Section: Anaesthesiology

Original Research Article

A COMPARATIVE EVALUATION OF KETAMINE-PROPOFOL COMBINATION AND PROPOFOL AS INDUCTION AGENT ON HAEMODYNAMICS AND SIDE EFFECT PROFILE IN PATIENTS UNDERGOING ELECTIVE SURGICAL PROCEDURES UNDER GENERAL ANAESTHESIA

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ABSTRACT

Background: Propofol and Ketamine are commonly used intravenous agents for the induction of general anaesthesia. While Propofol causes vasodilation and myocardial depression, Ketamine stimulates cardiovascular and respiratory systems. Combining them as 'ketofol' may yield synergistic benefits by balancing haemodynamic effects and minimising adverse effects. The results of this study may help in determining the role of both Propofol and Ketamine in Ketofol as compared to Propofol, so far as haemodynamic and recovery profile of patients undergoing surgical procedures under general anaesthesia are concerned. **Materials and Methods:** A randomized, prospective clinical trial compared ketamine-propofol (1 mg/kg propofol : 1 mg/kg ketamine) with propofol (2 mg/kg) alone for induction in 70 ASA grades I and II patients undergoing elective surgeries. Primary Outcomes were Heart Rate (HR) and Mean Arterial Pressure (MAP); Secondary Outcomes included side effects and recovery profile. HR, MAP, and SpO2 were recorded at baseline and serial intervals post-induction. **Result:** Group 1 (ketofol) showed significantly higher HR and MAP immediately post-induction and post-intubation compared to Group 2 (propofol), demonstration superior haemodynamic stability (HR: $p < 0.01$; MAP: $p < 0.001$). Group 1 maintained near-baseline MAP, whereas Group 2 experienced notable hypotension. No significant differences in SpO2 were found. Group 1 reported higher drowsiness (28.6% vs 11.4%) and tachycardia (14.3% vs 2.9%), while Group 2 showed more respiratory depression and hypotension. **Conclusion:** Ketofol (1:1) provides superior haemodynamic stability compared to propofol alone, with a manageable side effect profile, making it a valuable induction agent for short duration elective surgeries.

INTRODUCTION

In modern surgical practices, general anaesthesia is a crucial component in facilitating pain management and muscle relaxation during surgical procedures. For ensuring optimal outcomes in perioperative care, the essential parameters such as, the patient's haemodynamic stability and side effect profile, can be significantly affected by using combination of anaesthetic agents. In general anaesthesia, the two commonly used induction agents are Ketamine and Propofol. To achieve a balanced anaesthetic effect, both of these induction agents can be harnessed when used in combination as both of these have unique pharmacological properties.[1-3]

The focus of this research lies on evaluating the effects of a ketamine-propofol combination as an induction agent with Propofol, on haemodynamics and side effect profile in patients undergoing elective surgical procedures under general anaesthesia. The primary aim is to compare how this combination can influence key perioperative factors which are crucial for safety and comfort of patients during and after surgery.[4,6]

MATERIALS AND METHODS

This study was a randomized, prospective, parallel-arm clinical trial conducted in the Department of Anaesthesia, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly. The study adhered to ethical standards outlined in the Declaration of Helsinki and was approved by the Institutional Ethics Committee.

Written informed consent was obtained from all participants after explaining the purpose, methodology, and risks involved in the study.

The trial compared ketamine-propofol combination (1:1) with Propofol as induction agents during general anaesthesia for elective surgeries.

Patients of either sex, ASA grade l and ll of age not less than 18 years and not more than 60 years admitted in SRMS IMS for elective surgeries lasting not more than two hours, conducted under general anaesthesia were considered for the study.

Patients with ASA grade III or IV, unwillingness to be a part of the trial, history of allergy or hypersensitivity to ketamine or propofol, history of major psychiatric disorders or history of substance abuse, systemic illnesses involving cardiovascular, nervous or respiratory system, any renal or liver disease, pregnant women, patients with haemodynamic instability and patients with anticipated difficult airway anatomy were excluded from the study. The enlisted patients, who needed more than one intubation attempt or developed any intra-operative or post-operative complication, including unanticipated change in surgical plan or increase in the duration of surgery, were also excluded from further evaluation and analysis. Patients who could not be induced with the calculated study dose were also excluded from the study.

Sample size was calculated based on the study conducted by Chingtham B, Chaoba Singh l, Ramakrishna S, Jain R, Gurung A and using G-power software.[5]

A total of 70 patients aged 18-60 years of either sex with the American Society of Anaesthesiologists (ASA) grade I and II undergoing elective surgeries under general anaesthesia were enrolled in the study. A consecutive sampling strategy was adopted to enrol all eligible patients who presented for elective surgery during the study period, until the required sample size was reached.

All eligible patients for the study underwent pre-anaesthetic checkup prior to surgery where, a detailed history was taken from each patient which included history of present and past illness, past history of any surgery or anaesthetic exposure, history of drug intake or any allergy, any significant family history and history of addiction. A thorough general survey (including body weight and height) was performed along with the examinations of the cardiovascular and respiratory, genitourinary, gastrointestinal and central nervous system. The airway of each patient was assessed according to Mallampati classification. Routine pre-operative investigations which included complete hemogram, coagulation profile, blood sugar, serum urea, creatinine, renal and liver profile, chest X- ray and 12-lead resting electrocardiogram were performed and evaluated.

The eligible patients for the study were randomly assigned into two groups by a computer-formulated randomization technique, using consecutively numbered opaque sealed envelopes, which were organized by a volunteer who was not a part of the trial.

In order to collect data required for the study, the investigator looked for the available tools. A perusal of the survey, review of related studies and other test material led to the fact that most of the tools available were not suitable for the present investigation. It was, therefore, planned to construct a suitable Proforma, the Ketofol Perioperative Monitoring and Recovery Proforma (KPMRP). The Proforma was framed covering the necessary parameters related to the subject of investigation, starting with the Demographic information of the patient, the bolus dosing of Fentanyl prior to induction, haemodynamic profile at various time points, and post operative haemodynamic and side effect profile.

Patients and attendants were informed and explained about the procedure and written and informed consent were obtained. All the patients included in this study received tablet alprazolam 0.25 mg the night before surgery and had to fast for 6 hours prior to anaesthesia. In the pre-operative room, intravenous access was secured, and patients were pre-loaded with 20 ml/ kg crystalloid solution. Also, the patients were pre medicated with injection glycopyrrolate at the dose of 0.004 mg / kg.

In the operation theatre, the patient's body weight, fasting, consent, and pre-anaesthetic checkup was checked. Standard monitors like ECG, Pulse oximeter, NIBP, were connected to the patients and baseline Heart Rate (HR) and Mean Arterial Blood Pressure (MAP) noted.

Study drugs were prepared by an expert technician or an anaesthesia trainee as per assigned group. This anaesthesia trainee was not a part of study thereafter. All the drug combinations were prepared as a total of 2 mg / kg body weight.

After connecting all essential monitoring, baseline vitals (PR, NIBP, spO2, ECG) were noted and patients were pre oxygenated with 100% O2 over 3 minutes. The study drug was given over a period of 30 seconds. Induction time was noted, which was defined as the time taken from the start of the injection till the loss of verbal command.

Intra-operative and post-operative monitoring was done by independent anaesthesia trainee who was not a part of the study.

General anaesthesia was induced with intravenous (IV) fentanyl 2 microgram/kg and IV induction agent as per the assigned group. Intubation was attempted, after achieving complete muscle relaxation with IV vecuronium bromide 0.1 mg/kg. A swift, smooth laryngoscopy attempt was taken by a well experienced anaesthesiologist after three minutes, lasting less than 15 seconds, using a Macintosh blade (size 3 or 4). Endotracheal intubation was performed with a sterile single lumen cuffed polyvinyl chloride (PVC) -endotracheal tube (Internal diameter 7-7.5mm in females and 7.5-8 mm in males). Graded endotracheal tube cuff inflation was performed till no audible air leakage was present. Cuff pressure was confirmed with a cuff-manometer and monitored

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intra-operatively at 30 minutes duration to maintain the cuff pressure within safe limit of 20-30 cm of H20.

Anaesthesia was maintained using 50:50 oxygen: nitrous oxide mixture and isoflurane (1-1.2 MAC). All patients were mechanically ventilated (TV - 6-8 ml/kg, RR - 12-14 breaths/min) to achieve end-tidal CO2 of 35-45 mm Hg.

Ondansetron 4mg IV and metoclopramide 10 mg IV were given intra-operatively to prevent any regurgitation of gastric contents and thereafter every eight hours post-operatively. The skin incision was not placed until 15 minutes after induction and until depth of anaesthesia was not maintained, so that, the primary end point was not influenced by pain due to skin incision. Prior to extubating, gentle oropharyngeal suctioning was performed to remove residual secretions, if any. Neuromuscular blockade was reversed with the recommended dose of reversal agent, 0.04 mg/kg neostigmine with 0.005 mg/kg glycopyrrolate with adequate emergence and patients were extubated and shifted to post anaesthesia care unit (PACU) and discharged when Aldrete score was 10.

Haemodynamic variables such as Heart Rate (HR) and Mean Arterial Pressure (MAP) were monitored at baseline (Prior to induction), immediately post induction, immediately post tracheal intubation, and subsequently at 1, 2, 4, 6, 8, and 10 minutes following intubation and subsequently hourly in the post-operative period till the first rescue analgesic. Patients received injection tramadol 100 mg IV as per hospital protocol.

Side effect profile was evaluated at the above-mentioned time frames in the post-operative period.

Data were analysed using SPSS (version 26.0). Descriptive statistics included mean ± standard deviation (SD). ANOVA, Kruskal-Wallis were used for between-group comparisons. A p value < 0.05 was considered statistically significant.

RESULTS

A total of 70 patients were included for this study and randomly allocated to one of two groups, named as Group 1 and Group 2 representing Ketamine and Propofol combination and Propofol used for the study. Each group was comprised of 35 patients.

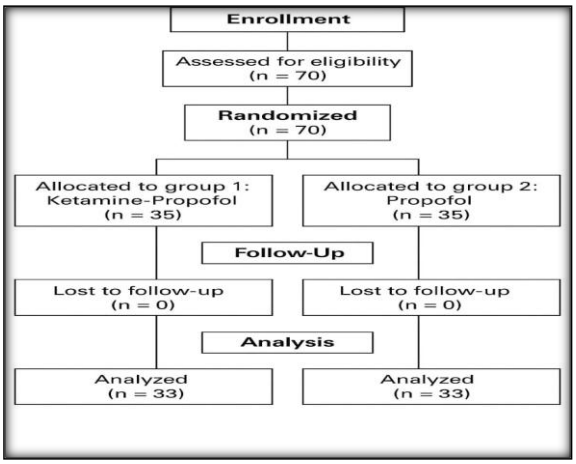

Figure 1: Flowchart showing the process of the randomized, prospective study

Baseline Characteristics: In this section the difference of 'Background Variables' among two groups of respondents is measured.

Table 1: Demographic profile of the two groups

Parameter	Group 1 mean ± SD	Group 2 mean ± SD	P value
Age	32.44 ± 12.16	33.21 ± 11.91	0.9356
Height	165.91 ± 7.58	162.81 ± 7.39	0.0885
Weight	58.83 ± 10.79	58.32 ± 8.88	0.8303

Table 2: Frequency distribution of ASA grades and Sex Distribution of patients in the two groups

	Group 1(N=35)		Group 2 (N=35)		P value
	frequency	%	Frequency	%	
ASA Grade I	27	77.14	31	88.57	0.835
ASA Grade II	8	22.85	4	11.42	0.368
SEX – MALE	16	45.71	18	51.42	0.867
SEX – FEMALE	19	54.28	17	48.57	0.882

There are no statistically significant differences among the groups regarding age, height, weight, sex, ASA physical status, or baseline haemodynamic parameters ($p > 0.05$ for all comparisons). This similarity in baseline data ensures that subsequent differences in outcomes could be more confidently attributed to the allocated study interventions.

Haemodynamic Profile: Haemodynamic variables such as Heart Rate (HR), Mean Arterial Pressure (MAP), and Peripheral Oxygen Saturation (SpO2) were monitored and recorded at baseline (prior to induction), immediately post induction, immediately post tracheal intubation, and subsequently at 1, 2, 4, 6, 8, and 10 minutes following intubation and subsequently hourly in the post-operative period till the first rescue analgesic.

Heart Rate (HR)

Table 3: Comparison of Heart Rate (HR) between study groups

	Group 1 Mean ± SD	Group 2 mean ± SD	P Value
Baseline heart rate	86.29 ± 15.12	83.95 ± 14.01	0.5033
Immediate post induction	93.07 ± 16.22	82.21 ± 13.50	0.0033
Immediate post tracheal intubation	98.81 ± 16.08	87.37 ± 11.17	0.0009

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Post intubation hr 1 min	98.87 ± 14.80	86.90 ± 12.81	0.0006
HR 2 Mins	96.99 ± 14.99	87.62 ± 13.37	0.0074
HR 4 Mins	95.63 ± 15.38	84.72 ± 13.57	0.0025
HR 6 Mins	93.16 ± 15.75	82.16 ± 12.84	0.0021
HR 8 Mins	90.03 ± 15.37	80.93 ±12.70	0.0087
HR 10 Mins	88.72 ± 14.94	79.98 ± 12.92	0.0108

The [Table 3] shows the comparison of HR among the two study groups at 'Baseline', 'Immediate Post Induction', 'Immediate Post Tracheal Intubation' and 'Post Intubation' at specific time intervals, such as, at 1 minute, 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes respectively. Significant variation is observed at 'Immediate Post Induction' stage, at 'Immediate Post Tracheal Intubation' stage, and at '1, 2, 4, 6 and 8 minute post intubation' stages as indicated by a P value of 0.0033, 0.0009, 0.0006, 0.0074, 0.0025, 0.0021 and 0.0087 respectively. Slightly significant difference (P value of 0.0108) is observed among the two groups at '10 minutes post Intubation' stage. It is also observed that study group 1 is exhibiting lesser fall in HR post induction as compared to Group 2.

Mean Arterial Pressure (MAP)

Table 4: Comparison of Mean Arterial Pressure (MAP) among two Groups

Variable	Group 1 mean ± SD	Group 2 mean ± SD	P Value
Baseline map	90.73 ± 10.08	89.66 ± 8.15	0.6286
Immediate post induction	92.37 ± 15.56	78.04 ± 10.81	0.0000
Immediate post tracheal intubation	105.11 ± 9.15	91.52 ± 14.82	0.0000
Post intubation map 1 Min	103.45 ± 12.02	89.13 ± 13.45	0.0000
MAP 2 Mins	103.24 ± 10.11	88.06 ± 12.58	0.0000
MAP 4 Mins	97.63 ± 11.74	84.18 ± 12.50	0.0000
MAP 6 Mins	95.58 ± 10.10	83.50 ± 12.90	0.0000
MAP 8 Mins	90.63 ± 8.33	83.49 ± 12.93	0.0077
MAP 10 Mins	90.16 ± 8.00	85.83 ± 11.00	0.0642

The [Table 4] shows the comparison of MAP among the two study groups at 'Baseline', 'Immediate Post Induction', 'Immediate Post Tracheal Intubation' and 'Post Intubation' at specific time intervals, such as, at 1 minute, 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes respectively.

No significant variation is observed at 'Baseline' (P value – 0.62).

However, a highly significant difference at .05 level is observed among the two groups at 'Immediate Post Induction' stage (P value - 0.000) 'Immediate Post Tracheal Intubation' stage (P-value – 0.000), 'Post Intubation' at 1 minute (P-value 0.000), 2 minutes (P-value – 0.000), 4 minutes (P-value 0.000), and at 6 minutes (P-value 0.000). At '10 minutes post intubation' stage, the difference seen is not significant (P value – 0.06).

Peripheral Oxygen Saturation (SpO2)

Table 5: Comparison of Peripheral Oxygen Saturation (SpO2) among two Groups

Variable	Group 1			Group 2			P value
	Mean	SD	N	Mean	SD	N	
BASELINE SpO_2	99.30	.72	35	99.29	.76	35	0.362
Immediate Post Induction	99.62	.33	35	99.66	.34	35	0.784
Immediate Post Tracheal Intubation	99.69	.32	35	99.68	.36	35	0.791
Post Intubation SpO_2 1 Min	99.65	.37	35	99.76	.31	35	0.402
SpO_2 2 Mins	99.69	.32	35	99.67	.37	35	0.959
SpO_2 4 Mins	99.60	.37	35	99.69	.35	35	0.394
SpO_2 6 Mins	99.62	.37	35	99.75	.34	35	0.240
SpO_2 8 Mins	99.64	.35	35	99.72	.32	35	0.544
SpO_2 10Mins	99.72	.28	35	99.77	.30	35	0.447

The [Table 5] shows the comparison of SpO2 among the two study groups at 'Baseline', 'Immediate Post Induction', 'Immediate Post Tracheal Intubation' and 'Post Intubation' at specific time intervals, such as, at 1 minute, 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes respectively.

There are no statistically significant differences among the groups regarding SpO2 at Baseline, Immediate Post Induction, Immediate Post Tracheal Intubation and Post Intubation at time intervals, such as, at 1 minute, 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes.

Side Effects

Table 6: Frequency Distribution of Side Effects among two Groups

Side effects	Group 1 Frequency %	Group 2 Frequency %	Group 1 %	Group 2 %	P value
Drowsiness	10	4	28.57	11.43	0.135
Respiratory depression	0	1	0.0	2.86	1.0
Irrelevant talking	1	0	2.86	0.0	1.0

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Tachycardia	5	1	14.29	2.86	0.2
Hypotension	1	1	2.86	2.86	1.0
Nausea	4	2	11.43	5.71	0.669
Vomiting	1	1	2.86	2.86	1.0

The data indicates that group 1 shows the highest incidence of adverse effects experienced by the respondents after extubation with 10 of the 35 respondents experiencing drowsiness, 1 showing respiratory depression, 1 showing irrelevant talking, 5 showing tachycardia, 4 experiencing nausea and 1 showing vomiting.

Lesser incidence of the above side effects is seen with respondents of Group 2 with 4 respondents showing drowsiness, 1 showing irrelevant talking, 1 showing tachycardia, 1 with hypotension, 2 experiencing nausea and 1 showing vomiting.

DISCUSSION

This study was conducted with an aim to evaluate the haemodynamic responses and side effect profiles associated with ketamine-propofol combination (ketofol) when used as an induction agent compared to Propofol, in patients undergoing elective surgical procedures under general anaesthesia.

When employed for anaesthesia induction, ketofol has been shown to confer greater haemodynamic stability than propofol alone. Despite these findings, the haemodynamic implications of ketofol against Propofol specifically for anaesthesia induction remain inadequately explored, warranting further investigation.

The findings would likely contribute valuable insights into optimizing the ketamine-propofol usage strategy, ensuring a balance between anaesthetic efficacy and haemodynamic stability while facilitating a smoother postoperative recovery in patients undergoing elective surgical interventions.

Demographic profile

The baseline characteristics, including age, height, weight, and BMI, were compared among the two groups, each consisting of 35 participants. The basic demographic profile was comparable between the two groups in terms of mean age (p=0.93), mean height (p=0.08) and mean weight (p=0.83).

Overall, none of the background variables demonstrated significant differences among the two groups, suggesting that they were well-matched in terms of demographic characteristics. This reduces the likelihood of bias or confounding effects and ensures a credible and reliable comparison of study outcomes.

The study was consistent with intergroup demographic comparability as exhibited in studies by Chingtham et al, Elsherbiny et al and Jong Cheol Rim et al.[6-8]

Heart Rate profile: At baseline, the Heart Rates were statistically similar across the two groups (P value – 0.503), confirming that the groups were homogenous in terms of their initial cardiac status. This baseline equivalence ensures that any subsequent differences observed post-induction and post-intubation are attributable to the interventions rather than pre-existing variations. At the immediate post-induction phase, a significant difference in Heart Rate was detected (p = 0.003). A highly statistically significant difference emerged at the immediate post-tracheal intubation stage (p = 0.0009) and persisted at one-minute post-intubation (p = 0.0006). Significant differences were observed at 2,4,6 and 8 minutes as well (p = 0.007, 0 002, 0.002, 0.008). At 10 minutes post intubation, the difference became slightly less significant (p = 0.01). Notably, Group 1 exhibited the least fall in Heart Rate post induction, while Group 2 showed greater fall in Heart Rate post induction.

In this study, the differential Heart Rate variability appears to be attributable to the ketamine-propofol combination employed. Specifically, Group 1, with a combination of ketamine and propofol, experienced sympathetic stimulation, resulting in higher Heart Rate readings immediately after induction. Conversely, the relatively higher Propofol content in Group 2 likely subdued the sympathomimetic response, leading to greater Heart Rate fall immediately post-induction and at one minute thereafter. Importantly, at later post-intubation time points, significant differences in Heart Rate were observed (all p > 0.05) that gradually decreased towards the 10 minute time point, suggesting that the initial haemodynamic disturbances were transient and that Heart Rates eventually stabilized.

Our findings differs from that of Jong Cheol Rim et al., where post-induction Heart Rate initially decreased slightly in all groups—with no significant intergroup differences—and a uniform sharp increase in Heart Rate was observed following endotracheal intubation, likely reflecting the stress response and the sympathomimetic effects of ketamine. This can be explained by the fact that Rim et al. employed a maximum ketamine dose of 0.6 mg/kg, versus 1 mg/kg in our case, which may account for the observed differences in Heart Rate variability.[8]

Mean Arterial Pressure (MAP) profile

MAP was compared across the two groups at different time points. Baseline MAP showed no significant intergroup difference (P = 0.62), ensuring comparable haemodynamic status prior to induction. From the 'Immediate Post Induction' stage till 6 minutes Post induction, a highly significant difference was observed (p = 0.000). At 8 minutes post-intubation, MAP showed slightly less significant differences (p = 007). At 10 minutes post intubation, the difference was not significant (p = 0.06).

This transient MAP fluctuation likely reflects the combined effects of propofol-induced hypotension, post-induction and the sympathetic surge following tracheal intubation. Group 1, with ketamine-propofol

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combination exhibited greater haemodynamic stability, mitigating MAP reductions post-induction. Whereas, Group 2 with Propofol, exhibited a significant fall in MAP post induction.

Several studies have examined MAP variability with different ketofol ratios. Elsherbiny et al found that ketofol 1:1 resulted in significantly lower post-induction hypotension (16%) compared to 1:3 (37%) and required less norepinephrine.[7] Chingtham et al. observed no significant MAP changes in 1:1 and 1:2 groups but noted a MAP drop in 1:3 at 5 minutes post-induction.[6] This study's earlier intubation may have prevented a similar decline.

Post-intubation, MAP decreased significantly in Group 2, which may be relevant for patients with coronary artery disease where hypotension must be prevented. Whereas, in Group 1, a rise in MAP was observed post induction. This aligns with Furuya et al, who reported a transient MAP peak post-intubation.[9] Blood pressure variability stems from ketofol's pharmacodynamics—propofol induces vasodilation and hypotension, especially in higher proportions, while ketamine's sympathomimetic effects counteract these effects.

Tracheal intubation triggers a hypertensive response due to catecholamine release, which is amplified in ketamine-heavy group and blunted in propofol-dominant groups. The 1:1 ketamine-propofol ratio offers better MAP stability, making it preferable for hypotension-prone patients, while Propofol enables rapid induction but requires close haemodynamic monitoring. Additionally, the 1:1 ratio mitigates post-intubation MAP surges, reducing cardiovascular stress, whereas Propofol may necessitate adjuncts like opioids or beta-blockers.

Peripheral Oxygen Saturation level profile

[Table 6] presents the comparison of SpO_2 levels across the two study groups at Baseline and subsequently at multiple pre-determined time points. No statistically significant differences were observed among the groups at any of these time points, indicating consistent oxygen saturation levels across both study groups throughout the observation period. Additionally, ketofol combination may be helpful in spontaneously breathing patients as propofol, which may potentially cause respiratory depression, is counteracted by ketamine's ability to maintain airway reflexes and stimulate respiration. This synergistic interaction helps preserve stable oxygen saturation levels during anaesthesia.

Side effects profile

The most common side effect observed was drowsiness, significantly higher in Group 1 (28.57%) compared to Group 2 (11.43%), suggesting prolonged sedation in Group 1, possibly due to the ketamine-propofol combination, which aligns with previous findings on ketamine's sedative effects.[7]

Irrelevant talking (2.86%) was seen in Group 1, likely as a result of the psychomimetic properties of ketamine. Tachycardia (14.29%) was seen more in Group 1 as compared to Group 2 (2.86%), reinforcing the role of ketamine's NMDA receptor activity in emergence delirium and its sympathomimetic effects leading to tachycardia.[10]

Hypotension was reported in Group 2 (2.86%), consistent with research showing propofol's vasodilatory effects leading to transient blood pressure drops.[11]

Nausea (11.43%) and vomiting (2.86%) were seen more in Group 1, similar to studies reporting higher emetic effects with ketamine-based anaesthesia.[6]

Respiratory depression was observed in Group 2 (2.86%), likely due to the effect of Propofol. The absence of respiratory depression in Group 1 is noteworthy and supports previous studies that balanced ketamine-propofol mixtures maintain stable respiratory function.[7]

These findings highlight the need for adjusting ketofol ratios to optimize sedation, haemodynamic stability, and emergence effects, reducing the risk of undesirable side effects.

CONCLUSION

This randomized, prospective trial demonstrates that a ketamine–propofol combination (ketofol) provides a more favourable balance for haemodynamic stability, and a manageable side-effect profile in patients undergoing short-duration elective surgeries. Compared with Propofol-only formulations, the ketamine-propofol combination effectively harnesses ketamine's sympathomimetic and analgesic properties while minimizing propofol-induced cardiovascular depression and ketamine-related psychomimetic phenomena. While higher ketamine content enhances analgesia, it also prolongs sedation and increases the risk of sympathomimetic effects. However, the sympathomimetic effects seen with Group 1 may be of use in patients susceptible to hypotension. Conversely, a propofol-only induction (Group 2) ensures a more stable recovery but may necessitate additional pain management along with some propensity for post operative respiratory depression and hypotension. These insights can help refine ketofol usage strategies to enhance anaesthetic efficacy while mitigating haemodynamic instability and postoperative complications, ultimately improving patient outcomes in elective surgical procedures.

Nevertheless, the scope of this investigation was limited to ASA I and II patients with relatively short-duration procedures, warranting further research in more diverse and higher-risk populations. Future studies might also explore pharmacokinetic modelling, various dosing ratios, cost-effectiveness, and long-term postoperative outcomes to fully establish the optimal ketofol ratio for different surgical contexts. Adopting larger, multicentre trials with extended follow-up periods will help refine these findings and provide guidance for anaesthesiologists worldwide, ultimately contributing to more effective, patient-centred care in clinical anaesthesia practice.

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