

Propofol-Ketamine vs. Propofol-Fentanyl for Sedation during Gastrointestinal Endoscopy

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Abstract

Background: Propofol is an essential agent for sedation for GI endoscopy. Opioids are administered during endoscopy to provide analgesia, suppress cough, and reduce the dose of propofol. Opioids with rapid onset and short duration are generally preferred. The most commonly used opioids in this setting is fentanyl. Ketamine also produces a dissociative state with amnesia, intense analgesia and minimal respiratory depression at sedative doses which may be administered along with propofol.

The aim of study is to compare Propofol-ketamine vs. propofol-fentanyl combinations for sedation during gastrointestinal endoscopy to reach a safe and satisfactory level of sedation for patients and operators with the least effective drugs as being a day case procedure with fast track criteria

Methods: The study was conducted on 88 patients scheduled for diagnostic upper endoscopy. In group K; the patients in this group were injected with a combination of ketamine 0.25 mg/kg and propofol 1 mg/kg. In group F, the patients in this group were injected with a combination of Fentanyl 1 ug/kg and propofol 1 mg/kg.

Results: The mean procedure time in the 2 groups was (13 min \pm 4.7 min in group K vs. 11.76 min \pm 3.8 min in group F). The volume of the drug injected was 12.3 \pm 3.63 ml in group K vs. 13.29 \pm 4.2 ml in group F to achieve the targeted level of sedation, however the level of sedation was significantly higher in the fentofol group (RASS -5 in 20% vs. 84.4% in group K and F respectively). The level of sedation was achieved in shorter time in group K (10.8 \pm 4.5 min) vs. (12.62 \pm 2.92 min) in group F. The total top up dose was significantly lower in group F vs. group K (6.3 \pm 4.17 ml vs. 8.2 \pm 3.84 ml respectively). The recovery time was significantly earlier in group F than in group K (1.83 \pm 2.08 min vs. 3.5 \pm 2.64 min). The patient's satisfaction as well as the operator satisfaction was much higher in group F than in group K.

Conclusion: Fentanyl-propofol combination in the aforementioned dose is a good choice for upper GI endoscopy with a little hemodynamic change, respiratory events and earlier patients discharge.

Keywords: Sedation; Propofol; Ketamine; Fentanyl; Gastrointestinal endoscopy

Introduction

There has been a rapid increase in the gastrointestinal (GI) endoscopic procedures performed during the last decade [1]. The role of anesthetist ranges from providing anesthesia for procedures that require sedation or general anesthesia to provide only monitoring for patients with significant co-morbidities, for whom advanced endoscopic procedures are often performed as alternatives to open surgery [2].

The patient undergoing gastrointestinal endoscopy should be assessed for conditions that increase sensitivity to sedative and analgesic medications (e.g., older age; obstructive sleep apnea, advanced chronic lung disease, pulmonary hypertension, coronary artery, liver, or renal diseases, anxiety disorders, chronic pain, use of opioids, sedatives, or recreational drugs) to allow appropriate drug dosing and administration [2]. Patients should follow the preoperative fasting guidelines. For those with impaired gastric emptying or with a high risk of aspiration and in emergencies situations, the potential for aspiration makes the endotracheal intubation the best choice for those patients. However, some clinicians intubate all or most patients who undergo complex endoscopic procedures (e.g., endoscopic retrograde cholangiopancreatography (ERCP) [3].

Moderate or deep sedation is commonly used for patients without risk factors for aspiration. Deep sedation can easily become general anesthesia, whenever propofol is administered [4]. Moderate sedation refers to a level of sedation in which patients respond purposefully to verbal commands and maintain spontaneous ventilation without

support. Patients under deep sedation cannot be easily aroused, but respond purposefully to painful stimulation, and may require assistance in maintaining a patent airway [2].

The depth of sedation may affect the rate of complications during GI endoscopy, with deeper sedation (usually with propofol) [4], there is increased risk of respiratory and cardiopulmonary complications [5,6], as well as a risk of colonic perforation during colonoscopy [7]. Respiratory events, including hypoxemia, hypercarbia, and respiratory arrest, are among the most common complications of anesthesia for GI endoscopy. So, ventilation should be monitored with capnography especially during moderate or deep sedation. Capnography facilitates early detection of apnea and airway obstruction [8], predicts the development of hypoxemia and may reduce patient injury related to respiratory depression [9]. The medications used for GI endoscopy should be based on patient factors, clinician preference and experience, the depth of sedation, the pharmacodynamic of the drugs used [2]. Propofol is an essential agent for sedation for GI endoscopy. Advantages of propofol are its rapid effect, short elimination half-time even after prolonged infusion, rapid recovery without residual psychomotor effects and improved patient satisfaction during endoscopy, compared with standard sedation. In addition, nausea and vomiting were less

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common and it is efficient in case of difficulty with sedation with other medications [3,9].

However, propofol has a narrow therapeutic index (i.e. patients may rapidly have a deeper level of sedation or even general anesthesia with its consequence as apnea, airway obstruction, hypoxemia, and/or hypotension). In addition, the depth of sedation may be unpredictable, especially in older patients, and if opioids are added [10,11]. Opioids are administered during endoscopy to provide analgesia, suppress cough, and reduce the dose of propofol. Opioids with rapid onset and short duration are generally preferred. The most commonly used opioids in this setting are fentanyl and remifentanyl. Fentanyl is typically administered in small, intermittent IV boluses of 50 to 100 mcg, with reduced doses in elderly [12].

Ketamine produces a dissociative state with amnesia, intense analgesia and minimal respiratory depression at sedative doses (ketamine 0.25 to 0.5 mg/kg IV). This small dose may be administered along with propofol [13] or dexmedetomidine [14] to reduce the required doses and cardiovascular effects of those medications, enhance analgesia and reduce the need for opioids.

Aim of Study

The aim is to compare of Propofol-ketamine vs. propofol-fentanyl combinations for sedation during gastrointestinal endoscopy to reach a safe and satisfactory level of sedation for patients and operators with the least effective drugs as being a day case procedure with fast track criteria.

Patients and Methods

The study is a double blinded clinical trial that was conducted in Ain shams University hospital on 88 patients scheduled for diagnostic upper endoscopy. The study was approved by the medical ethics committee and conducted in accordance with the principles of the declaration of Helsinki. All patients provided written informed consent before enrolment. Any patient with risk of aspiration, obstructive sleep apnea was excluded from the study. The patients were randomly divided into two equal groups group K and group F.

The patients in the two groups laid down in supine position, the standard monitors including ECG, pulse oximeter, non-invasive blood pressure and capnography were attached to the patients. 20 G cannula is inserted. The patients are then asked to lie in the lateral position. In group K; the patients in this group were injected with a combination of ketamine 0.25 mg/kg (Ketalar Pfizer 50 mg/ml) and propofol 1 mg/kg (Deprivan Astra Zenica 1%).

In group F, the patients in this group were injected with a combination of Fentanyl 1 ug/kg (fentanyl citrate janssen 100 mcg/2 ml) and propofol 1 mg/kg (Deprivan Astra Zenica 1%). The time interval from the induction till the accepted level of sedation were recorded, the accepted level of sedation was RASS ≤ -4 (Table 1). If the accepted level of sedation was not achieved within 2 minutes from the induction another 50 mg propofol were given or whenever the level of sedation decreased to an extent interfering with the continuation of the process and the total doses were recorded.

Monitoring and supplemental oxygen (O₂) should be maintained during the patient recovery from the effects of the sedative. Patient should be transferred to phase I recovery area (post-anesthesia care unit [PACU]) for early detection of respiratory or cardiovascular compromise, whether they have received general anesthesia or sedation. Patients who have completely recovered (i.e., breathing spontaneously without airway support, alert, speaking, obeying, and hemodynamically stable) can be fast-tracked to the phase II recovery area (pre discharge unit). The time of the procedure was recorded as well as the time

of full recovery (the time by which the patients become alert and obeying) any mishaps during the procedure were recorded including respiratory events (apnea and subsequent desaturation, laryngospasm, aspiration) and hemodynamic instability.

Richmond scale		
4	Combative	Overtly combative or violent; immediate danger to staff
3	Very agitation	Pulls on or removes tube(s) or catheter(s) or has aggressive behavior toward staff
2	Agitated	Frequent non-purposeful movement or patient-ventilator dyssynchrony
1	Restless	Anxious or apprehensive but movements not aggressive or vigorous
0	Alert and calm	-
-1	Drowsy	Not fully alert, but has sustained (more than 10 seconds) awakening, with eye contact, to voice
-2	Light sedation	Briefly (less than 10 seconds) awakens with eye contact to voice
-3	Moderate sedation	Any movement (but no eye contact) to voice
-4	Deep sedation	No response to voice, but any movement to physical stimulation
-5	Unarousable	No response to voice or physical stimulation

Table 1: Richmond sedation agitation scale.

The patients were then discharged to the recovery room and the patients' satisfaction as well as the operator's satisfaction and the time interval for discharge were also recorded. The patients and the operator's satisfaction were recorded by yes/no questions of 4 questions, whenever the score is equal to or more than 3, the patients/operators are reported as being satisfied. The stability of the hemodynamics was given a point for each the intraoperative and the post-operative (no more than 15% of the base line).

Statistical analysis: Statistical analysis was done using Statistical package for Social Science program version 20. (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Quantitative variables are expressed as mean and SD or as median and interquartile range (IQR) in cases of non-parametric variables. Student t test or Mann Whitney Test was used to compare a continuous variable between two study groups according to data distribution. Chi square and Fisher's exact tests were used to examine the relationship between categorical variables. P-value<0.05 was considered statistically significant.

Results

There is no significant statistical difference in the geographic data among the patients in the two groups regarding the gender, age groups as well as the ASA classification as shown in Table 2.

The mean procedure time in the 2 groups was (13 min ± 4.7 min in group K vs. 11.76 min ± 3.8 min in group F). The volume of the drug injected was 12.3 ± 3.63 ml in group K vs. 13.29 ± 4.2 ml in group F to achieve the targeted level of sedation, however the level of sedation was significantly higher in the fentofol group (RASS -5 in 20% vs. 84.4% in group K and F respectively). The level of sedation was achieved in shorter time in group K (10.8 ± 4.5 min) vs. (12.62 ± 2.92 min) in group F.

	Group		P	Sig.	
	Ketofol	Fentofol			
	Mean ± SD/N (%)	Mean ± SD/N (%)			
Age	41.6 ± 18.01	35.71 ± 14.92	0.092++	NS	
Body weight	78.09 ± 9.64	75.16 ± 15.92	0.293++	NS	
Sex	Male	21 (46.7%)	29 (64.4%)	0.09*	NS
	Female	24 (53.3%)	16 (35.6%)		
ASA classification	I	30 (66.7%)	24 (53.3%)	0.494**	NS
	II	12 (26.7%)	16 (35.6%)		
	III	3 (6.7%)	5 (11.1%)		

++Student t test, *Chi square test, **Fisher exact test NS: Non-significant

Table 2: Comparison between both groups as regard personal and medical characteristics.

The coughing and gagging reflex were significantly abolished in group F than in K. The total top up dose was significantly lower in group F vs. group K (6.3 ± 4.17 ml vs. 8.2 ± 3.84 ml respectively). There was no significant statistical change in the oxygen saturation, hemodynamic abnormalities, respiratory events in the form of obstruction, aspiration etc. or other adverse events apart. The recovery time was significantly earlier in group F than in group K (1.83 ± 2.08 min vs. 3.5 ± 2.64 min). All the patients were discharged within the first 2 hour from the end of the procedures in both groups Table 3.

The patient’s satisfaction as well as the operator satisfaction was much higher in group F than in group K (Table 3 and Figure 1).

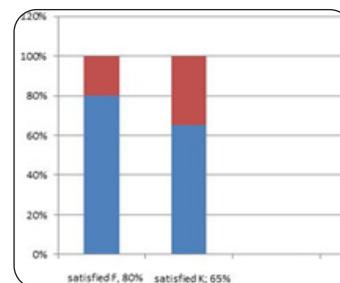


Figure 1: Comparison of Group F and Group K.

Discussion

Anesthesia for GI endoscopy may be associated with a higher risk of complications than anesthesia for many other procedures. The reasons for this association are multifactorial, and likely include the fact that most of these procedures are performed in out-of-operating room locations, increasingly complicated procedures and patients, and the anesthetic technique. Many complications of sedation for GI endoscopy involve respiratory events; cardiac arrest is most commonly preceded by hypoxemia.

In practice, propofol is often combined with a low dose of midazolam to enhance amnesia, as well as a low dose of opioid (e.g. fentanyl or remifentanyl) to provide analgesia and suppress cough. Moderate or deep sedation is commonly used for patients without risk factors for aspiration [4]. With moderate sedation, the patients respond purposefully to verbal commands and maintain spontaneous ventilation while at deep sedation the patients can’t

Table 3: Comparison between both groups as regard operative and post-operative characteristics.

	Group		P	Sig.	
	Ketofol	Fentofol			
	Mean ± SD/median (IQR)	Mean ± SD/median (IQR)			
Procedure time (min)	13.07 ± 4.74	11.76 ± 3.83	0.152++	NS	
Volume of anesthetic (ml)	12.33 ± 3.63	13.29 ± 4.2	0.251++	NS	
Time to accepted sedation level (min)	10.8 ± 4.57	12.62 ± 2.92	0.027++	S	
Total top up volume (ml)	8 (5-12)	5 (5-7)	0.004++++	HS	
SaO ₂ %	98 ± 2	99 ± 1	0.095++	NS	
Recovery time (min)	3 (1-4)	1 (0.5-2)	0.0001++++	HS	
	N (%)	N (%)	P	Sig	
RASS	-5	9 (20%)	38 (84.4%)	0.0001*	HS
	-4	36 (80%)	7 (15.6%)		
Lost Coughing/gagging reflex	9 (20%)	43 (95.6%)	0.0001*	HS	
Unstable respiration	6 (13.3%)	4 (8.9%)	0.502*	NS	
Unstable hemodynamics	0 (0%)	0 (0%)	N/A	N/A	
Hallucination	3 (6.7%)	0 (0%)	0.242**	NS	
Satisfaction	36 (80%)	45 (100%)	0.003**	HS	
Time to discharge (2 hours)	45 (100%)	45 (100%)	N/A	N/A	

++Student t test, ++++Mann Whitney test, *Chi square test, **Fisher exact test, NS: Non-significant, S: Significant, HS: Highly significant

be easily aroused but respond purposefully to painful stimulation and usually require assistance in maintaining a patent airway.

Respiratory event including hypoxemia, hypercarbia, and respiratory arrest, are the most common complications of anesthesia for GI endoscopy. Monitoring with capnography during moderate or deep sedation is mandatory for early detection of apnea and airway obstruction [8], predicts the development of hypoxemia [15].

The total top up dose was significantly lower in group F vs. group K (6.3 ± 4.17 ml vs. 8.2 ± 3.84 ml respectively). This results coincide with a study where the combination of fentanyl (1 mcg/kg IV) or remifentanyl (0.05 mcg/kg/min IV) with propofol (1.5 mg/kg IV followed by 1 mg/kg/hour IV) for sedation/analgesia for ERCP reduced the required dose of propofol and increased hemodynamic stability, compared with propofol alone [6]. But this were against the results of a study done by Riham and Wael where the total dose of propofol needed to achieve a deep sedation level was lower in the ketofol group (57.71 ± 16.97) than in the fentanyl-propofol group (97.08 ± 23.31), which contributed to the lower incidence of propofol sedation-related adverse effects [16]. Despite an out-of-operating room, location is a risk factor for complications of anesthesia. Contributing factors may include unfamiliar procedure rooms and personnel, inadequate availability and space for routine anesthesia equipment, a dark environment, and inadequate monitoring. But different retrospective reviews and analysis of malpractice claims had reported that most complications result from over sedation and inadequate oxygenation during monitored anesthesia care [17]. The current study reveals that the rate of complications was almost the same in the two groups. There is no difference in the hemodynamic abnormalities or respiratory events in the form of obstruction, aspiration etc.

The recovery time was significantly earlier in group F (1.83 ± 2.08 min vs. 3.5 ± 2.64 min). This result were going with the results of the study done by Riham and Wael where the recovery time and time to discharge from the recovery room in the ketofol group (11.19 ± 2.59) and (13.28 ± 5.14), was slightly longer than that of group fentanyl-propofol (9.43 ± 1.23) and (12.58 ± 5.41) [16]. The patient's satisfaction as well as the operator satisfaction was much higher in group F than in group K. All the patients were discharged within 2 hours from the end of the procedures in both groups.

Conclusion

Fentanyl-propofol combination in the aforementioned dose is a good choice for upper GI endoscopy with a little hemodynamic change, respiratory events and earlier patients discharge.

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