ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 17, Issue 3, 2024

Online - 2455-3891
Print - 0974-2441

Research Article

COMPARISON OF THE EFFECTIVENESS AND SAFETY BETWEEN INTRAVENOUS DEXMEDETOMIDINE WITH FENTANYL VERSUS INTRAVENOUS PROPOFOL WITH FENTANYL FOR SEDATION IN DIAGNOSTIC UPPER GASTROINTESTINAL ENDOSCOPY

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Received: 14 November 2023, Revised and Accepted: 09 Januay 2014

ABSTRACT

Objective: The aim of this study was to compare the effectiveness and safety of intravenous dexmedetomidine with fentanyl versus intravenous propofol with fentanyl for sedation in diagnostic upper gastrointestinal (GI) endoscopy.

Methods: 50 patients of ASA grade I, II, or III scheduled for GI endoscopy were randomly divided into two groups of 25 patients each. Group D received intravenous fentanyl and intravenous dexmedetomidine, and Group P received intravenous fentanyl and intravenous propofol. Hemodynamic variables, level of sedation using the Ramsay sedation score (RSS), patient satisfaction, and surgeon satisfaction using the visual analog scale (VAS) were recorded.

Results: There was no significant difference in the demographic parameters (age, gender, weight, ASA class) between the two groups. The mean time to reach RSS 4–5 was less in group P (27.60±6.44 s) when compared to group D (521.56±39.13 sec; p=0.0004). Patient satisfaction was higher in group D (7.9±0.7) as compared to group P (7.3±0.8; p=0.0069). While there was no significant difference in the surgeon's satisfaction regarding difficulty during the procedure (8.3±0.9 and 7.9±1.3 in group D and group P, respectively; p=0.2120).

Conclusion: Dexmedetomidine with fentanyl resulted in a better hemodynamic profile, respiratory profile, patient satisfaction, and quicker recovery than propofol with fentanyl. Whereas propofol with fentanyl provided quicker onset and more efficient sedation compared to dexmedetomidine with fentanyl.

Keywords: Gastrointestinal endoscopy, Sedation, Analgesia, Dexmedetomidine, Propofol, Fentanyl.

 DOI: http://dx.doi.org/10.22159/ajpcr.2024v17i3.49596. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Gastrointestinal (GI) endoscopic procedures have revolutionized the field of gastroenterology by providing clinicians with minimally invasive tools to diagnose and treat various GI-related disorders. Many of these procedures can be performed on an outpatient basis, eliminating the need for prolonged hospital stays. However, during the endoscopic procedures, patients may experience anxiety, pain, fear, and GI adverse reactions, which can negatively impact their cooperation during the procedure and potentially lead to adverse cardiovascular events [1,2]. As the prudent administration of sedation has the potential to mitigate the sympathetic reaction, the utilization of sedation becomes crucial during the execution of GI endoscopy (GIE) procedures. Nevertheless, the determination of sedation necessity is contingent upon several factors, including the specific type of endoscopy being performed, the duration of the procedure, the level of complexity involved in the endoscopic examination, the physical condition of the patient, and the preferences of the physician [3]. As the majority of the GIE procedure is completed within a brief duration, pharmacological agents that exhibit rapid onset, short duration of action, minimal adverse effects, and enhanced safety profiles are administered. Various pharmacological agents, such as benzodiazepines, either alone or in combination with opiates and alpha-2 adrenoceptor agonists, are used to elicit sedation during endoscopic interventions. Dexmedetomidine is one such drug called which has been identified as a potentially appropriate agent for conscious sedation during upper GI (UGI) endoscopy. It has a brief duration of action, fast onset, and rapid recovery time, as well as a propensity to mitigate postoperative symptoms such as nausea, vomiting, agitation, and shivering [4]. Balanced anesthesia mitigates the likelihood of deep sedation while simultaneously affording effective analgesia. This can be attained by the administration of short-acting opioids such as alfentanil, remifentanil, and fentanyl in conjunction with midazolam. Propofol is one such significant sedative agent that is utilized for UGI endoscopy as it offers several advantages, such as prompt onset of action, a brief elimination half-life even following extended infusion, swift recuperation without any residual psychomotor effects, and enhanced patient contentment during endoscopic procedures. Furthermore, it has mild side effects such as transient hypotension, respiratory depression, and hypoventilation, all of which are dose-dependent [5]. The literature suggests that the concomitant administration of sedative and analgesic agents during outpatient procedures may potentially optimize sedation efficacy while concurrently reducing the incidence of adverse effects associated with each agent. Until date, to the best of our knowledge, studies that have compared the effectiveness and safety of intravenous dexmedetomidine with fentanyl versus intravenous propofol with fentanyl for sedation in diagnostic UGI endoscopy are scarce, especially in the Indian scenario. So, in this prospective study, we have compared the effectiveness and safety of intravenous dexmedetomidine with fentanyl versus intravenous propofol with fentanyl for sedation in diagnostic UGI endoscopy.

METHODS

A prospective observational study was undertaken among the adult patients presenting to the tertiary care hospital over a period from May 2019 to December 2020. Patients of either sex, aged 18–60 years of age, who had undergone elective UGI and belonged to the American Society of Anesthesiologists (ASA) grades I, II, or III were included

in this study. After a thorough preanesthetic check-up, patients who were on alpha-2 antagonist treatment and who had an abnormal and difficult airway were excluded. All patient-related information, like age, gender, symptoms and signs at presentation, addiction to smoking, comorbidities, and medical history, was recorded on the case-record sheet. All patients underwent a pre-anesthetic checkup the day before surgery, and all routine investigations like a complete blood count, renal function test, liver function test, random blood sugar, electrocardiography (ECG), and chest X-ray were advised. Patients were kept nil by mouth for at least 8 h. An intravenous cannula was secured in the recovery room, and a crystalloid like Ringer's lactate or normal saline solution was started in the pre-anesthetic room. In the operating room, patients were made to lie in a lateral position. Baseline vital parameters like pulse rate, ECG, blood pressure, and oxygen saturation were recorded. Previously, a total of 52 patients were enrolled, but of these 2 patients, had anatomical variation (1 patient had post-cricoid growth and the other had esophageal stenosis), and so scope could not be negotiated. So, these patients had to be intubated, and so they were excluded from the study. So, 50 patients that were enrolled in our study were divided into two groups of 25 patients each. Randomization was done by ASA, which did not take part further in the study. The choice of sedative used in UGI endoscopy was decided by the in-charge ASA. The study drugs were prepared by the same ASA involved with randomization. The observer and patient were blinded to the study. Topical pharyngeal anesthesia was administered by spraying 2 puffs of a metered dose of 10% lignocaine prior to drug infusion. All the patients in both groups received premedication inj. Glycopyrrolate (0.008 mg/kg) and inj. Midazolam (0.03 mg/kg) intravenously.

Group D: Patients received intravenous fentanyl (1 μg/kg) and intravenous dexmedetomidine (1 μg/kg) loading doses over 10 min, followed by 0.5 μg/kg/h as continuous infusions for maintenance of sedation throughout the UGI endoscopy.

Group P: Patients received intravenous fentanyl (1 μg/kg) and an intravenous 1.5–2 mg/kg loading dose of propofol, followed by 3 mg/kg/h for maintenance of sedation throughout the UGI endoscopy.

The level of sedation was assessed by the Ramsay sedation score (RSS), and when a score of 4–5 was achieved, surgeons were asked to insert the endoscope. While insertion of the endoscope or during the procedure, if patients had coughing, gagging, retching, or the desired level of sedation was not achieved, a rescue propofol bolus dose of 1 mg/kg was administered in either of the group, and the total rescue dose of propofol was recorded. After administration of the study drug, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and oxygen saturation (SpO_2) were recorded at 2 min, 4 min, 6 min, 8 min, 10 min, 15 min, 20 min, and till the end of the procedure. Following cessation of the medication, vital signs were recorded at intervals of 2, 4, 6, 8, 10, and 15–30 min. In order to evaluate the patient's satisfaction regarding discomfort (pain and gaging) and the surgeon's satisfaction regarding difficulty during the procedure, the visual analog scale (VAS) score (0=no retching and gagging/difficulty to 10=maximum retching and gagging/difficulty) was used. Oxygen desaturation was considered when SpO_2 <92% for more than 10 s, and those patients were given 4 L/min oxygen by nasal prongs and were managed by supporting the airway and/or assisting ventilation. Bradycardia was considered when HR was <60 beats/min and managed with glycopyrrolate 0.2 mg i.v. Side effects like nausea and vomiting (PONV), apnea, agitation, and shivering were recorded and managed accordingly. All the UGI endoscopies were carried out by the same operator using an Olympus flexible endoscope.

The data was collected using a pre-designed case record sheet, which was later entered into Microsoft Excel. The two groups were compared for various parameters, and statistical analysis was done with the help of Medcalc software (version 20.218). The baseline patient characteristics are presented as frequencies for the categorical variables and as means and standard deviations for continuous variables. The comparison of quantitative variables between the study groups was done using the Student t-test or ANOVA test, while for comparing categorical data, the Chi square (χ^2) test was performed. The results were considered

Table 1: Demographic data of the study population

Parameters	Group D (n=25)	Group P (n=25)	p-value
	Mean±SD	Mean±SD	
Age (years)	39.5±13.9	44.4±13.3	0.6282
Male	14 (56%)	12 (48%)	0.2575
Female	11 (44%)	13 (52%)	
Weight (kg)	50.6±9.1	49±9.5	0.5460
Duration of endoscopy (min)	11.15±2.8	11.12±4.04	0.9758
ASA Class (II/III)	1/24	1/24	---

Table 2: Intra-procedure mean HR value of study participants

Timeline	Group D (n=25)	Group P (n=25)	p-value
Baseline	90.4±11.7	89.8±12	0.8587
2 min	86.9±10.6	87.3±11.1	0.8969
4 min	82.6±11.8	85±10.2	0.4455
6 min	79.6±11.1	83.3±9.4	0.2095
8 min	76.8±10.1	82.3±9.3	0.0508
10 min	74.9±8.9	82.1±8.9	0.0063
15 min	73.4±9.3	82.9±7.9	0.0003
20 min	72±9.9	78.6±10.6	0.0274

HR: Heart rate

Table 3: Intra-procedure mean SBP value of study participants

Timeline	Group D (n=25)	Group P (n=25)	p-value
Baseline	114±17.1	112±15.3	0.6649
2 min	111.8±15.1	108.4±14.7	0.4238
4 min	109.1±15.1	104.9±14.5	0.3208
6 min	107.1±14.3	101.9±13.4	0.1909
8 min	105.6±14	100±12.8	0.1465
10 min	105.1±13.4	95.3±19.9	0.0466
15 min	103.7±13.6	101.9±13.1	0.6358
20 min	101.9±11.9	98±8.3	0.1853

SBP: Systolic blood pressure

Table 4: Intra-procedure Mean DBP value of study participants

Timeline	Group D (n=25)	Group P (n=25)	p value
Baseline	71.9±11.1	70.5±9.7	0.6370
2 min	70.8±10.5	69.1±9.9	0.5586
4 min	68.8±10.1	66±9.3	0.3130
6 min	67.8±10.3	64.8±9.4	0.2874
8 min	67.4±10.1	63.7±9.3	0.1842
10 min	66.6±9.6	63.1±9.5	0.2013
15 min	65.6±9.3	62.9±9.6	0.3175
20 min	63.3±7.3	61.3±7.1	0.3310

DBP: Diastolic blood pressure

Table 5: Intra-procedure Mean SpO_2 value of study participants

Timeline	Group D (n=25)	Group P (n=25)	p value
Baseline	98.1±0.8	98.1±0.8	1.0000
2 min	98.0±0.9	98.0±0.9	1.0000
4 min	97.6±0.7	95.7±2.9	0.0025
6 min	97.3±0.8	94.0±3.8	0.0001
8 min	96.8±0.8	94.1±3.4	0.0003
10 min	96.9±0.7	94.1±2.4	<0.0001
15 min	97±0.9	94.6±1.6	<0.0001
20 min	97±0.9	95.6±0.9	<0.0001

Table 6: Sedation Score, patient satisfaction and surgeon satisfaction in the patients of the study group

Parameter	Group D (n=25)	Group P (n=25)	p value
Mean Time (second) to achieve Ramsay Score 4–5	521.56±39.13	27.60±6.44	0.0004
Patient satisfaction (regarding pain and gagging)	7.9±0.7	7.3±0.8	0.0069
Surgeon satisfaction (regarding difficulty during procedure)	8.3±0.9	7.9±1.3	0.2120

significant if p<0.05. All necessary precautions outlined in the hospital guidelines were followed throughout the study in order to protect patients' confidentiality. Informed consent was obtained from the patients regarding the publication. The institutional ethical committee also approved the study (approval number: 12815/19; dated May 21, 2019).

RESULTS

There was no significant difference in the demographic parameters (age, gender, weight) between the two groups (p>0.05) (Table 1). At baseline, there was no significant difference in the mean HR values in both groups (p=0.8587). There was a continuous decrease in the mean HR from the baseline in both groups. There was a significant decrease in the HR form 8th min. The decrease in HR was higher in group D when compared to group P (Table 2). There was no significant difference in the SBP values between the two groups at all-time intervals except at 10th min (p=0.0466) (Table 3). The mean DBP values were comparable between the two groups (p>0.05) (Table 4). In our study, it was observed that patients in the propofol group exhibited a notable decrease in respiratory rate compared to those in the dexmedetomidine group at various time intervals (p<0.05) (Table 5). The mean time to reach RSS 4–5 was less in group P (27.60±6.44 sec) when compared to group D (521.56±39.13 s), and the difference was found to be statistically significant (p=0.0004). Patient satisfaction was higher in group D (7.9±0.7) as compared to group P (7.3±0.8) (p=0.0069) (Table 6). Similarly, the surgeon satisfaction (evaluated by VAS score) regarding difficulty during the procedure was 8.3±0.9 and 7.9±1.3 in groups D and P, respectively, and the difference between the two groups was statistically insignificant (p=0.2120).

DISCUSSION

In the present study, we observed that the administration of dexmedetomidine in combination with fentanyl and propofol in conjunction with fentanyl has been shown to achieve a satisfactory level of anesthesia for adult patients undergoing diagnostic UGI endoscopy. Moreover, we observed differences in the hemodynamic profile, respiratory profile, and recovery profile between the two groups. The groups were homogeneous in terms of demographic characteristics (gender, age, and weight). Propofol required statistically significantly less time to achieve the desired level of sedation when compared to dexmedetomidine. This is due to the fact that the loading dose of dexmedetomidine has to be given as an infusion over 10 min to avoid cardiovascular complications. These results were consistent with Kalyan *et al*. and Samson *et al*. who reported that the time to achieve the desired sedation level was significantly higher in the dexmedetomidine group [6,7]. Hasanin *et al*. found that there was a trend towards a lesser requirement of a rescue drug (propofol) bolus dose during the procedure in the propofol group as compared to the dexmedetomidine group, which was consistent with our study as none of the patients in the propofol group required a rescue dose, suggesting that propofol gives deeper sedation compared to dexmedetomidine in UGI endoscopy [8]. In group D, there was a statistically significant fall in HR in the intra-procedure period compared with baseline. The incidence of bradycardia is due to stimulation of the α-2_b receptors in vascular smooth muscle. Whereas tachycardia was observed in group P, post-procedure there was no significant difference in the HR between the two groups (p>0.05). Muller *et al*. and Sethi *et al*. also reported a lower HR in the dexmedetomidine group as compared to propofol [9,10]. In group P, there was a significant drop in SpO_2 when compared to the baseline throughout the procedure (p<0.05). Out of 25 patients, six patients in group P had desaturation. The lowest SpO_2 seen in group P was 84%, and all these patients were treated with increased oxygenation by nasal cannula (6–8 lit/min). Basarigidad *et al*. demonstrated that mean SpO_2 was considerably lower in the propofol and fentanyl (PF) groups than in the propofol and dexmedetomidine (PD) groups. Additionally, airway maneuvers were employed more frequently in the PF group, with 55% of patients requiring such interventions [11]. In contrast, only 2.9% of patients in the PD group necessitated airway support. Further, dexmedetomidine in our study had no effect on the respiratory center, and these findings are consistent with whose of Sethi *et al.* [10]. In our study, the dexmedetomidine group recovered more quickly than the propofol group, and the difference was highly statistically significant in the dexmedetomidine group (p<0.05), and these findings were consistent with those of Kalyan *et al*. and Samson *et al*. The VAS score was used to assess the patient's satisfaction and the surgeon's satisfaction [6,7]. Patient satisfaction was statistically significant (p<0.05) in the dexmedetomidine group. There was no statistically significant difference in surgeon's satisfaction regarding difficulty during the procedure in group D (8.3±0.9) and in group P (7.9±1.3; p>0.05). While Sethi *et al*. Samson *et al*. and Demiraran *et al*. reported considerably higher surgeon satisfaction rates in the dexmedetomidine group (p=0.0001) [7,10,12].

Our study is also subject to certain limitations. The current investigation was conducted at a single center and involved a limited number of patients. Consequently, the findings of this study cannot be extrapolated to a broader population unless extensive, multicenter, double-blind, randomized trials are conducted, encompassing a larger sample size. The focus of our study was on adult patients; therefore, the findings cannot be extended to pediatric or geriatric patients. The procedure is performed under sedation, although the airway is not secured, necessitating constant vigilance and preparedness for intubation throughout the procedure. Additional research is necessary to determine the optimal dosage of medications that can effectively mitigate the patient's response during endoscopy.

CONCLUSION

With this dose regimen, both dexmedetomidine with fentanyl and propofol with fentanyl provide an adequate level of anesthesia for diagnostic UGI endoscopy in adult patients. However, dexmedetomidine with fentanyl gives a better hemodynamic profile, respiratory profile, patient satisfaction, and quicker recovery than propofol with fentanyl. Whereas propofol and fentanyl provide quicker onset and more efficient sedation compared to dexmedetomidine and fentanyl.

AUTHOR CONTRIBUTIONS

All authors contributed to the study's conception and design. A literature search was carried out by RN and SP. Data acquisition was done by SP, while data analysis was done by SAP and KP. The first draft of the manuscript was framed by SAP, which was later modified as per the suggestions of all the authors. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

None.

SOURCE OF SUPPORT

None.

DATA AVAILABILITY STATEMENT

Data shall be available from the corresponding author upon specific request.

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