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Comparison of Propofol Ketamine and Propofol Fentanyl Combinations to Make Patient Comfort and Psychologically Ease in Colonoscopy Procedures

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Abstract

Introduction: Patient comfort and ease are crucial for successful colonoscopy procedures. Propofol, due to its minimal analgesic properties, needs to be combined with other analgesic drugs, especially opioids. The mixture of ketamine with propofol is a balanced and ideal combination, particularly in emergency patients with unstable hemodynamic, and it produces better sedation quality than the mixture of propofol-fentanyl. With the avoidance of hypotensive effects and manageable pain, discharge time for outpatients or inpatients can be shorter.

Objectives: Analysis of the changes between fentanyl propofol and the combination of sedative drugs in patients requiring colonoscopy.

Methods: This research was a single-blinded randomized intervention analytical experimental cross-sectional study with a consecutive sampling technique. Thirty-two patients who met the inclusion criteria were divided into two groups, one receiving a combination of propofol-fentanyl sedation drugs and the other receiving a combination of propofol-ketamine.

Results: In the comparison test of blood pressure, systolic and diastolic heart rate from the beginning to the 25th minute, all p-values were > 0.05 between the propofol-fentanyl and propofol-ketamine groups, indicating no significant difference in hemodynamic among the two groups. In the comparison test on saturation, all p-values were <0.05 between the propofol-fentanyl and propofol-ketamine groups, indicating a significant difference in saturation between the two groups. The mean saturation value was lower in the propofol-fentanyl group compared to the propofol-ketamine group. The comparison test on respiratory rate obtained p-values > 0.05 between the propofol-fentanyl and propofol-ketamine groups, indicating no significant difference in respiratory rate between the two groups. The recovery time was longer in the propofol-fentanyl group (37.87 minutes) compared to the propofol-ketamine group (33.00 minutes).

Conclusions: There were no changes in haemodynamic (blood pressure and pulse rate). There was an important difference in breathing (respiratory rate and saturation time to retrieval) and PADSS in both groups, including propofol ketamine and propofol fentanyl, in the colonoscopy procedure.

Keywords: colonoscopy, fentanyl-propofol, ketamine-propofol.

1. Introduction

Colonoscopy is currently one of the most important diagnostic and therapeutic tools for managing patients with lower gastrointestinal diseases. In addition to its visual diagnostic capabilities, colonoscopy can be used for tissue sampling (biopsy) for histological confirmation and can also be used as a therapeutic tool in cases of polyps or early cancer resection (Lin, 2017). Furthermore, advancements in technology have made colonoscopies more comfortable for patients by increasing flexibility in the instrument. However, the procedure is inherently uncomfortable and can cause abdominal pain, cramping, bloating, risk of aspiration, vomiting, and

gastrointestinal perforation during endoscopy (Lin, 2017). Therefore, patient comfort and peace of mind are essential for all parties involved in a successful GIE procedure. However, some patients cannot tolerate the procedure due to inappropriate sedation (Aydogan et al., 2013). The goal of sedation is to reduce anxiety, increase comfort, patient satisfaction, and endoscopic success (Grossmann, 2019).

Endoscopic procedures with sedation in the Integrated Diagnostic Center Building (GPDT) of Dr. Soetomo Hospital in 2019 amounted to 1249 cases, consisting of 618 colonoscopic cases (49.5%) and 631 endoscopic cases (50.5%), with an average of 52 colonoscopic cases per month. Patients were predominantly ASA score II (80%), followed by ASA score I (11.5%) and ASA score III (8.3%). A study conducted by Hormati et al. (2019) found that intraprocedural hemodynamic instability was the most common complication during sedation procedures (37.01%), followed by desaturation events (11.65%). Other complications such as dysrhythmia, PONV, aspiration, apnea, headache, delirium, and mortality had a lower incidence.

Different sedatives and analgesics can be used and combined to achieve levels of sedation and analgesia in endoscopic procedures. Although benzodiazepines and opioids have been used in endoscopy, propofol has become the preferred alternative for the past two decades, due to the rapid onset, short duration and rapid recovery time. (Grossmann, 2019).

Propofol is a short-duration hypnotic drug with a rapid onset of approximately 30-40 seconds (Grossmann, 2019). However, excessive doses of propofol can cause respiratory depression, temporary hemodynamic and cognitive impairment, and pain at the injection site. Since propofol has minimal analgesic properties, it needs to be combined with other analgesic drugs, especially opioids (Arora, 2008; Yuce et al., 2013). However, the use of opioids can have negative side effects, such as respiratory depression, sympatholytic effects, bradycardia, and hypotension, despite using opioid preparations with a rapid duration and onset (Arora, 2008; Barash et al., 2018). Therefore, there is a need for a drug that can address the limitations or negative effects of using propofol and fentanyl.

Ketamine is a sedation-analgesia drug known to maintain blood pressure stability with its sympathomimetic properties (Akhondzadeh et al., 2016). However, the use of ketamine as a single sedative agent requires high doses, which can increase the potential for psychomimetics (hallucinations, nightmares, depersonalization), hypersalivation, increased intracranial and intraocular pressure, and a relatively long recovery time. Other sedative agents are needed to overcome the negative effects of ketamine (Morgan Jr & Mikail, 1996; Nejati et al., 2011; Yuce et al., 2013)

The combination of ketamine with propofol is a balanced and ideal combination, especially in emergency patients with unstable hemodynamics (Arora, 2008; Smischney et al., 2012). Hasanein & El-Sayed (2013) even stated that the quality of sedation produced was better than the combination of propofol-fentanyl in emergency measures. With the avoidance of hypotensive effects and managed pain, discharge time for outpatients or inpatients can be shorter (Aydogan et al., 2013; Fabbri et al., 2012; Motamed et al., 2012). Baker et al. (2018) even used a combination of ketamine and propofol induction dose in endoscopic retrograde cholangio-pancreatography/ERCP, and found no significant adverse events. Data on ketamine are mostly generated through studies in pediatric groups with emergency procedural situations. With a profile like the one above, ketamine should be used more frequently in ambulatory procedures in adults. With the right drug combination and dose, ketamine can be a complement/alternative to opioids and propofol.

Colonoscopy is one of the screening modalities for colorectal disorders, and the need for colonoscopy is increasing every year. In 2019, an average of 50-60 colonoscopies per month was performed at the Integrated Diagnostic Center Building (GPDT) of Dr. Soetomo Hospital. Although more flexible and smaller probes have been found, colonoscopy is still an invasive procedure and can cause discomfort to the patient. This has led to the need for sedation, which is expected to help the colonoscopy procedure run smoothly and comfortably for the patient (American Society for Gastrointestinal Endoscopy, 2011).

Sedation procedures involve the administration of sedatives or dissociative drugs, with or without analgesics, to achieve a state that enables patients to undergo unpleasant procedures while maintaining cardiovascular and

respiratory function. Sedation reduces consciousness but allows patients to maintain oxygenation and control their own airway. Additionally, sedation can provide an amnesic effect and reduce anxiety during the procedure.

The purpose of endoscopic sedation is to maximize patient comfort and minimize the risk of medication-associated side effects. Optimal sedation should take into account patient- and procedure-associated variables, such as age, health status, history of drug use, pre-procedure anxiety, pain tolerance, degree of immortality, and duration of examination. The pharmacokinetic and pharmacodynamic profiles of the sedative agents used, drug interactions and side effects should also be taken into account. (Cohen et al., 2007).

Trissel et al. (1997) examined the compatibility of propofol with 112 drugs and found that 98 were compatible for 1 hour at 23°C, with 14 incompatibilities. Andolfatto & Willman (2010) He said ketamine from a syringe and propofol were physically and chemically compatible.

The ideal combination of sedative-analgesic drugs should not provoke respiratory and hemodynamic depression, should be a rapid onset and recovery, and have a small influence of castaways and postoperative vomiting. A small castaway effect and postoperative vomiting will accelerate the recovery time, keeping the patient's hemodynamic status as close as possible to the situation prior to sedation. (Baker et al., 2018).

2. Objectives

Based on the background, it is necessary to conduct studies on the size of hemodynamic changes (systolic-diastolic blood pressure, blood pressure / MAP, pulse), effect of respiratory complications (airway obstruction, hypoventilation, hypoxia and laryngospasm), and time to recover conscious sedation of patients with propofol-fentanyl and propofol colonoscopy. The aim of this study is to analyse the differences between hemodynamic changes, respiratory side effects, and recovery time of propofol-fentanyl and propofol-ketamine sedation drugs in patients undergoing colonoscopy.

3. Methods

An analytic experimental cross-sectional study with a consecutive sampling technique was used, with a single-blinded randomized intervention. The study aimed to compare the incidence of complications in the respiratory and hemodynamic systems, as well as the recovery time between the combination of propofol-ketamine and the combination of propofol-fentanyl in patients undergoing colonoscopy.

The research was conducted between March and April 2023 in the Diagnostic Center building of Soetomo Surabaya Hospital. The research population consisted of patients with colonoscopy of general anesthesia in the Endoscopy Room of the Soetomo Surabaya Hospital. Samples were introduced by patients with selective colonoscopy and met the inclusion criteria. In total, 32 patients were hospitalized (16 in the ketamine group and 16 in the propofol-fentanyl group), based on patients who met the inclusion principles. (Bahrami et al 2016).

A consecutive sampling technique was used, and the study population comprised patients undergoing colonoscopy with general anesthesia at the endoscopy room of Dr. Soetomo Hospital Surabaya. The inclusion criteria were patients aged 17-64 years with ASA I-II physical status and a BMI between 18.5 and 30 kg/m^2, undergoing elective colonoscopy with sedation. The exclusion criteria included patients with uncontrolled underlying systemic diseases, history of alcohol abuse or dependence, potential difficulty in ventilation and intubation, psychological disorders, or those taking psychotherapeutic drugs, and a history of allergy to eggs, egg products, soy, or soy products. Thirty-two patients were included in the study, with 16 patients in each group.

The dependent variables were the incidence of airway obstruction, hypoventilation-apnea, hypoxia, laryngospasm, and hemodynamic changes, including changes in systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and heart rate (HR), as well as recovery time, which was defined as the time required to achieve PADSS scale score ≥ 9. The independent variables were the ketamine - propofol combination and the fentanyl - propofol combination.

The study materials included a non-invasive blood pressure (NIBP) monitor, an electrocardiogram (ECG), a respiratory rate monitor, a pulse oximeter, a syringe pump, an anesthesia machine, and complete resuscitation

equipment. Anesthetic drugs used were fentanyl, propofol, and ketamine. Emergency medicines used included ephedrine, sulphas atropine, and adrenaline. Connox was also used in this study. A time meter and data collection questionnaire were also used.

Data collection was performed through specialized data collection sheets containing vital sign data, including SBP, DBP, MAP, HR, RR, SpO2, qCON, qNOX, the incidence of hypoventilation/apnea/desaturation/laryngospasm, and recovery time with PADSS scale score. Descriptive data analysis was conducted using statistical tests, including a two-sample t-test if the data were normally distributed or a Mann-Whitney test if not. A Chi-Square test was also conducted for nominal scale data. The significance level used was $\alpha = 0.05$, and the statistical tests were conducted using the SPSS computer program.

The conceptual framework outlines the pharmacological actions and side effects of three different drugs used in anesthesia: Propofol, Ketamine, and Fentanyl. Propofol acts primarily as a GABA receptor agonist, increasing intercellular inhibition. However, it has major side effects in the form of respiratory and cardiovascular depression. Ketamine is an analgesic drug that acts centrally, mainly by inhibiting NMDA receptors, thereby reducing the process of interpreting impulses in the central nervous system. Its side effects include respiratory depression, nausea, vomiting, and psychomimetic symptoms such as hallucinations and nightmares. Meanwhile, fentanyl, which is an opioid agonist, acts on opioid receptors by increasing potassium efflux, decreasing calcium channel activity and cyclic-AMP. Its side effects include respiratory depression, cardiovascular depression, nausea, vomiting, and psychomimetic symptoms such as hallucinations. All side effects caused by the three agents are dose-dependent. Therefore, the combination of two drugs is expected to provide maximum effectiveness with a minimal dose, thereby minimizing the side effects.

To achieve maximum effectiveness and minimize side effects, a combination of two drugs is often used. Based on this assumption, the conceptual framework proposes three hypotheses for colonoscopy patients:

1. The combination of ketamine and propofol will cause fewer hemodynamic changes (blood pressure and heart rate) than the combination of fentanyl and propofol.
2. The combination of ketamine and propofol will result in fewer respiratory complications (airway obstruction, hypoventilation-apnea, hypoxia, and laryngospasm) compared to the combination of fentanyl and propofol.
3. The recovery time to consciousness will be shorter in the ketamine-propofol combination compared to the fentanyl-propofol combination for colonoscopy patients.

4. Results

Characteristics of Research Subjects

The characteristics of the subjects in this study are based on sex, age and BMI. To ensure that there are no changes in these characteristics, among the combination of propofol ketamine and propofol fentanyl, an equality or homogeneity test is performed among both research groups.

Table 1. Distribution of characteristics and equivalence test between the propofol - ketamine combination and the propofol - fentanyl combination

Subject characteristics	Combination Group		p-value
	Fentanyl (n=16)	Ketamine (n=16)	
Gender			
Woman	5 (31.3%)	9 (56.3%)	0.285*
Man	11 (68.8%)	7 (43.8%)	
Age (Years)			
Min-Max	23-59	23-59	0.964*

Mean ± SD	43.44 ± 11.55	43.25 ± 11.51	
BMI			
Min-Max	18-25	18-30	0.687*
Mean ± SD	20.62 ± 1.96	21.50 ± 3.34	

* declared equal/homogeneous if the p value > 0.05

The equality/homogeneity test was conducted on subject characteristics between the propofol-fentanyl and propofol-ketamine combinations, as shown in Table 1. For gender characteristics, the frequency of women in the fentanyl and ketamine groups were not significantly different: 5 (31.3%) and 9 (56.3%) respectively, while the frequency of men were 11 (68.8%) and 7 (43.8%) respectively. The p-value obtained from the test was 0.285, indicating no significant difference in gender characteristics between the two combinations. Age characteristics were also not significantly different, as evidenced by the mean age of 43.44 ± 11.55 and 43.25 ± 11.51 for the fentanyl and ketamine groups respectively, with a p-value of 0.964. Similarly, BMI characteristics showed no significant difference between the fentanyl and ketamine groups, with mean values of 20.62 ± 1.96 and 21.50 ± 3.34 respectively, and a p-value of 0.687.

From these results, it can be concluded that there is no significant difference between the combinations of propofol-fentanyl ketamine and propofol, in the characteristics of sex, age and subject BMI. Therefore, these characteristics cannot be considered as a mixing/confounding factor in this study.

Recovery Time Comparison Test

A test was performed to compare the recovery time between fentanyl propofol-fentanyl and propofol, using the T-test and the Mann-Whitney test. The T-test was used for normally distributed data, while the Mann-Whitney test was used for non-distributed data. Normality was tested with the Shapiro-Wilk test, as each team's sample size was less than 50. If the Shapiro-Wilk p-value is greater than 0.05, the data is generally distributed.

The following table presents the results of the normality test and the comparison of recovery time based on blood pressure values.

Table 2. Recovery Time normality test in fentanyl and ketamine groups

Recovery Time	Group	p Shapiro Wilk	Information
Recovery Time	Fentanyl	0.819	Normal
	Ketamine	0.123	Normal

*normal if the Shapiro Wilk test p value > 0.05

Table 2 shows the results of the normality test using the Shapiro-Wilk test on the recovery time of the propofol-fentanyl and propofol-ketamine combination groups. All p-values obtained from the test were greater than 0.05, indicating that the data was normally distributed. Therefore, the comparison test of recovery time between the two groups can be conducted using parametric methods, specifically the Independent T test.

Table 3. Recovery time comparison test in the fentanyl and ketamine groups

Recovery Time		Combination Group		p value
		Fentanyl (n=16)	Ketamine (n=16)	
RR 0	Min-Max	28 – 51	25 – 45	0.041*
	Mean ± SD	37.87 ± 6.31	33.00 ± 6.60	

*stated to be significantly different if the p value <0.05

The results of the recovery time comparison test presented in Table 3 indicate that the p-value of the p-value obtained between the fentanyl propofol-fentanyl and propofol-ketamine combinations was less than 0.05 and optional a important change in recovery time. The graph also shows that the mean recovery time for the propofol-fentanyl combination was higher, at 37.87 ± 6.31, compared to the propofol-ketamine combination at 33.00 ± 6.60.

Comparison Test of PADSS Scores

The PADSS score comparison test between the fentanyl combination and the ketamine propofol combination was performed through the T-test and the Mann-Whitney test. The T-test was common the data were distributed, while the Mann-Whitney test was used if the data were not distributed normally. The normality test was performed through the Shapiro-Wilk test, since the sample size of each team was <50 >. Table 4 shows the results of the normality test and the PADSS score test among the fentanyl and ketamine teams.

Table 4. Normality test of PADSS scores in the fentanyl and ketamine groups

PADSS score	Group	p Shapiro Wilk	Information
PADSS score	Fentanyl	0.000	Abnormal
	Ketamine	0.000	Abnormal

*normal if the Shapiro Wilk test p value > 0.05

Based on the findings presented in Table 4, the results of the normality test using the Shapiro-Wilk test on the PADSS scores of the propofol-fentanyl combination group and the propofol-ketamine combination group were all found to have p-values of less than 0.05. This indicates that the data is not normally distributed, and as such, a non-parametric method is required to compare the PADSS scores between the two combination groups. The Mann-Whitney test will be used for this purpose.

Table 5. Comparison test of PADSS scores in the fentanyl and ketamine groups

PADSS score		Combination Group		p value
		Ketamine(n=16)	Fentanyl(n=16)	
PADSS score	Min-Max	9 – 9	8 – 9	0.007*
	Mean ± SD	9.00 ± 0.00	8.63 ± 0.500	

*stated to be meaningfully dissimilar if the p value <0.05

According to the results presented in Table 5, the comparison test on PADSS scores revealed a p-value of less than 0.05 between the propofol-fentanyl combination and the propofol-ketamine combination. This indicates a important change in PADSS scores among the two groups. Additionally, based on the graph, it can be seen that the mean PADSS score of the propofol-fentanyl combination group is higher, at 9.00 ± 0.00, compared to the propofol-ketamine combination group with a mean score of 8.63 ± 0.50.

5. Discussion

Ketamine Propofol

Ketamine and propofol are two commonly used anesthesia, with different forms of action. Ketamine blocks communication among the thalamic and limbic areas of the brain, stopping external stimuli (Bagheri et al., 2022) and provides good analgesia, while maintaining proper muscle tone for defensive airway reactions (Woldekidan and Mohammed, 2021) and natural breathing (Rahmanian et al., 2015). Ketamine is metabolized in the body and is its main metabolite, it is also an analgesic molecule, but with a strength level between 20 and 30% lower than ketamine. Studies have shown that ketamine quickly reaches its receptor site, with a half-life of less than one minute (Wang et al., 2020).

The outcomes of this research recommend that the Propofol-Ketamine mixture analgesia caused a reduction in the average systolic and diastolic blood pressure, as noted by the blood pressure checks conducted every 5 minutes by researchers. However, this decrease did not show a significant difference between the Propofol-Fentanyl group. Ketamine causes sympathetic stimulation, which increases myocardial contractility and peripheral vascular resistance, leading to an rise in mean major pressure and pulse (Park et al., 2019). In addition, propofol leads us to further reduce blood pressure, increasing anesthesia, reducing peripheral vascular resistance and midchannel disappointment. Patients with bulking, cardiovascular impairment, and hypertension are at increased risk of lowering blood pressure with propofol use. In addition, propofol reduces pulse rate as a result of harmonic side effects, and its use can produce important restrictions on pulse rate, systolic and diastolic blood pressure, and blood pressure. (Garg et al., 2013; Sahinovic et al., 2018).

Although propofol and ketamine have contrasting effects and different notes of use from some patients, their combined use may temporarily reduce systolic and diastolic blood pressure, blood pressure (MAP), and pulse rate. In the first two minutes, the main impact of propofol has returned to normal by minute 5. These findings are consistent with earlier studies that used this combination of anesthetic agents to avoid anaesthesia. (Hirayama et al., 2019; Khandelwal et al., 2022).

Another study, however, showed that the combination of ketamine propofol can have a large impact on increasing systolic and diastolic blood pressure, MAP and pulse rate, when a ketamine dose of 2 mg/kg and then 1 mg/kg propofol is used for induction. This effect is due to the main impact of ketamine on the patient's hemodynamic profile (Dunnihoo et al., 1994; Scarrone et al., 1990). However, stable haemodynamic can be attained using an appropriate combined dose of propofol and ketamine of 1 mg/kg. Thus, the cardio stimulant effect of ketamine can be counterposed by the cardio depressant impact of the cardio depressant effect.(Garg et al., 2013).

The outcomes of this research indicate that the administration of propofol-ketamine mixture maintained the respiratory rate without causing a significant increase or decrease. Moreover, the oxygen saturation parameters remained stable with a mean saturation of 98%. These findings demonstrate the ability of the propofol-ketamine combination to maintain stable respiratory parameters. Another study investigated the impact of ketamine on patients with hypoventilation during deep anesthesia and found that the occurrence of hypoventilation in the ketamine group was lesser than the group given isotonic saline solution. This difference was found to be 28% greater than the isotonic saline group, and the need for airway manoeuvres was also lower in the ketamine group. These results suggest that the direct respiratory stimulation impact of ketamine or the mixture of both propofol-ketamine mechanisms may have a beneficial effect on hypoventilating patients with deep sedation (De Oliveira Jr et al., 2014).

However, another study found that the oxygen saturation in the propofol-ketamine group was lower than that in the ketamine-midazolam group (Irwanto & Miarta, 2021). Several common side effects of propofol administration include respiratory depression, transient cognitive impairment, and pain at the injection site. Another study (Shah et al., 2011) showed that the propofol-ketamine combination has a better sedation effect but may cause airway complications such as decreased oxygen saturation and respiratory rate. Nonetheless, in theory, combining propofol with ketamine is expected to reduce the respiratory depression effects of propofol, as shown in the present study.

Fentanyl Propofol

Fentanyl, the opioid, has good analgesic and sedative properties. It is a hemodynamically stable drug that takes between 7 and 8 minutes to produce the effect and lasts between 1 and 2 hours. Fentanyl is used along with propofol or midazolam as a co-induction agent to administer sedation for outpatient procedures. When patients receive combinations of internal anesthetic agents, results and side effects cannot be predicted solely based on individual dosage requirements (Pouraghaei et al., 2014).

The outcomes of one research presented that the mean systolic and diastolic blood pressure of patients who received a combination of fentanyl and propofol was reduced every 5 minutes throughout the study, mostly to 5, 10, and 20 minutes. This result is consistent with the theory that fentanyl administration may result in blood

pressure and decreased cardiovascular output. However, a higher dose of fentanyl is needed to produce a significant hypotensive effect. Another study by Singh et found similar results in which fentanyl administration (<30 minutes) significantly reduced systolic and diastolic blood pressure at 1, 3, and 5 minutes (Goyal et al., 2012).

The study Pouraghaei et al. (2014) analysed the impact of fentanyl on hemodynamic intubation and found that seismic and mean diastolic blood pressure was reduced to 3 and 5 minutes. In addition, according to a study by Ongewe et al (2019), the systolic and diastolic blood pressure of patients who received fentanyl for induction was reduced to 2.5 minutes after induction, but was found to increase 5 minutes after induction. However, both studies showed fentanyl's ability to maintain good blood pressure stability, similar to the results of current research.

Regarding the pulse rate parameter, this study showed that fentanyl administration was able to reduce the pulse rate to 5, 15 and 25 minutes, increasing by 10 and 20 minutes. These results can be compared to the study Singh et al. (2012), which significantly reduced the pulse rate to 1, 3 and 5 minutes. A meta-analysis by Mohsin et al. (2022) analyzed the impact of dexmedetomidine likened to fentanyl on the pulse rate of patients undergoing laparoscopy. The study found that fentanyl reduced the pulse rate at minutes 1, 5, and 10 post-intubation, although the mean pulse rate was higher than that of dexmedetomidine. The increased hemodynamic response to pulse rate is due to increased pain response through a pleasant medium tone and diffuse activation. Fentanyl plays an important role in reducing this response, keeping the patient's hemodynamic stable. (Mohsin et al., 2022).

The consequences of this research showed that the administration of Fentanyl Propofol mixture relatively maintained the respiratory rate without causing a significant increase or decrease. Additionally, the results of the oxygen saturation parameter showed good stability, with the mean saturation maintained at 98%. These findings demonstrate the ability of the Propofol Fentanyl combination to maintain stable respiratory parameters. In contrast, a study by Pattinson (2008) found that fentanyl and opioid agonists can cause respiratory depression by acting on μ-opioid receptors at various locations, which reduces the answer to increased PCO2 and decreased PO2, leading to a reduction in the stimulus to breathe. Large doses of fentanyl can result in the loss of or reduced stimulation to breathe, leading to a reduced respiratory rate and a period of apnea, which can be life-threatening (Pattinson, 2008).

Comparison of Propofol Ketamine and Propofol Fentanyl combinations

The outcomes presented that in the Propofol Ketamine group, both in systolic and diastolic blood pressure, the mean was higher. In systolic blood pressure parameters there were no important changes at minutes 0, 10, 15, 20 and 25. However, in diastolic blood pressure, there was a noticeable alteration among both teams at 10. Singh et al. (2012) found that in 10 years there had been no significant changes in the hemodynamic parameters of patients receiving ketamine propofol, which can occur at the subanaesthetic doses that make up the cardio depressive effect of propofol (Singh et al., 2012). Similar results were found to the organization Goh et al. (2005), but the parameter used was mean arterial pressure. The results showed that the mean blood pressure of patients who received Ketamine Propofol was much higher than that who received Fentanyl Propofol. According to the study, the blood pressure of patients receiving ketamine propofol was higher, but with a similar trend (Goh et al., 2005).

The pulse rate parameters of both teams presented an important change in 10. The mean pulse rate in the ketamine propofol group was lower than in the fentanyl propofol group. This result is contrary to the research conducted (Aydogan et al., 2013; Gorji et al., 2016), who found no important alterations in pulse rate limits among the two groups. However, previous studies have shown that administration of propofol ketamine offers better hemodynamic stability. Detecting a lower pulse rate provides deeper sedation and an analgesic effect that helps anaesthesiologists maintain a stable level of sedation (Aydogan et al., 2013; Gorji et al., 2016). In contrast, Goh et al. (2005) showed a trend of higher pulse rate in the ketamine group, which increased the pulse rate in the Propofol Ketamine group from its baseline, while the Propofol Fentanyl combination induced bradycardia. This condition may be due to the indirect action of the sympathomimetic impact of ketamine on the sinus node, causing an increase in pulse rate (Goh et al., 2005).

Based on oxygen saturation parameters, this study found a significant difference between both groups and showed that the saturation of the propofol-fentanyl combination was lower than the propofol ketamine combination. However, it did not cause severe clinical symptoms, as the lowest saturation was 99% and did not require aerial manoeuvres. Previously, oxygen saturation could be reduced due to the effect of opioids on muscle action. Respiratory anesthesia in the spine, fentanyl can increase muscle action and reduce lung volume, which can influence gas exchange and lead to hypoxemia.(Griffiths, 2010).

This condition was located in this research, which could be a consequence of the dose used. The study, entitled Gorji et al. (2016), gave similar results and investigated the sedative and analgesic effects of ketamine propofol and fentanyl propofol, in patients with endoscopic retrograde cholangiopancreatography., giving similar results, without significant differences between both groups and the mean showed a stable saturation rate.

Similarly, Aydogan (2013) in patients undergoing upper gastrointestinal endoscopy found no significant change in oxygen saturation among the two groups. This is thought to be due to the impact of the mixture of propofol with ketamine or fentanyl, which offsets the respiratory depressive effects of propofol (Aydogan et al., 2013). Respiratory rate was not much different in the two groups at minutes 5, 10, 15, 20, and 25, where the mean respiratory rate in the propofol-ketamine group was virtually the same compared to the propofol-fentanyl group. According to these results, the combinations of propofol-fentanyl and propofol-ketamine maintain the stability of respiratory parameters.

In contrast to a study by Pattinson (2008), who found that fentanyl and opioid agonists can cause depression of respiration by acting on μ-opioid receptors at various locations, which decreases the response to increase PCO2 and decrease PO2, thus reducing the stimulus to breathe. Loss of or reduced stimulation to breathe can occur with the use of large doses of fentanyl, leading to a reduced respiratory rate and a period of apnea, which poses a mortal threat (Hill et al., 2020).

The recovery time of the propofol-fentanyl combination is longer compared to the propofol-ketamine combination. In contrast to research by Sinurat (2014), which shows that the length of wakefulness in the group of patients with propofol-ketamine treatment is 1,42 minutes faster than the propofol-fentanyl treatment group (Sinurat et al., 2014). The results of this study used several parameters to assess the discharge time of anesthetized patients using the PADSS score. According to the graphic image, the mean PADSS score value of the fentanyl propofol combination is higher than the propofol ketamine combination.

These data suggest that both the fentanyl-propofol and ketamine-propofol combinations are safe with respect to hemodynamic and respiratory changes in patients undergoing colonoscopy.

6. Conclusion

Based on the outcomes of this study, it can be deduced:

1. There is no change in hemodynamics (blood pressure, pulse rate) among the Propofol Ketamine group and the Propofol Fentanyl Combination group during colonoscopy procedures.
2. Important differences in respiratory parameters (respiratory rate and saturation) were detected between the two drug combinations (propofol ketamine and fentanyl-propofol), but there were no respiratory complications, such as airway barrier, hypoventilation, hypoxia or laryngospasm colonoscopy.
3. Recovery time was longer in the group getting combined anesthesia with Propofol Fentanyl, as indicated by the lower PADDS score, compared to the group receiving analgesia with Propofol Ketamine..

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12