ORIGINAL ARTICLE

Comparative Study between Intravenous Ketamine-Propofol Versus Ketamine- Dexmedetomidine for Sedation of Adult patients during Upper Gastrointestinal Endoscopy

Abdullah M. A. Al-Sheikh, Ali A. A. Al-Kumity, Ibrahim S. M. Saad *

Department of Anesthesiology, Intensive Care and Pain Management, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***It is common practice to combine intravenous ketamine with dexmedetomidine, a selective alpha-2 adrenergic receptor agonist, for sedative, analgesic, and anxiolytic effects; this combination has several benefits, including hemodynamic stability, postoperative pain relief, and the lack of respiratory depression. Several studies have examined this combination in pediatric patients.***

Aim and objectives: ***In order to evaluate the safety profile, hemodynamics, and sedation quality of ketamine-propofol (KP) vs. ketamine dexmedetomidine (KD) for procedural sedation in adult patients having upper gastrointestinal endoscopy.***

Patients and methods: ***This is a randomized clinical trial blinded study that was performed at Al-Azhar University Hospitals over 60 adult patients undergoing upper gastrointestinal endoscopy divided into two groups: Group(KP): 30 patients were sedated by KP and Group(KD): 30 patients were sedated by kD.***

Results: ***Regarding heart rate after loading dose, endoscope insertion, and 20 minutes, there was a statistically significant difference among the cases analyzed. When looking at the cases that were studied, there was no discernible difference in terms of recovery time. In terms of endoscopist satisfaction, there was no statistically significant distinction among the cases that were studied. When comparing the cases, we found that oxygen saturation levels varied significantly after the loading dosage, after the endoscope was inserted, and even after 5 minutes. In terms of Ramsay sedation scores, there was no discernible variation among the cases that were examined. When comparing the instances, there was a statistically significant difference in the amount of time it took for the first rescue bolus to be administered.***

Conclusion: ***We found no significant differences in recovery time, mean arterial pressures (MAP), respiration rate, pain score, or Ramsay sedation levels between the KP and KD groups. In contrast to Group (KD), Group (KP) had a shorter time to first rescue bolus.***

Keywords: Gastrointestinal endoscopy; Sedation; Intravenous; Ketamine-dexmedetomidine

1. Introduction

The frequency of outpatient surgical operations has increased during the last several decades. Day case operations are a great way to cut down on hospital stays. The idea of having surgery and recovery on the same day requires careful preparation of the anesthetic approach, which in turn helps to reduce the risk of complications.[1]

Common sedative combinations include propofol, benzodiazepines, and opioids. Due to the lack of analgesic action in benzodiazepines and propofol, opioids are typically administered during painful procedures. Opioid treatment has many benefits, but it also carries the risk of adverse effects and excessive drowsiness.[2]

Without inducing respiratory depression, ketamine provides the benefits of analgesia, forgetfulness, and hypnosis as a noncompetitive antagonist at the N_methyel_d_aspàrtate and glutamate receptors.

A sedative-hypnotic with no analgesic effects, propofol has a rapid beginning of action. Cardiovascular and respiratory depression that is dose-dependent are among the adverse effects of propofol.

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* Corresponding author at: Anesthesiology, Intensive Care and Pain Management, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: Isaad6560@gmail.com (I. S. M. Saad).

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When administered together, ketamine and propofol mitigate each other's adverse effects while simultaneously reducing the dosage needed to achieve the desired anesthetic effects due to their synergistic hypnotic, sedative, and analgesic actions.[3]

The calming, analgesic, and anxiety-reducing properties of dexmedetomidine come from its role as a selective alpha-2 adrenergic receptor agonist. Combining intravenous ketamine and dexmedetomidine has several benefits, such as stabilizing hemodynamics, relieving postoperative pain, and not causing respiratory depression.[4]

This study aims to assess the safety profile, hemodynamics, and sedation quality of ketamine-propofol (KP) vs. ketamine dexmedetomidine (KD) for procedural sedation in adult patients having upper gastrointestinal endoscopy.

2. Patients and methods

The research ethics and scientific committee of the relevant department gave their stamp of approval to this study, which took place at the Al-Azhar University Hospitals. After each patient understood the purpose of the study, their written informed consent was obtained. Two groups of sixty adult patients receiving esophageal or gastric band endoscopies make up the current study:

The patients in Group (KP) were sedated using KP, while those in Group (KD) were sedated using KD.

Study Design and Sampling:

The research strategy for this investigation is a randomized clinical trial with a single blind. Using G power program 3.1.9.4, the necessary sample size was determined. Using data from prior research on the effects of ketamine in combination with dexmedetomidine or propofol... A power level of 0.80, an alpha level of 0.05 (two-tailed), and an effect size of 0.78 for the duration (mean ± SD in the ketamine plus adding Propofol group is 8±4 and in the ketamine plus adding Dexmedetomidine group is 12±6, respectively) necessitate a minimum of 27 patients in each group. Thirty participants were included in each group, a 10% increase above the original calculation to account for dropouts.

Randomization:

The research investigator opened opaque envelopes with computer-generated random numbers, which were then used to assign equal numbers of patients to receive either ketamine-propofol intravenously or ketamine-dexmedetomidine intravenously. The same anesthesiologist administered both of the medications mixed with ketamine.

Inclusion criteria

Candidates for upper gastrointestinal endoscopy must be adults (aged 30–60) who meet the physical status II criteria set out by the American Society of Anesthesiologists (ASA).

Exclusion criteria

individuals experiencing severe hemodynamic instability, those with a history of myocardial infarction or substantial cardiovascular disease, those with acute renal failure or decompensated liver disease, those with psychosis or neurological disease, those with a known allergy to any of the study drugs, and those who declined to sign the informed consent form were not eligible to participate.

Methods:

Preoperative Preparation:

conveyed in writing: A full medical history, informed consent, electrocardiogram (ECG), and laboratory profile (including coagulation, liver, kidney, and blood counts) are all necessary components of a comprehensive ECG

Preoperative monitoring and baseline readings:

Upon patients' arrival to the operating room, standard monitoring tools such as electrocardiograms, pulse oximeters, and non-invasive blood pressure started recording their heart rate (HR), blood pressure (BP), and oxygen saturation. After inserting an 18-gauge IV cannula into the dorsum of the non-dominant hand, 4ml/kg/hr of Ringer lactate was infused.

Anesthetic Techniques:

According to the randomization, individuals in Group KP were given ketamine and propofol intravenously, whereas those in Group KD were given ketamine and dexmedetomidine. For induction, patients in Group KP received intravenous ketamine at a dose of 1 mg/kg, and during the procedure, they received an additional dose of 1 mg/kg of intravenous propofol. A combination of intravenous ketamine (1 mg/kg) and intravenous dexmedetomidine (0.5 mg/kg) was given to patients in Group KD for induction, with an additional 0.5 mg/kg of dexmedetomidine given intravenously as needed throughout the procedure.

Using a nasal catheter to administer 3 L/min of oxygen, all patients were given the green light to breathe on their own. The patient was always positioned on the left side during the surgery. A final dose of ondansetron (0.1 mg/kg) is administered throughout the surgery. Paracetamol (1 gm) injections were used as the usual method of postoperative pain relief.

Measurement:

Measured Parameters:

The hemodynamic parameters (blood pressure,

heart rate, and oxygen saturation level) were monitored at the beginning of the procedure and then every five minutes until it ended. The presence of bradycardia (heart rate below 60 beats per minute) or hypotension (blood pressure below 20 percent of baseline) was documented in every case. In order to gauge the level of sedation, the Ramsay sedation scale was utilized. The duration to recover (the amount of time it takes to react to an aural stimulus) and the duration to be discharged from the post-anesthesia care unit (PACU) (Aldrete score of 9) were recorded.[5]

Aldrete score:

It was recorded how many doses of rescue bolus were needed during the procedure as well as the time it took to administer the first dose. There were other remarkable occurrences as well, such as airway adverse events (apnea lasting >15 seconds) and procedural interference (movement of the lower limbs).

Endoscopists were asked to rate the procedure's ease on a three-point scale, with 1 being the most difficult, 2 being adequate, and 3 being the most difficult. Their satisfaction was recorded at the end of the surgery. Using a three-point scale, patients' levels of satisfaction were recorded: 1 for very dissatisfied, 2 for good, and 3 for extremely satisfied. The assessment of procedure pain was carried out using the non-verbal pain scale (NVPS).[6]

During the time following surgery, we recorded any instances of vomiting or nausea, signs of recovery, restlessness, and recollection of what happened during the procedure.

Statistical analysis:

We used IBM SPSS software package version 21.0 to examine the data that was fed into the computer. ("Armonk, NY: IBM Corp.") Quantitative and qualitative data were characterized by percentages and counts. The distribution was checked for normalcy using the Kolmogorov-Smirnov test. Standard deviation, median, interquartile range (IQR), range (minimum and maximum), and mean were used to characterize quantitative data. We used a 5% level of significance to evaluate the results.

This testing was conducted: When comparing groups based on categorical variables, the chi-square test is useful;

When comparing two groups, the Student t-test (t) is used for normally distributed quantitative variables, and the Maan-Whitney test (U) is used for non-parametric quantitative variables.

3. Results

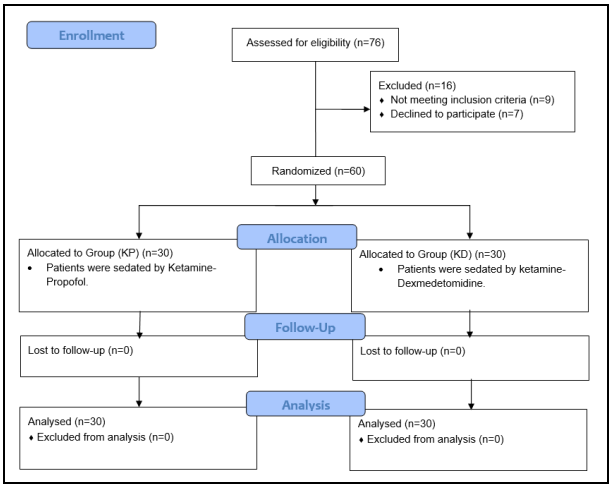

Figure (1): Flowchart of the study.

Table 1. Comparison between the studied cases.

	GROUP (KP) (N=30)		GROUP (KD) (N=30)		TEST OF SIG.	P
AGE						
RANGE.	35-55		34-55		t=0.960	0.341
MEAN±SD.	47.5±6.37		45.87±6.8			
SEX	No.	%	No.	%		
FEMALE	10	33.3	7	23.3	$\chi2$=0.739	0.390
MALE	20	66.7	23	76.7		
BMI						
RANGE.	22.2-31.9		22.4-31.9		t=0.722	0.473
MEAN±SD.	27.59±2.65		27.06±3.09			
ASA	No.	%	No.	%		
I	18	60.0	20	26.7	$\chi2$=0.287	0.592
II	12	40.0	10	33.3		

Data are presented as frequency(%) unless otherwise mentioned, SD:Standard deviation.

In terms of medical history, the cases that were considered did not differ significantly from one another, (table 1).

Table 2. Comparing the examined instances based on their heart rates.

	GROUP (KP) (N=30)	GROUP (KD) (N=30)	TEST OF SIG.	P
BASELINE				
RANGE.	73-93	73-95	t=0.760	0.450
MEAN±SD	83.8±5.79	82.63±6.09		
AFTER LOADING DOSE				
RANGE.	68-93	59-91	t=4.170	<0.001*
MEAN±SD	80.67±6.36	72.9±7.97		
AFTER INSERTION OF THE ENDOSCOPY				
RANGE.	75-119	62-115	t=2.789	0.007*
MEAN±SD	99.2±11.45	90.17±13.55		
5 MIN				
RANGE.	53-112	42-113	t=1.877	0.066
MEAN±SD	82.33±14.71	74.73±16.6		
10 MIN				
RANGE.	54-111	42-114	t=1.933	0.058
MEAN±SD	82.63±14.71	74.77±16.75		
15 MIN				

RANGE.	53-112	41-114	t=1.891	0.064
MEAN±SD	82.57±14.99	74.8±16.77		
20 MIN				
RANGE.	56-114	43-116	t=2.273	0.027*
MEAN±SD	84.87±14.86	75.6±16.66		
25 MIN				
RANGE.	54-113	43-117	t=1.806	0.076
MEAN±SD	84.97±15.21	77.5±16.78		
40 MIN				
RANGE.	53-112	44-122	t=0.748	0.457
MEAN±SD	83.9±15.27	80.77±17.12		
55 MIN				
RANGE.	54-113	46-127	t=0.031	0.975
MEAN±SD	83.73±14.98	83.6±17.76		
70 MIN				
RANGE.	54-114	46-128	t=0.165	0.870
MEAN±SD	83.93±15.16	84.63±17.67		

Data are presented as frequency(%) unless otherwise mentioned, SD:Standard deviation.

The heart rates of the cases under study varied statistically significantly after the loading dose, after the endoscope was inserted, and after 20 minutes, (table 2; figure 2).

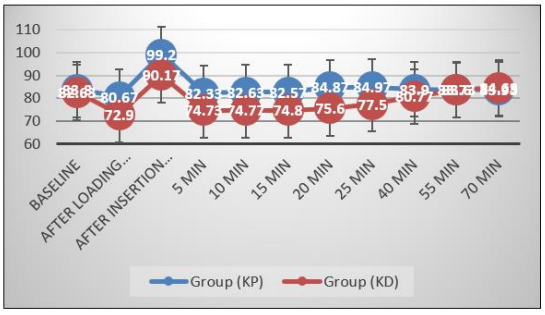

Figure 2. Comparison between the studied cases according to heart rate.

Table 3. Comparison between the studied cases according to SpO2.

	GROUP (KP) (N=30)	GROUP (KD) (N=30)	TEST OF SIG.	P
BASELINE				
RANGE.	97-99	97-99	t=0.713	0.479
MEAN±SD	98.17±0.79	98.3±0.65		
AFTER LOADING DOSE				
RANGE.	95-99	97-99	t=4.021	<0.001*
MEAN±SD	97.2±1.35	98.3±0.65		
AFTER INSERTION OF THE ENDOSCOPY				
RANGE.	95-99	97-99	t=2.880	0.006*
MEAN±SD	97.17±1.34	97.97±0.72		
5 MIN				
RANGE.	95-99	97-99	t=3.338	0.001*
MEAN±SD	97±1.41	97.97±0.72		
10 MIN				
RANGE.	97-99	97-99	t=0.841	0.404
MEAN±SD	98.17±0.79	98±0.74		
15 MIN				
RANGE.	97-99	97-99	t=0.841	0.404
MEAN±SD	98.17±0.79	98±0.74		
20 MIN				
RANGE.	97-99	97-99	t=0.173	0.863
MEAN±SD	98.13±0.82	98.1±0.66		
25 MIN				
RANGE.	97-99	97-99	t=0.0	1.0
MEAN±SD	98.17±0.79	98.17±0.65		
40 MIN				
RANGE.	97-99	97-99	t=1.874	0.066
MEAN±SD	98.5±0.57	98.2±0.66		
55 MIN				
RANGE.	97-99	97-99	t=0.375	0.709
MEAN±SD	98.17±0.7	98.23±0.68		
70 MIN				
RANGE.	97-99	97-99	t=0.375	0.709
MEAN±SD	98.17±0.7	98.23±0.68		

Data are presented as frequency(%) unless otherwise mentioned, SD:Standard deviation.

After the loading dose, after the endoscope was inserted, and after five minutes, there was a statistically significant difference in SpO2 between the cases under study, (table 3;figure 3).

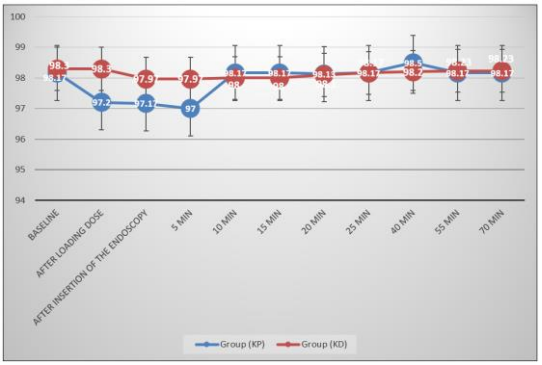

Figure 3. Comparison between the studied cases according to SpO2.

Table 4. comparison between the studied cases according to recovery time using the Modified Aldrete's score

TIME POINTS	GROUP (KP) (N = 30)	GROUP (KD) (N = 30)	TEST OF SIG.	P
PACU ARRIVAL	6 (5-7)	7 (6-7)	U=315.5	0.731
5 MINUTES	7 (5-7)	8 (7-9)	U=406.0	0.494
10 MINUTES	7 (7-9)	8 (8-10)	U=454.3	0.715
15 MINUTES	9 (9-10)	10 (9-10)	U=413.0	0.570
30 MINUTES	10 (10-10	10 (10-10)	U=450.0	0.913

Data presented as median (min-max)

All patients in the two groups reported (MAS=9) after 15 minutes since arrival to PACU. After 30 minutes, all patients in the two group reported MAS= 10, and safely discharged to the ward. When comparing the two groups' MAS at the predetermined time points, no discernible differences were found. (Table 4, Figure 4).

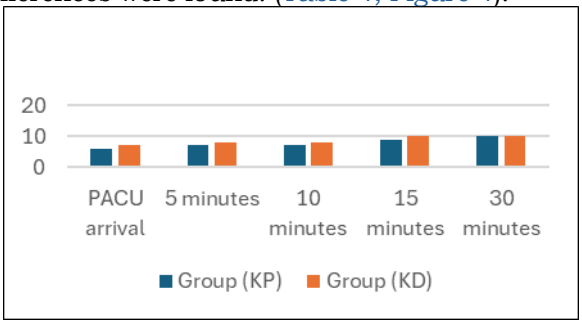

Figure 4. Comparison between the studied cases according to recovery time using MAS.

Table 5. Comparison between the studied cases according to Ramsay sedation scores.

	GROUP (KP) (N=30)	GROUP (KD) (N = 30)	TEST OF SIG.	P
BASELINE				
RANGE.	1-3	1-3	U=399.5	0.425
MEDIAN (IQR)	2(2-3)	2(1-3)		
AFTER				

INDUCTION RANGE. MEDIAN (IQR)	2-6 4.5(3-5)	2-5 4.5(3-5)	U=406.0	0.494
10 MIN RANGE. MEDIAN (IQR)	2-6 4.5(3.25-5)	2-6 5(4-5)	U=445.0	0.939
20 MIN RANGE. MEDIAN (IQR)	2-7 4.5(3.25-5)	2-6 5(4-5)	U=413.0	0.570
30 MIN RANGE. MEDIAN (IQR)	1-6 4(3-5)	2-6 5(4-5)	U=413.0	0.572

Data are presented as frequency(%) unless otherwise mentioned, IQR:interquartile range.

Regarding Ramsay sedation scores, there was no substantial variation among the cases under study, (table 5).

Table 6. Comparing the cases under study based on their respective outcomes.

	GROUP (KP) (N=30)		GROUP (KD) (N=30)		TEST OF SIG.	P
TIME TO FIRST RESCUE BOLUS (MINUTES)						
RANGE. MEDIAN (IQR)	2-14 7.5(5.25-11.75)		4-17 10.5(7.25-13.75)		U=307.5	0.035*
NUMBER OF RESCUE BOLUS						
RANGE. MEDIAN (IQR)	1-2 2(1-2)		1-3 1(1-2)		U=413.5	0.537
COMPLICATIONS	No.	%	No.	%	χ2	P
NAUSEA AND VOMITING	2	6.7	4	13.3	0.741	0.389
AIRWAY ADVERSE EFFECTS	1	3.3	0	0.0	1.017	0.313

Data are presented as frequency (%) unless otherwise mentioned, IQR: interquartile range.

There was statistically significant difference between the studied cases as regard time to first rescue bolus as shown in (table 6; figure 5).

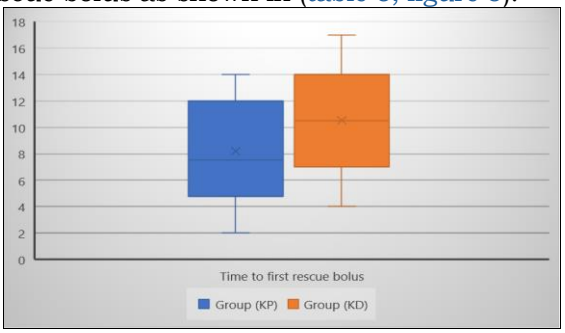

Figure 5. Comparison between the studied cases according to time to first rescue bolus.

Table 7. comparison between the studied cases according to patient satisfaction.

PATIENT SATISFACTION N (%)	GROUP KP N=(30)	GROUP KD N=(30)	P-VALUE
EXCELLENT	17(56.7)	19(63.4)	0.741
GOOD	11(36.7)	10(33.3)	0.915
UNSATISFIED	2(6.6)	1(3.3)	0.804

Data presented as number (%)

Table 7 indicates that there were no statistically significant differences in patient satisfaction across the instances under study.

Table 8. Comparison between the studied cases according to endoscopist satisfaction

	GROUP KP N=(30)	GROUP KD N=(30)	P-VALUE
EASY	17(56.7)	16(53.3)	0.436
ADEQUATE	13(43.3)	14(46.7)	0.272
IMPOSSIBLE	0(0)	0(0)	0.301

Data presented as number (%)

Table 8 indicates that there were no statistically significant differences in endoscopist satisfaction across the patients under study.

4. Discussion

When it came to demographic information (such as age, sex, body mass index, and ASA), the results of the present study found no statistically significant differences among the cases.

Seventy patients were assigned in Algharabawy et al.,[7] research randomly assigned 35 patients to one of two groups. When comparing the two groups according to standard demographic variables such as age, gender, weight, height, and ASA, no statistical significance was found.

When we looked at how long each surgery took, we didn't find any statistically significant differences.

Consistent with the current study, Algharabawy et al.,[7] discovered that the two groups did not differ significantly with regard to the time of the operation.

We found that the cases differed significantly with respect to heart rate following loading dose, endoscope insertion, and 20 minutes.

Similarly, In the study of Kakarla et al.,[8] Although the difference was not statistically significant until 12 minutes after induction, group KD had a lower HR than the control group.

When we looked at the patients in our study, we didn't find any statistically significant differences in the MAPs.

As previously shown by our records, Kakarla et al.,[8] discovered that systolic, diastolic, and mean arterial pressures were significantly higher in Group KD three minutes after induction, whereas otherwise, the BP readings were similar among the groups.

Regarding the respiratory rate, our investigation did not find any statistically significant differences among the cases.

Similarly, at any point in time, there was no statistically significant difference in respiratory rate variations between the two groups.[7]

Regarding SpO2 after loading dose, endoscope insertion, and 5 minutes, our investigation found a statistically significant difference among the cases.

The two groups did not vary statistically with respect to variations in oxygen saturation over all time points. Desaturation of oxygen (SpO2<90%) was observed in three patients (6% in the KD group and nine cases (18% in the KP group) (p-value=0.049). These cases were treated with a chin-lift or jaw-thrust maneuver, which increased the oxygen flow to 6 L/min, and neither manual ventilation nor an artificial airway was necessary.[7]

When it came to pain scores, the results of the present study found no statistically significant differences among the cases.

In the same context, in the study of Kakarla et al.,[8] When comparing the two groups' levels of pain using the NVPS-revised, the Chi-square test yielded similar results (p=0.161), suggesting that the results were not statistically significant.

When we compared the cases using the Ramsay sedation score, we didn't find any statistically significant differences.

The results of the study on Ramsay sedation scores match those of the results of the present study by Algharabawy et al.,[7] There was no statistically significant difference between the two studied groups.

In disagreement with the results of the present study, the subjects in the study of Kakarla et al.,[8] Results from the Ramsay sedation test were significantly higher in Group KD at both six- and fifteen-minute post-induction.

The duration needed to get an Aldrete score of 9 or higher in the PACU was similar in Group KP and Group KD, and there was no statistically significant difference between the two. Results from the study by Kakarla and colleagues, which included 194 patients slated for elective procedures with shorter durations, are consistent with this conclusion. In terms of recovery time or time required to reach MAS≥9, they proved that the KP and KD groups were not statistically different.[8]

When we compared the patients in the results of the present study, we found that the time to first rescue bolus varied significantly.

According to our data, the KP group required a substantially shorter amount of time to administer their initial rescue bolus than the KD group did (p=0.026). There was little difference between the two groups in terms of wakeup and recuperation times.[8]

Amer et al.,[9] when administering anesthesia for pediatric endoscopy, discovered that a combination of ketamine and dexmedetomidine reduced the requirement for supplemental drugs.

When we looked at how satisfied the endoscopist was with each instance, we didn't find any statistically significant differences. Endoscopist satisfaction was not significantly different across the instances in the study, which is consistent with our findings.[9]

Limitations:Its limited sample size and single-center design raise concerns that rare clinical occurrences may have gone undetected. Dexmedetomidine is more costly than propofol, which can restrict its usage unless absolutely necessary, especially in patients with tight ascites and respiratory compromise. Therefore, the cost-benefit ratio needs to be examined.

4. Conclusion

Our results were comparable between the KP group and KD as regards mean arterial pressures MAP, respiratory rate, pain score, recovery time, and Ramsay sedation scores. However, the time to first rescue bolus was lesser in Group (KP) than the ketamine dexmedetomidine (KD) group.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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