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Comparison of Ketamine-Propofol and Fentanyl-Propofol on Intraoperative Hemodynamic Stability in Endoscopic Procedures

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ABSTRACT

Background: Deep sedation is commonly used for endoscopic procedures and is often achieved with combinations of anesthetic agents.
Aims: This study compares ketamine-propofol (Ketofol) versus fentanyl-propofol (Fentofol) for maintaining intraoperative hemodynamic stability during endoscopy.
Settings and Design: The study is a prospective observational comparison conducted at Thumbay University Hospital, Ajman, UAE.
Methods and Materials: A prospective observational comparison was conducted in 100 adult patients (50 per group) undergoing various endoscopic procedures under deep sedation at a single centre. Systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate were recorded at baseline and 3-minute intervals intraoperatively.
Results: Both sedation regimens provided adequate anesthesia without serious adverse events. Early intraoperative hemodynamic readings were similar between groups ($p > 0.05$). However, at certain time points during the procedure (around 6 and 15 minutes after induction), the ketamine-propofol group exhibited significantly higher blood pressure readings (closer to baseline) compared to the fentanyl-propofol group ($p < 0.05$), indicating more stable hemodynamics. Heart rate did not differ significantly between the two combinations at any time.
Conclusion: Ketamine-propofol deep sedation maintained intraoperative hemodynamic stability more effectively than fentanyl-propofol in endoscopic procedures, particularly in preventing blood pressure drops during the procedure. These findings support the preferential use of ketamine-propofol for sedation in high-risk endoscopic cases where maintaining blood pressure is crucial.

Keywords: Ketamine-propofol, Fentanyl-propofol, Deep sedation, Hemodynamic stability, Endoscopic procedures

1. INTRODUCTION

Endoscopic procedures are widely performed for diagnostic and therapeutic purposes in gastroenterology. Endoscopic procedure is defined as a minimally invasive and safe technique with a low incidence of scarring, bleeding, and oedema, while it may lead to uncomfortable and anxiety for patients [1,2]. Deep sedation administered by anesthesiologist is commonly used to ensure patient comfort and immobility during endoscopy. Maintaining hemodynamic stability throughout these procedures is critical for patient safety and optimal outcomes. Hemodynamic instability during sedation can lead to complications ranging from patient discomfort and procedure interruption to more serious morbidity [3,4].
Propofol is an intravenous anesthetic agent frequently used for induction and maintenance of sedation due to its rapid onset and quick recovery profile. However, propofol alone often causes dose-dependent hypotension and bradycardia because of vasodilatory and myocardial depressive effects. To mitigate these side effects and provide analgesia, propofol is commonly combined with either an opioid or a dissociative anesthetic for procedural sedation [5]. Fentanyl, a potent opioid, is often added to propofol to provide analgesia and deepen sedation (the combination sometimes termed

"Fentofol"). Fentanyl may itself cause respiratory depression and bradycardia, but in moderate doses it helps blunt procedural pain without profoundly affecting blood pressure [6]. Ketamine, a dissociative anesthetic with analgesic characteristics, is another adjunct used in conjunction with propofol ("Ketofol"). Notably, Ketamine has the unique ability to stimulate the sympathetic nervous system, which can raise heart rate and blood pressure [7]. This property may counteract propofol's depressant effects on circulation, potentially resulting in more stable hemodynamics during sedation. Ketamine also provides analgesia and usually preserves respiratory drive, though it can cause other side effects like emergent delirium, nausea.

Tosun et al. and Hasanein and El-Sayed found that Ketofol provides steady hemodynamic parameters and is useful for pediatric and obese patients, with a safety profile like Fentofol [1]. Singh et al. showed no significant changes in outcome between propofol alone, Ketofol, and Fentofol for endoscopic ultrasonography [5]. Despite these findings, there is no consensus on the best sedation regimen, therefore, this study will evaluate Ketofol and Fentofol for preserving intraoperative hemodynamic stability during endoscopy.

2. METHODS

Study Design and Setting: We did a prospective, observational study in the operating theatre at Thumbay University Hospital in Ajman, UAE. The Gulf Medical University Ethics Committee approved the study [Ref No. IRB-COHS-STD-33-MAR-2023], and all patients provided written informed consent before enrolment. The study lasted three months (February–April 2023).

Participants: Based on the anesthesiologist's choice of sedative combination, 100 patients who met certain inclusion criteria were enrolled in the clinical study and split equally into two groups: 50 in the Ketamine-Propofol group and 50 in the Fentanyl-Propofol group. Participants between the ages of 18 and 60 who were receiving gastrointestinal or other endoscopic operations under deep sedation, had an ASA physical status of 1–4, and gave their informed consent were eligible to participate. Patients who refused to participate, had severe cardiac instability, or were contraindicated for ketamine or fentanyl were not included.

Procedure and Data Collection: During endoscopic operations, all patients underwent routine anesthetic monitoring, with baseline vital signs (blood pressure, mean arterial pressure, and heart rate) recorded before sedation. Deep sedation was achieved using either Ketofol (propofol 1-2 mg/kg IV + ketamine 0.5 mg/kg IV, maintained with further propofol/ketamine) or Fentofol (propofol 1-2 mg/kg IV + fentanyl 1 µg/kg IV, maintained with extra propofol/fentanyl). There were no inhalational anesthetics or muscle relaxants used and patients were spontaneously ventilated with supplemental oxygen administered by an anesthesia specialist.

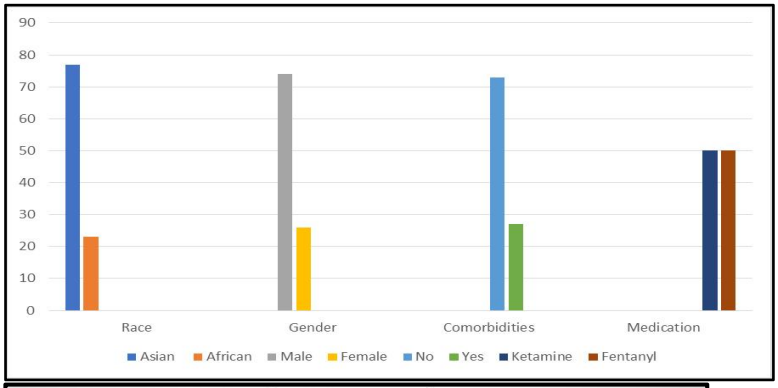
Vital signs were taken at baseline and every 3 minutes for the first 15 minutes after surgery (a total of six time points). Data were collected from a patient monitor, with an emphasis on the first 15 minutes for uniformity, but additional measurements were taken if operations took longer than that. Other sedatives or analgesics were administered only when inadequate sedation or considerable hemodynamic instability occurred, but no severe instances or rescue interventions were required. Patients were observed in recovery until the discharge criteria were met.

Data Analysis: The data were entered into a spreadsheet and analyzed using descriptive and inferential statistical methods with SPSS. Continuous variables (e.g., blood pressure, heart rate) were presented as mean ± standard deviation for each group at each time point, while categorical variables (e.g., gender, comorbidities) were summarized as frequencies and percentages. Inferential analysis utilized chi-square tests for categorical data (e.g., comparing >20% blood pressure drops between groups) and repeated-measures comparisons for continuous data, such as independent-sample t-tests or repeated measures ANOVA to compare mean SBP, DBP, MAP, and HR between groups at each time point, with significance set at $P < 0.05$. P-values for group differences in hemodynamic parameters were determined.

3. RESULTS

The study compared Ketofol and Fentofol, and the results were identical, but Ketofol had fewer hemodynamic changes, indicating improved stability. The groups had similar baseline demographics, with the mean age of 29 years; 91% of participants were under 30 and 9% were over 30 (6% aged 30-40, 3% over 40). Figure 1 shows demographics: of 100 individuals, 77% were Asian and 23% were African; 74% were male and 26% were female; 73% had no comorbidities, whereas 27% had coexisting disorders. Each group (ketofol and fentofol) had 50 individuals to ensure a fair comparison. Figure 2 indicates that 43% of participants were overweight (BMI 25 to <30), 32% had normal BMI (18.5 to <25), and 25% were obese. The study discovered that 73 participants had no comorbidities, while 27 had comorbidities, as illustrated in Figure 3. The most prevalent comorbidities were hypertension (47%), diabetes (39%), and gastro-oesophageal reflux disease (9%). Other uncommon diseases accounted for 5% of comorbidities.

Figure 1: Shows demographic data of the participants



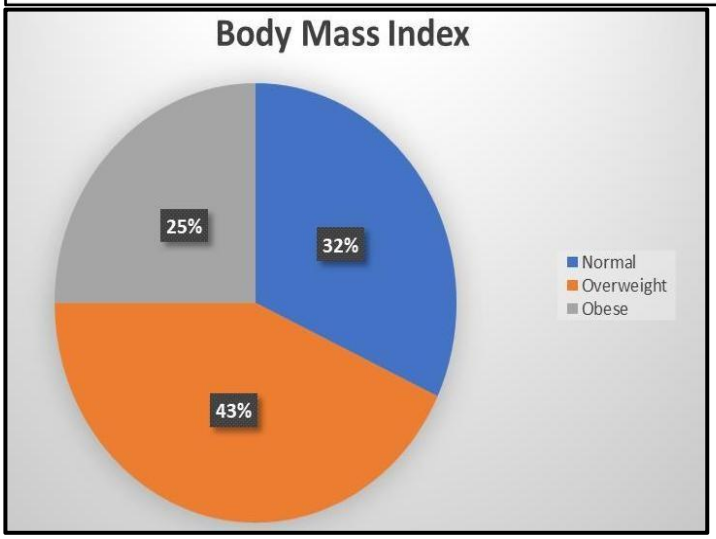


Figure 2: Shows the Body Mass Index of the participants

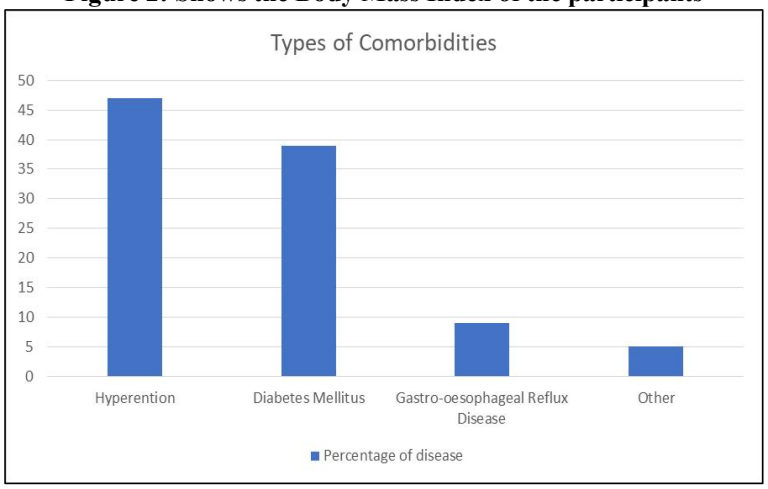


Figure 3: Shows the Comorbidities of the participants

The study evaluated baseline hemodynamic measures (systolic blood pressure [SBP], diastolic blood pressure [DBP], and heart rate [HR]) between the Ketofol and Fentofol groups, and found no significant differences before induction. Both sedation regimes kept vital signs within acceptable limits intraoperatively. At 3 minutes post-induction, both groups saw a small decline in blood pressure and heart rate due to propofol, with no significant differences (SBP: 123 mmHg Ketofol vs. 122 mmHg Fentofol, P = 0.68; HR: 85 bpm Ketofol vs. 82 bpm Fentofol, P = 0.68). At 6 minutes, vital signs remained equivalent (SBP: 119 mmHg Ketofol vs. 117 mmHg Fentofol, P = 0.49; HR in mid-80s, P > 0.1), showing comparable sedative depth without bradycardia or tachycardia.

By ~9 minutes, the Fentofol group exhibited a higher BP fall (SBP: 111 mmHg vs. 118 mmHg Ketofol, P = 0.044; DBP: 70 mmHg vs. 75 mmHg, P = 0.033; MAP: 84 vs. 89, P = 0.019), while HR remained similar (84 bpm Ketofol vs. 80 bpm Fentofol, P = 0.129), suggesting Ketofol better maintained BP. At ~12 minutes, Ketofol BP slightly increased (SBP: 119

mmHg), while Fentofol BP stabilized (SBP: 111 mmHg). There were significant differences in SBP (P = 0.013) and MAP (P = 0.041), but not in DBP (P = 0.144) or HR (P = 0.070).

After around 15 minutes, the difference in SBP between Ketofol and Fentofol decreased to 116.5 mmHg (Ketofol) vs. 109.4 mmHg (Fentofol, P = 0.082). There were no significant alterations in most parameters except MAP (P = 0.024) and SBP (P = 0.001), whereas DBP (P = 0.128) and HR (P = 0.078) remained unchanged. At 15 minutes, both groups had slightly lower blood pressure and slightly higher heart rates than baseline, all within acceptable ranges, indicating comparable hemodynamic stability by the completion of the procedure.

Table 1: Preoperative and intraoperative readings

Parameter	Medication	Mean	Standard Deviation	P-value
Preoperative Baseline Reading				
Systolic Blood Pressure	Ketamine	116.5	11.866	0.082
	Fentanyl	109.4	14.188	
Diastolic Blood Pressure	Ketamine	71.9	10.06	0.189
	Fentanyl	67.63	11.926	
Mean Arterial Pressure	Ketamine	86.4	9.619	0.108
	Fentanyl	81.63	11.686	
Heart Rate	Ketamine	82.53	11.62	0.264
	Fentanyl	79.16	13.184	
Intraoperative First Reading at 0 min(T0)				
Systolic Blood Pressure	Ketamine	122.8	12.763	0.679
	Fentanyl	122.1	15.847	
Diastolic Blood Pressure	Ketamine	78.88	13.481	0.679
	Fentanyl	75.72	11.997	
Mean Arterial Pressure	Ketamine	93.32	13.016	0.679
	Fentanyl	90.08	11.398	
Heart Rate	Ketamine	84.88	13.346	0.679
	Fentanyl	82.24	14.539	
Intraoperative Second Reading at3 min(T3)				
Systolic Blood Pressure	Ketamine	119.3	12.691	0.494
	Fentanyl	116.9	14.73	
Diastolic Blood Pressure	Ketamine	76.1	11.576	0.494
	Fentanyl	72.68	12.645	
Mean Arterial Pressure	Ketamine	90.78	11.516	0.494
	Fentanyl	87.34	12.345	
Heart Rate	Ketamine	84.76	12.896	0.19
	Fentanyl	80.26	13.39	
Intraoperative Third Reading at 6 min (T6)				
Systolic Blood Pressure	Ketamine	118	12.61	0.044*
	Fentanyl	111.4	20.051	
Diastolic Blood Pressure	Ketamine	74.82	12.027	0.033*
	Fentanyl	69.88	12.642	
Mean Arterial Pressure	Ketamine	89.34	11.974	0.019*
	Fentanyl	84.2	12.172	
Heart Rate	Ketamine	84.44	13.874	0.129
	Fentanyl	79.84	13.663	
Intraoperative Fourth Reading at9 min(T9)				
Systolic Blood Pressure	Ketamine	118.8	13.291	0.013*
	Fentanyl	111.1	13.64	
Diastolic Blood Pressure	Ketamine	74.2	10.897	0.144
	Fentanyl	70.58	12.031	
Mean Arterial Pressure	Ketamine	88.89	11.134	0.041*
	Fentanyl	83.56	11.465	
Heart Rate	Ketamine	84.16	12.373	0.07
	Fentanyl	79.74	13.181	
Intraoperative Fifth Reading at 12min (T12)				
Systolic Blood Pressure	Ketamine	116.5	11.866	0.082
	Fentanyl	109.4	14.188	
	Ketamine	71.9	10.06	0.189

Diastolic Blood Pressure	Fentanyl	67.63	11.926	
Mean Arterial Pressure	Ketamine	86.4	9.619	0.108
	Fentanyl	81.63	11.686	
Heart Rate	Ketamine	82.53	11.62	0.264
	Fentanyl	79.16	13.184	
Systolic Blood Pressure	Ketamine	116.5	11.866	0.082
	Fentanyl	109.4	14.188	
Intraoperative Sixth Reading at 15 min (T15)				
Systolic Blood Pressure	Ketamine	119.4	13.085	0.001*
	Fentanyl	107.2	13.368	
Diastolic Blood Pressure	Ketamine	73.88	11.047	0.128
	Fentanyl	68.89	11.463	
Mean Arterial Pressure	Ketamine	90.38	13.48	0.024*
	Fentanyl	81.8	10.729	
Heart Rate	Ketamine	83.79	11.673	0.078
	Fentanyl	77.94	12.488	
Systolic Blood Pressure	Ketamine	119.4	13.085	0.001*
	Fentanyl	107.2	13.368	

*Statistically significant ($P < 0.05$).

4. DISCUSSION

This study, conducted at Thumbay University Hospital in Ajman, compared hemodynamic parameters (systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate) in patients undergoing endoscopic procedures under deep sedation with Ketamine-propofol (Ketofol) or Fentanyl-propofol. Data were obtained both before and during surgery to determine which combination provided the best hemodynamic stability. Deep sedation requires fewer pharmaceuticals than general anesthesia (no muscle relaxants and inhalation agents), but intraoperative analgesia frequently uses opioids like fentanyl or sedatives with analgesic characteristics like ketamine. The study sought to establish which alternative provides better intraoperative hemodynamic stability for patients and the anesthesia team while maintaining high-quality anesthesia.

A previous study with 100 individuals evaluated Ketofol with Fentofol during induction for minor procedures, with an emphasis on hemodynamic parameters (systolic/diastolic blood pressure, heart rate) within the first 3 minutes after induction. It was discovered that Ketofol was superior, needing lower doses, producing less induction pain, lowering propofol use, and resulting in less uncontrollable movements [10]. In the current study, Ketofol was more typically utilized, but Fentofol was also used. The majority of patients had no cardiovascular comorbidities, therefore, hemodynamic variations were most likely caused by pain, discomfort, anxiety, or factors such as body mass index, premedication dosage, operation time, patient positioning, or increased intraoperative medication. The study concluded that Ketofol performed marginally better than Fentofol in terms of hemodynamic stability at specific intraoperative time points [11].

Intraoperative data revealed no significant changes in the first reading (<3 minutes post-induction) for all hemodynamic parameters ($P = 0.0679$), with Ketofol and Fentofol differing by only 1-3 points. Differences from baseline varied from 2 to 7 points, with Ketofol's heart rate changing the most (84.88 to 77.44 bpm), albeit this was not statistically significant. The second reading (~6 minutes) revealed non-significant P-values, with only 3-4 points between groups. With Fentofol, systolic blood pressure dropped somewhat but stayed normal, whereas diastolic blood pressure, mean arterial pressure, and heart rate changed by 2-3 points each. By the third reading (~9 minutes), significant differences emerged in all parameters except heart rate. Fentofol showed a larger drop (e.g., systolic blood pressure: 116.9 to 111.4 mmHg, an 11-point drop from baseline) than Ketofol's minor changes (1-2 points), indicating Ketofol's superior blood pressure stability [12,13].

In the fourth reading (~12 minutes), Ketofol readings slightly increased, whereas Fentofol showed modest 1-point fluctuations. There was a significant 7-point difference in systolic blood pressure and high P-values for systolic and mean arterial pressure. The fifth reading (~15 minutes) revealed no significant P-values, with group differences ranging from 3-7 points and modest changes (<3 points) from the previous reading. When comparing the fifth and final readings, Ketofol's systolic blood pressure climbed while Fentofol's fell; diastolic blood pressure and mean arterial pressure increased for both, and heart rate increased somewhat with Ketofol but decreased with Fentofol. Overall, Ketofol improved hemodynamic stability, particularly blood pressure maintenance, over the 6- to 12-minute intraoperative period [14,15].

5. CONCLUSION

In conclusion, ketamine-propofol combination sedation was found to maintain intraoperative hemodynamic stability more effectively than fentanyl-propofol in patients undergoing endoscopic procedures under deep sedation. Ketamine's sympathomimetic properties appear to counteract propofol-induced hypotension, resulting in higher blood pressure readings at critical time points during procedures, without increasing heart rate beyond normal limits. The fentanyl-propofol regimen, while effective for sedation, was associated with a greater tendency for blood pressure reduction, though no severe hypotension occurred.

REFERENCES

[1] Tosun Z, Aksu R, Guler G, Esmaoglu A, Akin A, Aslan D, et al. Propofol- ketamine vs propofol-fentanyl for sedation during pediatric upper gastrointestinal endoscopy. Paediatr Anaesth [Internet]. 2007 [cited 2023 Feb 23];17(10):983–8.

[2] Pathanon P, Jangprajak N, Chansing S, Jaidee A, Tubtimhin S. Efficacy of Sedation for Colonoscopy, A Comparison between Propofol and Ketamine Combination (Ketofol) Versus Propofol and Fentanyl Combination (Fenofol). j dept med ser [Internet]. 2021.

[3] ASGE Standards of Practice Committee, Early DS, Lightdale JR, et al. Guidelines for sedation and anesthesia in GI endoscopy. Gastrointest Endosc. 2018;87(2):327-337.

[4] Vargo JJ, Niklewski PJ, Williams JL, Martin JF, Faigel DO. Patient safety during sedation by anesthesia professionals during routine upper endoscopy and colonoscopy: an analysis of 1.38 million procedures. Gastrointest Endosc. 2017;85(1):101-108.

[5] Singh H, Poluha W, Cheung M, Choptain N, Baron KI, Taback SP. Propofol for sedation during colonoscopy. Cochrane Database Syst Rev. 2008;(4):CD006268.

[6] Smith I, Monk TG, White PF, Ding Y. Propofol infusion during regional anesthesia: sedative, amnestic, and anxiolytic properties. Anesth Analg. 1994;79(2):313-319.

[7] Goyal R, Hasnain S, Mittal S, Shreevastava D. A randomized, controlled trial to compare fentanyl-propofol and ketamine-propofol combination for procedural sedation in endoscopic retrograde cholangiopancreatography. Saudi J Anaesth. 2013;7(1):24-29.

[8] Akin A, Guler G, Esmaoglu A, Bedirli N, Boyaci A. A comparison of fentanyl-propofol with ketamine-propofol combination for sedation during endometrial biopsy. J Clin Anesth. 2005;17(3):187-191.

[9] Green SM, Roback MG, Kennedy RM, Krauss B. Clinical practice guideline for emergency department ketamine dissociative sedation: 2011 update. Ann Emerg Med. 2011;57(5):449-461.

[10] Hasanein, R., & El-Sayed, W. (2013). *Ketamine-Propofol vs. Fentanyl-Propofol for Sedation in Upper Gastrointestinal Endoscopy: A Randomized Controlled Trial.* Saudi Journal of Anaesthesia, 7(1), 24-29.

[11] Farsi, D., et al. (2014). *Ketamine-Propofol (Ketofol) vs. Propofol-Fentanyl for Sedation in Lumbar Puncture: A Randomized Clinical Trial.* Iranian Journal of Pediatrics, 24(6), 703-708.

[12] Ghodki, P. S., et al. (2012). *Ketamine-Propofol vs. Fentanyl-Propofol for Sedation in ERCP: A Randomized Controlled Trial.* Journal of Anaesthesiology Clinical Pharmacology, 28(4), 483-487.

[13] Yalcin, S., et al. (2019). *Hemodynamic and Respiratory Effects of Ketamine-Propofol vs. Fentanyl-Propofol in Pediatric Cardiac Catheterization.* Brazilian Journal of Anesthesiology, 69(1), 23-30.

[14] Messaoud, M. A., et al. (2020). *Ketamine-Propofol vs. Opioid-Propofol for Procedural Sedation: A Systematic Review and Meta-analysis.* Journal of Clinical Medicine, 9(5), 1381.

[15] Afsharpayman, S., et al. (2016). *Ketamine-Propofol vs. Fentanyl-Propofol for Sedation in Burn Dressing Changes: A Meta-analysis.* Burns, 42(6), 1213-122.