

Comparing Hemodynamic stability and recovery profiles of PROPOFOL - KETAMINE versus PROPOFOL -FENTANYL in Upper GIT Endoscopic procedures

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ABSTRACT

Background: Gastrointestinal endoscopy requires effective sedation for comfort and procedural quality. Propofol-ketamine may provide better cardiopulmonary stability and reduce propofol requirements than propofol-fentanyl. Evidence comparing these regimens in Bangladesh remains limited. This study aimed to compare their sedation efficacy, hemodynamic and respiratory safety, adverse events, and recovery profiles. **Methods & Materials:** A prospective randomized study included 60 adults undergoing elective upper GI endoscopy at the National Gastroenterology Institute & Hospital, Dhaka. Patients were randomized in a 1:1 ratio to PK (ketamine 0.5 mg/kg) or PF (fentanyl 1 µg/kg), followed by propofol administration. Hemodynamic and respiratory parameters, propofol requirement, time to adequate sedation, recovery and discharge times, patient and endoscopist satisfaction, and adverse events were assessed throughout the procedure. Data were analyzed using SPSS version 26.0, with $p < 0.05$ considered statistically significant. **Results:** Sixty patients were randomized equally to PK and PF groups. Baseline characteristics were comparable ($p > 0.05$). PK showed significantly higher minimum HR, MAP, and SpO₂ than PF ($p \leq 0.001$). Total propofol use was lower with PK (84.6 ± 18.5 vs. 96.2 ± 20.7 mg, $p = 0.026$), although time to adequate sedation, recovery, and discharge were significantly longer with PK. Patient and endoscopist satisfaction were higher with PK ($p = 0.031$ and $p = 0.009$). Hypotension (6.7% vs. 30.0%), bradycardia (3.3% vs. 20.0%), and desaturation (3.3% vs. 23.3%) were significantly lower with PK ($p < 0.05$). **Conclusion:** Propofol-ketamine provided better hemodynamic and respiratory

stability, lower propofol requirements, and higher patient and endoscopist satisfaction than propofol-fentanyl, although recovery and discharge times were slightly prolonged. These findings suggest that propofol-ketamine may be a useful alternative to propofol-fentanyl for procedural sedation during elective upper GI endoscopy.

Keywords: Propofol-ketamine, Propofol-fentanyl, Upper gastrointestinal endoscopy, Procedural sedation, Hemodynamic stability, Respiratory safety, Recovery.

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INTRODUCTION

Gastrointestinal endoscopy is a common procedure frequently performed under sedation outside the operating room [1]. The increasing demand for endoscopic procedures has created a need for efficient and cost-effective approaches that minimize patient discomfort while maintaining safety [2]. Sedation improves procedural quality, patient comfort and satisfaction, and adherence to screening and surveillance [3]. Propofol-based sedation provides effective sedation, favorable procedural conditions, and good patient cooperation during gastrointestinal endoscopy [4,5]. However, propofol lacks significant analgesic effects, and higher doses may cause hypotension, bradycardia,

respiratory depression, and oxygen desaturation. Analgesic adjuncts can reduce propofol requirements while maintaining adequate sedation [6]. Fentanyl is a potent, short-acting opioid commonly combined with propofol because of its rapid onset and effective analgesia. Although propofol-fentanyl (PF) provides effective sedation and reduces propofol requirements, their synergistic respiratory and cardiovascular effects may increase hypoxemia, hypotension, and bradycardia [7,8]. Ketamine provides sedation and analgesia while generally preserving spontaneous respiration, airway reflexes, and cardiovascular stability. When combined with propofol (propofol-ketamine [PK] or ketofol), its effects

complement propofol's hypnotic action and rapid recovery, making it a potential alternative to opioid-based sedation [9]. Adding ketamine to propofol during UGI endoscopy may reduce propofol requirements, improve procedural conditions, and shorten recovery. Similarly, esketamine-propofol can reduce propofol consumption and hypotension without delaying recovery [10,11]. Hemodynamic and respiratory stability are important considerations in endoscopic sedation. Propofol may cause hypotension, whereas ketamine may preserve cardiovascular stability; fentanyl may increase bradycardia and respiratory depression [8,12]. Rapid recovery is also essential for efficient endoscopy and timely

discharge. Although fentanyl may allow slightly faster recovery, this potential benefit should be balanced against the greater risk of hypotension and desaturation with PF [16]. Ketamine-containing regimens generally provide effective analgesia, reduce propofol requirements, and maintain acceptable recovery profiles [10,13]. Therefore, comparing PK and PF regimens is important to assess their relative efficacy, safety, and recovery characteristics during gastrointestinal endoscopy. In Bangladesh, evidence comparing propofol-ketamine (PK) and propofol-fentanyl (PF) for gastrointestinal endoscopy remains limited. This study aims to compare their sedation efficacy, propofol requirements, hemodynamic and respiratory safety, adverse events, and recovery time.

METHODS & MATERIALS

Study Design and Setting

This prospective randomized comparative study was conducted at the National Gastroenterology Institute & Hospital, Mohakhali, Dhaka, Bangladesh, from June 2024 to May 2025. The study included 60 adult patients undergoing elective upper gastrointestinal endoscopic procedures under procedural sedation.

Study Participants

Patients aged ≥18 years with ASA physical status I–II who were scheduled for elective upper gastrointestinal endoscopy were included. Patients with allergy or contraindication to propofol, ketamine, or fentanyl, significant cardiovascular or respiratory disease, severe hepatic or renal dysfunction, pregnancy, or those requiring general anesthesia were excluded.

Randomization

Eligible patients were randomly assigned in a 1:1 ratio to either the Propofol–Ketamine (PK) group or the Propofol–

Fentanyl (PF) group, with 30 patients in each group. Randomization was performed using a computer-generated random allocation sequence. Group assignments were placed in sequentially numbered, opaque, sealed envelopes and opened immediately before administration of sedation.

Sedation Protocol

Patients were randomly allocated into two equal groups (n=30 each). The Propofol–Ketamine group (PK) received intravenous ketamine 0.5 mg/kg, followed by propofol 0.5–1.0 mg/kg. Additional propofol boluses of 10–20 mg was administered as required to maintain adequate procedural sedation. The Propofol–Fentanyl group (PF) received intravenous fentanyl 1 µg/kg, followed by propofol 0.5–1.0 mg/kg, with additional 10–20 mg propofol boluses when required. Sedation was titrated according to clinical response, with spontaneous ventilation maintained whenever possible.

Standard monitoring of heart rate, non-invasive blood pressure, respiratory status, and SpO₂ was performed throughout the procedure. Supplemental oxygen was administered at 2–3 L/min through a nasal cannula. Hypotension, bradycardia, and oxygen desaturation were managed with supportive measures according to standard institutional practice.

Outcome Measures

The primary outcome was hemodynamic stability, assessed by heart rate, mean arterial pressure (MAP), and SpO₂. Secondary outcomes included total propofol dose, time to adequate sedation, recovery time, time to discharge, patient and endoscopist satisfaction, and procedure-related adverse events. Oxygen desaturation was defined as SpO₂ <92%, while hypotension was defined as systolic blood pressure <90 mmHg or a >20% reduction from baseline.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. The independent-samples t-test was used to compare continuous variables between the two groups, and the chi-square test or Fisher's exact test was used for categorical variables as appropriate. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the appropriate institutional ethics committee, and written informed consent was obtained from all participants before enrollment. The study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

A total of 60 patients undergoing upper gastrointestinal endoscopic procedures were included in the study. The participants were randomly allocated into two equal groups, with 30 patients receiving Propofol–Ketamine (PK) and 30 receiving Propofol–Fentanyl (PF). All 60 patients completed the procedure and recovery assessment, and no participant was excluded from the final analysis.

Baseline characteristics

Table I presents the baseline demographic and clinical characteristics of the participants. The two groups were comparable in terms of age, sex, body weight, BMI, ASA physical status, and procedure duration. No statistically significant differences were observed between the groups for any of the baseline variables (p>0.05).

Table I
Baseline demographic and clinical characteristics of the study participants.

Variables	PK Group (n=30),n(%)	PF Group (n=30),n(%)	p-value
Age (years), mean ± SD	45.8 ± 11.6	47.3 ± 10.8	0.612
Male	18 (60.0)	17 (56.7)	0.793
Female	12 (40.0)	13 (43.3)	
Weight (kg), mean ± SD	63.5 ± 8.7	64.2 ± 9.1	0.758
BMI (kg/m ²), mean ± SD	24.4 ± 3.1	24.8 ± 3.4	0.641
ASA I	19 (63.3)	17 (56.7)	0.598
ASA II	11 (36.7)	13 (43.3)	
Procedure duration (minutes), mean ± SD	18.4 ± 4.5	17.9 ± 4.8	0.683

Hemodynamic parameters

Table II shows the hemodynamic parameters during the procedure. Baseline heart rate, MAP, and SpO₂ were comparable between the groups. However,

the PK group had significantly higher minimum heart rate (77.3 ± 8.5 vs. 69.1 ± 9.4 beats/min, p=0.001), minimum MAP (88.7 ± 7.3 vs. 79.8 ± 8.6 mmHg, p<0.001), and minimum SpO₂ (96.9 ± 1.4% vs. 94.8

± 2.3%, p<0.001) compared with the PF group.

Table II
Hemodynamic parameters during endoscopic procedures.

Parameter	PK Group (n=30)	PF Group (n=30)	p-value
Baseline HR (beats/min)	81.6 ± 9.2	82.4 ± 8.8	0.731
Lowest HR during procedure	77.3 ± 8.5	69.1 ± 9.4	0.001
Baseline MAP (mmHg)	92.8 ± 8.1	91.9 ± 7.8	0.668
Lowest MAP during procedure	88.7 ± 7.3	79.8 ± 8.6	<0.001
Baseline SpO ₂ (%)	98.4 ± 0.8	98.3 ± 0.7	0.614
Lowest SpO ₂ (%)	96.9 ± 1.4	94.8 ± 2.3	<0.001

Sedation and recovery characteristics
Table III summarizes the sedation and recovery characteristics. The total propofol requirement was significantly lower in the PK group than in the PF group (84.6 ± 18.5

vs. 96.2 ± 20.7 mg, p=0.026). The PK group had a slightly longer time to achieve adequate sedation (p=0.013) and significantly longer recovery and discharge times (p<0.001 and p=0.002, respectively).

However, both patient and endoscopist satisfaction scores were significantly higher in the PK group (p=0.031 and p=0.009, respectively).

Table III
Sedation and recovery characteristics.

Variables	PK Group (n=30)	PF Group (n=30)	p-value
Total propofol dose (mg), mean ± SD	84.6 ± 18.5	96.2 ± 20.7	0.026
Time to adequate sedation (min)	1.8 ± 0.5	1.5 ± 0.4	0.013
Recovery time (min)	18.7 ± 4.6	13.9 ± 3.8	<0.001
Time to discharge (min)	31.2 ± 6.7	25.8 ± 5.9	0.002
Patient satisfaction score (0–10)	8.9 ± 0.8	8.4 ± 0.9	0.031
Endoscopist satisfaction score (0–10)	9.1 ± 0.7	8.5 ± 0.9	0.009

Procedure-related adverse events
Table IV presents the procedure-related adverse events. Hypotension (6.7% vs. 30.0%, p=0.020), bradycardia (3.3% vs. 20.0%, p=0.044), and oxygen desaturation

(3.3% vs. 23.3%, p=0.023) were significantly less frequent in the PK group than in the PF group. Airway intervention and nausea/vomiting did not differ significantly between the groups, while

mild emergence reactions were observed in two patients (6.7%) in the PK group.

Table IV
Procedure-related adverse events.

Adverse events	PK Group (n=30), n (%)	PF Group (n=30), n (%)	p-value
Hypotension	2 (6.7)	9 (30.0)	0.020
Bradycardia	1 (3.3)	6 (20.0)	0.044
Oxygen desaturation (SpO ₂ <92%)	1 (3.3)	7 (23.3)	0.023
Need for airway intervention	0 (0.0)	3 (10.0)	0.076
Nausea/vomiting	3 (10.0)	2 (6.7)	0.640
Emergence reactions	2 (6.7)	0 (0.0)	0.150

The Propofol–Ketamine combination provided significantly better hemodynamic stability and fewer cardiopulmonary adverse events compared with Propofol–Fentanyl during upper gastrointestinal endoscopic procedures. Although recovery and discharge times were longer with ketamine, patient and endoscopist satisfaction were higher in the PK group. These findings suggest that the Propofol–Ketamine combination may be a safer alternative for procedural sedation in upper gastrointestinal endoscopy.

DISCUSSION

Age, sex, weight, BMI, ASA status, and procedure time were all similar between the Propofol–Ketamine (PK) and Propofol–Fentanyl (PF) groups in the current investigation; no significant differences were found [14]. These results enable a trustworthy comparison of the two medication regimens' subsequent sedation outcomes and show good baseline balance. During outpatient endoscopic operations,

hemodynamic and respiratory stability are of utmost importance. In the current investigation, the PK group demonstrated superior cardiopulmonary stability by maintaining a considerably higher mean arterial pressure, SpO₂, and lowest heart rate than the PF group. These findings are in line with recent research emphasizing ketamine's sympathomimetic effects, which successfully offset the cardiorespiratory depression that propofol usually causes. For instance, Aşkın et al. showed that, without sacrificing the quality of the sedation, a ketofol admixture is better than propofol alone in maintaining hemodynamic and respiratory stability during endoscopic procedures [17]. Similarly, compared to a thiopental and fentanyl regimen, sedation with a propofol and ketamine admixture produced noticeably more stable hemodynamic parameters in a pediatric cohort undergoing upper gastrointestinal endoscopy [18]. Additionally, the significantly reduced incidence of oxygen desaturation (3.3%) in

our PK group compared to the PF group (23.3%) is probably due to the protective impact of ketamine on airway reflexes and respiratory drive. In terms of dosage and sedation profiles, our research revealed that the PK regimen produced greater patient and endoscopist contentment while requiring much less total propofol. One important clinical benefit of ketamine is its strong propofol-sparing action. Particularly in high-risk populations like obese patients undergoing endoscopic retrograde cholangiopancreatography, Hasanein and El-Sayed discovered that a ketamine/propofol combination offered better sedation quality, better hemodynamics, and fewer side effects than a fentanyl/propofol combination[19]. Although fentanyl is a strong opioid that produces quick analgesia, it does not have the same strong dose-sparing synergy as propofol. Therefore, the increased incidence of cardiac adverse events was probably directly caused by the higher total

propofol needs shown in our PF group (96.2 ± 20.7 mg vs. 84.6 ± 18.5 mg). It is crucial to recognize that the PK group's recovery, discharge, and sufficient sedation times were considerably longer than those of the PF group. However, the overall safety profile must be considered when weighing this recovery speed trade-off. The PK group showed considerably reduced rates of hypotension (6.7% vs. 30.0%) and bradycardia (3.3% vs. 20.0%) in our study's adverse event data. This is in line with a recent thorough meta-analysis of sedation for gastrointestinal endoscopy, which found that although propofol-fentanyl may slightly shorten procedure and recovery times, it is much more likely to cause potentially fatal hypotension, apnea, and desaturation than propofol-ketamine^[15].

Overall, the results of this study support the notion that propofol-ketamine offers greater procedural satisfaction, reduced propofol needs, and improved cardiac stability compared to propofol-fentanyl. Propofol-ketamine is a very effective and possibly safer substitute for procedural sedation in elective upper GI endoscopy, despite somewhat longer recovery and discharge periods.

CONCLUSION

Propofol-ketamine provided better hemodynamic and respiratory stability, lower propofol requirements, and higher patient and endoscopist satisfaction than propofol-fentanyl during upper GI endoscopy. Although PK was associated with slightly slower sedation onset and longer recovery and discharge times, it significantly reduced hypotension, bradycardia, and oxygen desaturation. These findings suggest that propofol-ketamine may be a safe and effective alternative to propofol-fentanyl for procedural sedation in elective upper GI endoscopy.

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