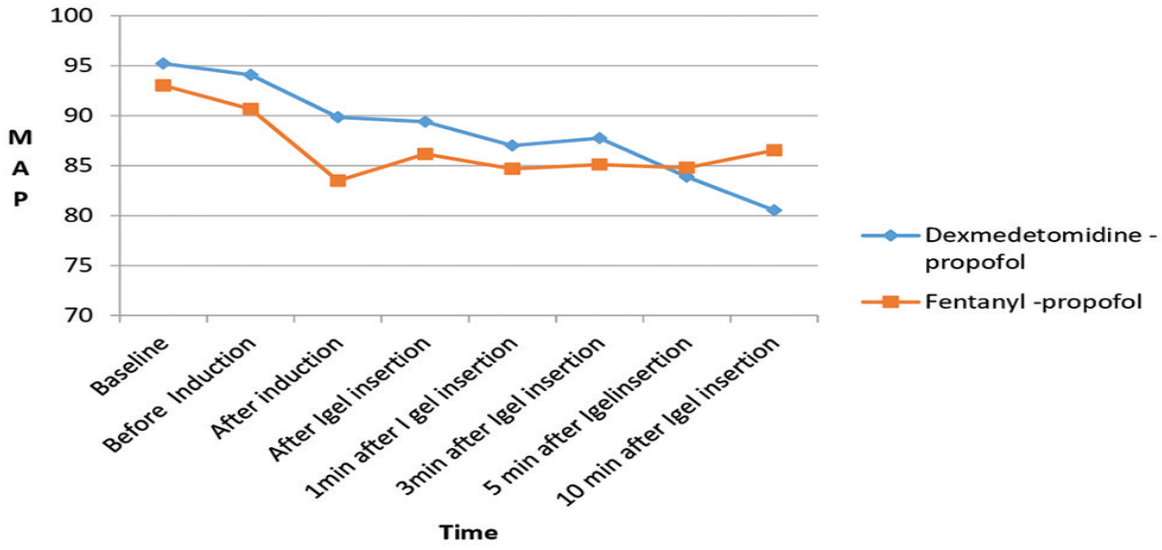

Figure 3: Comparison of mean arterial pressure between groups D and F

Following propofol induction, group F saw a higher percentage fall in MAP from baseline (10.3%) than did group D (5.6%) [Figure 4]. Throughout the course of the experiment, neither bradycardia

nor hypotension were statistically significant, and both groups' HR and MAP were within 15% of baseline. During I-GEL implantation, there was no indication of damage or regurgitation.

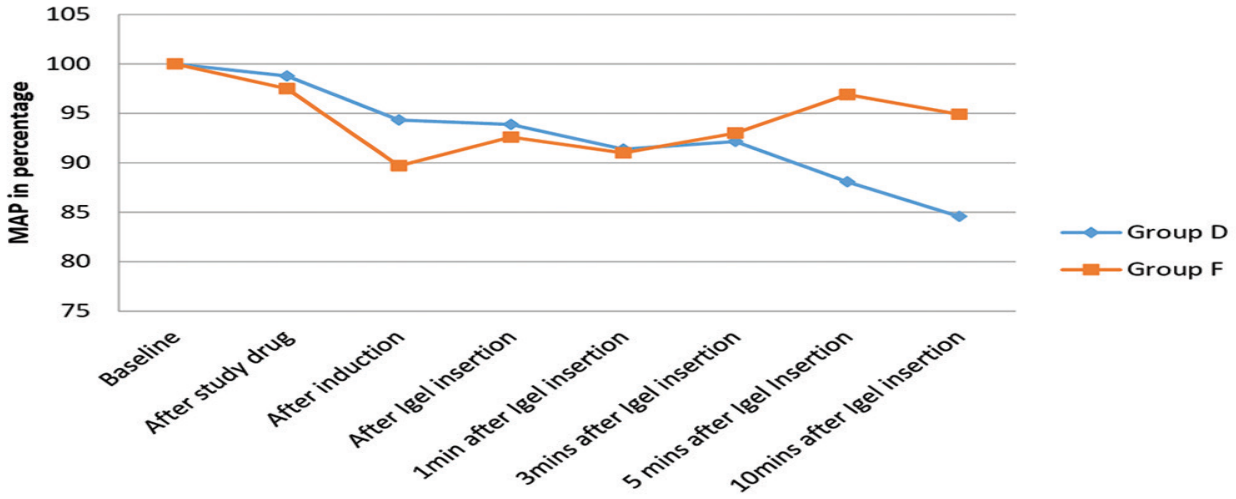

Figure 4: Comparison of percentage drop in mean arterial pressure from baseline in groups D and F

Discussion

Even though the overall insertion conditions as summarised by the modified scheme of Lund and Stovener [7] were comparable in both groups, dexmedetomidine provided better jaw relaxation as measured by Young's criteria, with 97.5% of patients having absolutely relaxed jaw as opposed to 87.5% with fentanyl. 12.5% of the patients in the fentanyl group required additional boluses of propofol to enable I-GEL implantation due to mildly relaxed jaws. Despite the fact that this discovery was not statistically significant, it was still noteworthy from a therapeutic standpoint because increased propofol dosage in group F resulted in episodes of hypotension (<15% of baseline MAP), which were treated with crystalloids.

96.6% of patients had completely relaxed jaws after given dexmedetomidine, according to research by Lande SA *et al*. [5] comparing dexmedetomidine with fentanyl during LMA installation. Dexmedetomidine is more effective than fentanyl at delivering superior jaw relaxation for SGAD insertion, according to other research.[5,6,10,12] Insufficient anaesthetic depth, multiple insertion attempts, patient movement, or the use of opioids can all result in regurgitation or aspiration during the insertion of the I-GEL. However, we found no signs of regurgitation or damage during I-GEL insertion in any of the instances.[13,14]

According to earlier studies, a dose of dexmedetomidine was administered as a 1 µg/kg infusion during a 10-minute period. [10] After an immediate loading dosage injection, dexmedetomidine can have biphasic effects on blood pressure, causing transient spikes due to peripheral vasoconstrictor-induced vasoconstriction and bradycardia, followed by a low mean arterial pressure from diminished sympathetic outflow.[15] Slow drug infusion over 10 minutes or longer promotes long-lasting stabilisation of heart rate and blood pressure at levels slightly below the baseline, which is most likely the result of activation of central

presynaptic α-2A adrenergic receptors leading to sympatholysis.[15,16]

According to reports, fentanyl 1μg/kg offers ideal SGAD insertion circumstances and dramatically improved haemodynamic stability. Higher fentanyl doses were administered, and prolonged apnoea was seen. [17,18]

Following pre-treatment with fentanyl or dexmedetomidine, the I-GEL was inserted at the appropriate time, and the anticipated dose of propofol induction (2 mg/kg) was administered as suggested by other studies. [6,19-22] The goal was to increase the drug combinations' to produce effective synergistic levels from those used prior to I-GEL insertion.

Fentanyl and dexmedetomidine have both been shown to decrease the amount of propofol needed during SGAD insertion. [11,21] But in our trial, individuals in the fentanyl group needed more extra boluses of propofol because their jaws weren't relaxed enough and they showed movements and coughing.

Hence mean total dose of propofol was significantly more with fentanyl (*P*-0.02). Similarly, 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]

Additionally, pre-treatment with dexmedetomidine lowers the half-maximal effective concentration (EC50) of propofol for SGAD insertion without muscle relaxants, reducing the overall need for propofol. [11,24]

This study has several restrictions. There was no separate propofol-only control group. Propofol control group was considered unethical because it has frequently been reported that propofol is insufficient for SGAD insertion when used alone and that greater dosages can be dangerous for breathing and hemodynamics. Another drawback is that no specific monitor was employed because it wasn't available, and the depth of anaesthesia at the time of I-GEL implantation was only evaluated clinically. It would have been more therapeutically appropriate to evaluate the degree of consciousness during airway manipulation using BIS/Entropy. Patients with MMT I and II participated in this study. To determine the impact of pre-treatment with these medicines on the I-GEL insertion condition in individuals with greater MMT or problematic airways, additional research is necessary.

Conclusion

Propofol and 1 μg/kg of dexmedetomidine or fentanyl pre-treatment produced equivalent and adequate insertion circumstances for I-GEL.

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