Original Article

Comparison of Propofol-Fentanyl and Propofol-Ketamine for Sedoanalgesia in Percutaneous Endoscopic Gastrostomy Procedures

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ABSTRACT

Background: Percutaneous endoscopic gastrostomy (PEG) procedures are performed under sedation in critically ill patients who cannot be fed orally. **Aim:** We compared the efficacy and safety of propofol-fentanyl and propofol-ketamine for deep sedation in patients undergoing PEG. Retrospective Study. **Materials and Methods:** The study was conducted from 1 January 2013 to 31 December 2018 in Adıyaman University. The patients given propofol-fentanyl (0.5–1.2 mg/kg and 0.2–1 μg/kg, respectively) for sedo-analgesia were designated Group F, and those who received propofol-ketamine (0.2–0.6 mg/kg and 0.5–1 mg/kg, respectively) were placed in Group K. The demographic and hemodynamic characteristics, recovery times, perioperative complications, and need for additional doses were recorded. **Results:** Seventy-one patients who underwent PEG were analyzed. The age, sex, American Society of Anesthesiologists (ASA) score, comorbidities, duration of anesthesia, and duration of the PEG procedure were similar in the two groups. Recovery time was longer in Group K. The total propofol dose was 64 mg in Group F and 35 mg in Group K. Additional doses of propofol were administered to 12 patients in Group F, compared to none in Group K. The mean blood pressure values were higher in Group K at all-time points. The perioperative complication rate was higher in Group F. Desaturation was observed in 9 (22.5%) patients in Group F and in 3 (9.6%) patients in Group K. Hypotension was observed in 4 (10%) patients in Group F. **Conclusion:** Propofol-ketamine should be preferred for sedoanalgesia during PEG procedures because of the lower dose of propofol, more stable blood pressure, and greater peripheral oxygen saturation. In addition, we believe ketamine-propofol is safer based on its low complication rate.

KEYWORDS: *Fentanyl, ketamine, percutaneous endoscopic gastrostomy, propofol, sedoanalgesia*

INTRODUCTION

Nasogastric, nasojejunal, gastrostomy, and jejunostomy tubes are used for long-term nutrition in patients with insufficient oral intake. Gastrostomy is the most suitable method for the long term. Percutaneous endoscopic gastrostomy (PEG) was introduced in 1980 by Gauderer and in 1981 by Ponsky as an alternative to surgical gastrostomy.[1,2] PEG has replaced surgical gastrostomy because of its lower cost and shorter recovery time.[3,4] Patients requiring PEG are usually elderly, cachectic, and/or malnourished.

All procedures necessary for patients preparing for general anesthesia should also be performed for patients undergoing a PEG procedure. These procedures begin with the preoperative evaluation and include all steps from the recovery room to the transfer of the patient to the service. The type of anesthesia used depends on the medical condition of the patient and

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the preference of the anesthesiologist. The purpose of anesthesia in PEG is to keep the patient immobile and to suppress reflex activities.[5,6] Because patients undergoing PEG are of advanced age and have many comorbidities, the anesthetics to be administered must be carefully adjusted.[7] The risk for aspiration is increased by gastric bleeding and consumption of bowel preparation agents. Access to the airway is hampered by the position of the patient, the darkened room, and the endoscope.[8] Therefore, it is important to protect spontaneous breathing and provide deep sedation during PEG procedures.

Side effects are common when propofol is used for sedation and general anesthesia induction in elderly patients; the propofol dosage should be reduced in such patients.[9] What was the mean age of patients in this study? Are they mainly elderly? When propofol alone is used for deep sedation, dose-related side effects such as hypotension, hypoventilation, and bradycardia may occur. To reduce these side effects, deep sedation is provided by adding an analgesic to propofol, such as fentanyl.[10-12] A mixture of ketamine and propofol has recently been used as a sedative and analgesic agent in, for instance, electroconvulsive therapy, endoscopic retrograde cholangiopancreatography, bronchoscopy, and endoscopy, and to support regional anesthesia.[13] Ketamine is a neuroleptic anesthetic agent and acts on n-methyl-d-aspartate receptors in the thalamocortical and limbic systems.

Propofol-ketamine is preferred because propofol has a short duration of action, providing rapid recovery, and decreases systemic vascular resistance, causing a decrease in the systolic, diastolic, and mean arterial pressures. In addition, ketamine has a relatively long duration of action and an analgesic effect. And also ketamine causes temporary increases in heart rate (HR), blood pressure, and cardiac output by activating the sympathetic system, preserving the hemodynamics of PEG patients.[14]

This study was aimed to compare the efficacy of propofol-fentanyl and ketamine-propofol for PEG procedures.

Materials and Methods

This retrospective study involved patients who underwent PEG in the Endoscopy Unit of the Department of Gastroenterology, Adiyaman University Training and Research Hospital, from 1 January 2013 to 31 December 2018. The study protocol was approved by Adiyaman University Faculty of Medicine Ethics Board (Date: 26/06/2018 Approval No: 2018/5-41), and the study was conducted in accordance with the Helsinki declaration. Approval for participation was not applicable because retrospective nature of study. Patient data were obtained from the hospital registration system and anesthesia follow-up form. The patients were evaluated in the anesthesia outpatient clinic in the preoperative period, and feeding through a nasogastric tube was stopped 8 h before the procedure.

The patients were divided into two groups according to the anesthetic method used. The patients given propofol-fentanyl for sedoanalgesia were designated Group F, and those given ketamine-propofol were designated Group K. In Group F, 0.5–1.2 mg/kg propofol (Propofol 1%; Fresenius Kabi, Turkey) and 0.2–1 μg/kg fentanyl (Fentanyl 0.05 mg/mL; Johnson and Johnson, Istanbul, Turkey) were administered, and 0.2–0.6 mg/kg propofol and 0.2–0.6 mg/kg ketamine (Ketalar 500 mg; Pfizer, Istanbul, Turkey) were used in Group K. The patients who received additional doses of medication for anesthetic purposes were recorded. Prilocaine (Citanest® Vial 2%; AstraZeneca, Istanbul, Turkey) was used for local anesthesia and lidocaine spray (Lidocaine Spray; Vem Pharmaceuticals, Istanbul, Turkey) for oropharyngeal anesthesia.

The sex, age, body mass index, American Association of Anesthesiologists score, and diagnosis of the patients were recorded. Hemodynamic parameters (mean arterial pressure [MAP], heart rate [HR], and peripheral oxygen saturation [SpO_2]) were recorded in the wards, preoperative unit, and operating room. Complications that developed during and after the procedure (hypoxemia, hypotension, nausea, and vomiting) and during recovery (the time from the end of the procedure until the Aldrete score reached 8 [in min]) were recorded. After the procedure, the patients sent to the post-anesthesia care unit were monitored and were returned to their wards after recovery.

Statistical analyses

The independent samples t-test was conducted for comparisons of independent groups and means ± standard deviation are reported. The Chi-square test was performed to examine differences in categorical variables. Numbers and percentages are reported. The significance level was set at $P < 0.05$. Statistical analyses were conducted using SPSS ver. 25 software (IBM Corp. Armonk, NY).

Results

All 122 patients who underwent PEG were analyzed. The patients who used drugs other than propofol-fentanyl and propofol-ketamine for sedoanalgesia ($n = 30$), those receiving mechanical ventilator support (intubated or tracheostomy, $n = 14$), and patients who underwent PEG

Table 1: Demographic data of the cases in Group F and Group K

Demographic data	Propofol-Fentanyl (*n*=40)	Ketofol (*n*=31)	*P*
Age (years)	60.7±26.37 (11-93)	69.26±18.57 (20-89)	0.114
Gender (F/M)	19 (47.5%)/21 (52.5)	1 4 (45.2%)/17 (54.8%)	0.845
ASA (3/4)	34 (85%)/6 (15%)	28 (90.3%)/6 (9.7%)	0.722
Service			
ICU	22 (55%)	12 (38.7%)	0.450, ns
Neurology Service	8 (20%)	6 (19.4%)	
Internal Medicine Service	4 (10%)	5 (16.1%)	
Chest Diseases Service	2 (5%)	5 (16.1%)	
Palliative Care Service	4 (10%)	3 (9.7%)	
Diagnosis			
Cerebro vascular disease	16 (40%)	12 (38.7%)	0.320 ns
Post CPR	5 (12.5%)	5 (16.1%)	
Trauma	9 (22.55%)	3 (9.7)	
Malignancy	3 (7.55%)	0	
Respiratory Failure	2 (5%)	5 (16.1%)	
Other	5 (12.5%)	6 (19.4%)	

ASA=American Association of Anesthesiologists score, ICU=Intensive care unit, CPR=Cardiopulmonary Resuscitation

Table 2: Procedure times, recovery times and hospitalization times, drug dose, diagnosis, and complications

Clinical data	Propofol-Fentanyl (*n*=40)	Ketofol (*n*=31)	*P*
Duration of hospital stay (days)	51.98±63.171 (1-346)	22.45±30.96 (1-157)	0.012
Procedure time (min)	14.75±4.40 (8-30)	15.97±2.20 (10-20)	0.163
Recovery time (min)	8.25±2.7 (5-15)	10.87±2.75 (5-17)	<0.001
Propofol (mg) consumed	64.37±25.9	34.8±11.7	<0.001
Additional dose	12	0	<0.001
Complication			
Desaturation	9 (22.5%)	3 (9.6%)	0.023s
Hypotension	4 (10%)	0 (0%)	

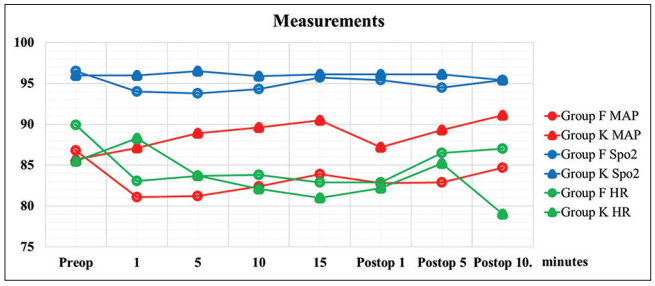

Figure 1: Hemodynamic parameters of patients given sedoanalgesia in Group F and Group K

exchange (n = 7) were excluded. Propofol-fentanyl was used in 40 (56%), and propofol-ketamine was used in 31 (44%) of the remaining 71 patients.

The mean age of patients was 60.7 ± 26.37 in Group F and 69.26 ± 18.57 in Group K. There were no significant differences in mean age or mean procedure time between the groups ($P > 0.05$). However, the mean hospitalization duration was longer in Group F ($P < 0.05$), and the recovery time was longer in Group K ($P < 0.05$).

There were no significant differences in the ASA value, service admitted to, or diagnosis ($P > 0.05$) [Table 1].

However, the complication rates during and after the procedure differed significantly between the two groups ($P < 0.05$). Desaturation was observed in 9 (22.5%) patients in Group F and in 3 (9.6%) patients in Group K. Hypotension was observed in 4 (10%) patients in Group F ($P = 0.023$) [Table 2].

The oxygen saturation of these patients was improved by repositioning of the head and chin and positive-pressure ventilation. Four patients who developed hypotension were treated with fluid replacement and intravenous administration of 5 mg ephedrine. The mean total propofol dose was significantly higher in Group F (64 mg) compared to Group K (35 mg) ($P < 0.001$). In addition, 12 patients in Group F needed an additional dose of propofol compared to no patient in Group K ($P < 0.001$) [Table 2].

The mean MAP, HR, and SpO_2 were compared using independent samples t-tests. There were no differences in the preoperative MAP ($P > 0.05$), but the MAP was significantly higher in Group K than Group F at 15 min ($P < 0.05$). In addition, the SpO_2 values

in Group K were significantly higher at 1–5 min and 10 min during the PEG procedure and at 5 min after the procedure ($P < 0.05$). However, the mean HR did not differ significantly between the two groups ($P > 0.05$) [Figure 1].

Discussion

When the groups were compared in terms of propofol consumption, less propofol consumption was found in Group K than in Group F. Although it provided less complications and more stable hemodynamics, longer recovery times were detected in Group K compared to Group F.

Propofol is a fast-onset short-acting hypnotic agent, which is highly lipid soluble and is metabolized in the liver. Propofol sedation is reportedly both safe and effective for elderly patients undergoing high-risk procedures and endoscopic procedures.[7,9,15] Horiuchi *et al*.[7] administered an average of 24 mg propofol to patients of mean age 91.8 years, and an average of 61 mg propofol to patients of mean age 55.4 years. The blood propofol concentration was similar at 30, 60, and 120 min after injection. In this study, the total propofol dose used was 64 mg in Group F and 35 mg in Group K, respectively. The lower dose of propofol in Group K was likely a result of co-administration of ketamine.

The combination of propofol and fentanyl is widely used in non-operating room anesthesia applications. While fentanyl affects psychomotor functions minimally, it also has analgesic activity. However, this combination causes an increase in the frequency of respiratory and hemodynamic complications due to the respiratory depression and cardiomyodepressant effects of both agents. In our current study, a decrease in blood pressure and lower SpO_2 values were recorded in patients in Group F. Additionally, desaturation was observed more in Group F due to the respiratory depression effect of this combination.

Tosun *et al*.[16] showed that propofol-ketamine caused deeper sedation than propofol-fentanyl in 1–16 aged children undergoing upper gastrointestinal endoscopy. Similarly, in this study, 12 patients in Group F needed an additional dose of propofol to provide deep sedation compared to none in Group K. PEG procedure is a surgical and painful procedure so that it requires deeper sedation than standard endoscopic methods. Similarly, deeper sedation is needed in pediatric patients to keep them still during the endoscopy procedure.[17] We think that the need for deep sedation in both patient groups led to similar results.

Hasanein and Sayed[18] reported that ketamine-propofol provided better sedation with less hemodynamic disturbance and respiratory depression than fentanyl-propofol in obese patients undergoing ERCP. García-Suárez *et al*.[19] found a complication rate of 21% for propofol in PEG procedures. In the study of Peveling-Oberhag *et al*.,[20] the rate of severe hypoxemia was 20%–41% with propofol. Aydogan *et al*.[21] examined propofol-ketamine compared to propofol in 100 patients undergoing upper gastrointestinal endoscopy. Propofol-ketamine resulted in a shorter recovery time, better hemodynamic stability, and higher satisfaction than propofol alone. In this study, desaturation was observed in 9 (22.5%) patients in Group F and in 3 (9.6%) patients in Group K. Hypotension was observed in 4 (10%) patients in Group F ($P = 0.023$). The MAP was not significantly different between the groups before the procedure; it was higher in Group K at 1,5,10,15min. min and significantly higher at 15 min. The SpO_2 values were higher at 1–5 min and 10 min during the PEG procedure and at 5 min after the procedure ($P < 0.05$) in Group K.

Pambianco *et al*.[22] reported a recovery time of 9–12 min for propofol during endoscopy. Tosun *et al*.[16] reported that propofol-ketamine was associated with a longer recovery time than propofol-fentanyl in children undergoing upper gastrointestinal endoscopy. Here, the recovery time was shorter in Group F.

PEG is frequently performed in patients with chronic neurological disorders (brain trauma, cerebral palsy, and neuromuscular disorders), oncology patients, those with severe head-and-neck trauma or chronic lower gastrointestinal system obstruction (such as abdominal malignancy), and patients undergoing upper respiratory tract surgery.[3,23] In this study, PEG was most frequently performed in neurological and trauma patients. The PEG procedure time is reportedly 8–16 min[18,19]; in this study, it was procedure time 14.75 (8–30) min in Group F and 15.97 (10–20) min in Group K ($P = 0.163$).

In conclusion, propofol-ketamine provides better and comfortable sedoanalgesia in PEG, due to low-dose propofol consumption, more stable blood pressure, and peripheral oxygen saturation. In addition, the use of ketamine-propofol during PEG procedure is safer because of its low complication rates.

Limitations of this study

This was a retrospective study, and early and late complications of PEG were not considered separately.

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Conflicts of interest

There are no conflicts of interest.

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