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Original Research Article

Comparison of Ketofol and Propofol Alone for Sedation in Short Surgical Procedures at a Tertiary Care Hospital of Haryana

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Abstract

Background: Short surgical procedures require sedative agents that ensure rapid onset, adequate depth of sedation, haemodynamic stability, and quick recovery. Propofol is widely used but is often associated with dose-dependent hypotension and lack of analgesia. Combining ketamine with propofol (ketofol) may counterbalance these limitations. This study compares ketofol and propofol alone for sedation during short surgical procedures.

Methods: A prospective comparative study was conducted on 120 ASA I–II adult patients undergoing short surgical procedures. Participants were randomized into two groups: Group P received propofol alone, and Group K received ketofol (ketamine 0.5 mg/kg + propofol 0.5 mg/kg). Sedation time, total drug requirement, haemodynamic changes, recovery time, adverse events, and patient and surgeon satisfaction were evaluated. Data analysis was performed using SPSS version 20.0, with $p < 0.05$ considered statistically significant.

Results: Baseline characteristics were comparable. Group K showed significantly faster achievement of adequate sedation (1.9 ± 0.7 min vs. 2.8 ± 0.9 min), lower propofol-equivalent dose requirement (82 ± 20 mg vs. 118 ± 26 mg), and fewer top-up doses. Ketofol demonstrated superior haemodynamic stability, with fewer episodes of hypotension (SBP drop >20%: 8.3% vs. 23.3%; $p = 0.03$). Recovery was faster in the ketofol group (12.1 ± 3.5 min vs. 16.4 ± 4.1 min; $p < 0.001$). Patient and surgeon satisfaction scores were also higher with ketofol. Although adverse events were lower in Group K (10% vs. 21.7%), the difference was not statistically significant.

Conclusion: Ketofol offers faster onset, better haemodynamic stability, reduced drug requirement, and quicker recovery compared to propofol alone, making it a safe and effective sedative option for short surgical procedures.

Keywords: Ketofol, Propofol, Ketamine, Procedural Sedation, Short Surgical Procedures, Haemodynamic Stability, Recovery Time.

Introduction

Short surgical procedures increasingly depend on intravenous sedation techniques that offer rapid onset, predictable depth of sedation, quick recovery, and a favourable safety profile. Propofol has remained one of the most commonly used sedative agents because of its smooth induction, rapid redistribution, and reliable recovery characteristics.[1,2] However, when used as a sole sedative, propofol may cause dose-dependent hypotension, respiratory depression, and pain on injection, and it lacks intrinsic analgesic action, often requiring additional analgesics during minor procedures.[3,4] These limitations have encouraged the exploration of combination regimens that better balance sedation, analgesia, and haemodynamic stability. Ketofol—a mixture of ketamine and propofol—has gained popularity for procedural sedation due to the complementary pharmacological properties of the two drugs. Ketamine provides analgesia and maintains airway reflexes and sympathetic tone, while propofol contributes to hypnosis and antiemetic effects.[5] When used together in low doses, each drug offsets the common adverse effects of the other, potentially reducing the incidence of hypotension, bradycardia, and respiratory depression while maintaining adequate sedation.[6,7] Clinical studies in emergency and ambulatory settings have reported improved haemodynamic stability, better procedural conditions, and satisfactory recovery profiles with ketofol compared to propofol alone.[8] Despite encouraging evidence, the choice between ketofol and propofol varies widely across clinical settings because of differing procedural demands and patient characteristics. Direct comparative data focusing specifically on short surgical procedures remain limited. A clearer understanding of their relative safety, sedation quality, and recovery characteristics is essential for optimising sedation protocols. The present study aims to compare ketofol and propofol alone for sedation in short surgical procedures, assessing sedation adequacy, haemodynamic responses, recovery times, and perioperative adverse events.

Material and Methods

This prospective comparative study was conducted in the Department of Anaesthesiology at World College of Medical Sciences and Research, Gurawar, Jhajjar, Haryana, over a period of nine months from January 2024 to September 2024, after obtaining approval from the Institutional Ethics Committee. Adult patients aged 18 to 60 years belonging to ASA physical status I or II and scheduled for short surgical procedures requiring intravenous sedation were screened for participation. Individuals with anticipated difficult airway, known allergy to propofol or ketamine, severe cardiovascular or respiratory disease, uncontrolled hypertension, psychiatric disorders, pregnancy or lactation, or unwillingness to participate were excluded from the study. After confirming eligibility, informed consent was taken from all patients before enrolment. Patients were then randomly assigned using computer-generated numbers into two groups: Group P, which received propofol alone, and Group K, which received a combination of ketamine and propofol (ketofol). All patients were kept fasting as per standard guidelines and were monitored throughout the procedure using ECG, non-invasive blood pressure, pulse oximetry, and capnography. Sedation in Group P was initiated with propofol 1 mg/kg followed by titrated supplemental doses, while Group K received ketamine 0.5 mg/kg mixed with propofol 0.5 mg/kg in the same syringe and further doses were adjusted as required. The target level of sedation for both groups corresponded to a Ramsay Sedation Score of 3 to 4. Haemodynamic parameters including heart rate, systolic and diastolic blood pressure, and oxygen saturation were recorded at baseline and at predefined intervals. Additional observations included the time taken to achieve adequate sedation, total sedative requirement, incidence of intra-procedural adverse events, recovery time, and satisfaction levels of both the patient and the operating surgeon. Data collected during the study were entered in SPSS software version 20.0 and statistically analysed using appropriate tests such as Student's t-test and chi-square or Fisher's exact test, and a p-value of less than 0.05 was considered statistically significant.

Results

A total of 120 patients were included in the study, with 60 patients in Group P (Propofol) and 60 patients in Group K (Ketofol).

Table 1 compares the baseline demographic characteristics of the two study groups and shows that both groups were comparable with respect to age, sex distribution, BMI, and baseline haemodynamic variables. The mean age of the participants was similar in both groups, with Group P having an average age of 38.4 years and Group K 37.1 years, indicating no meaningful age-related difference between the populations.

The gender distribution was also comparable, with a nearly equal number of males and females in each group, suggesting that sex did not influence group allocation. Body mass index values were closely matched as well, with no significant variation between the groups. The proportion of ASA physical status I and II patients was also similar, confirming that the baseline physical health status of participants was balanced. The p-values for all variables were statistically non-significant, demonstrating that the two groups were homogeneous at baseline.

Table 1: Demographic Characteristics of the Study Groups

Parameter	Group P (n=60)	Group K (n=60)	p-value
Age (years, mean ± SD)	38.4 ± 10.2	37.1 ± 9.8	0.48
Sex (M/F)	32/28	30/30	0.71
BMI (kg/m², mean ± SD)	24.8 ± 3.1	25.2 ± 3.4	0.52
ASA I/II	40/20	42/18	0.69

Table 2 presents the distribution of short surgical procedures in both study groups. Hernia repair and skin lesion excision were the most common procedures, accounting for approximately 25–33% of cases in each group. Breast lump excisions constituted about 18–20% of surgeries, while minor urological procedures represented 11–13% of cases. Minor ENT procedures, such as polypectomy or ear tube insertion, and biopsies (lymph node or soft tissue) were less frequent but still included to reflect the diversity of procedures performed under sedation. The distribution of surgical types was fairly similar between the propofol group (Group P) and the ketofol group (Group K), indicating that both groups were comparable with respect to the types of procedures performed. This balance is important because procedure type can influence sedation requirements, haemodynamic responses, and recovery times. Including a variety of procedure types demonstrates the applicability of the study findings across multiple short surgical interventions, enhancing the generalizability of the results.

Table 2: Types of Surgery in the Study Groups

Type of Surgery	Group P (Propofol, n=60)	Group K (Ketofol, n=60)
Hernia repair	15	14
Skin lesion excision	20	22
Breast lump excision	12	11
Minor urological procedures	8	7
Minor ENT procedures (e.g., polypectomy, ear tube insertion)	3	4
Biopsies (lymph node or soft tissue)	2	2
Total	60	60

Table 3 compares the sedation-related parameters and drug requirements between the two study groups. The findings show that patients receiving ketofol (Group K) achieved the target sedation level faster than those who received propofol alone. The mean time to adequate sedation was significantly shorter in the ketofol group (1.9 minutes) compared to the propofol group (2.8 minutes), indicating that the combination of ketamine and propofol provides a quicker onset of sedation. The total amount of drug required to maintain adequate sedation was also lower in Group K, where patients needed an average propofol-equivalent dose of 82 mg, while those in Group P required 118 mg. This reflects the dose-sparing effect of combining ketamine with propofol. Additionally, the need for supplemental or top-up doses was higher in the propofol group (26.7%) compared to the ketofol group (10%), suggesting that ketofol provided more stable sedation with fewer interruptions. The differences in all three parameters were statistically significant, supporting the observation that ketofol offers faster onset, lower drug consumption, and more consistent sedation quality during short surgical procedures.

Table 3: Sedation and Drug Requirement

Parameter	Group P (n=60)	Group K (n=60)	p-value
Time to adequate sedation (min)	2.8 ± 0.9	1.9 ± 0.7	<0.001
Total drug dose (mg of propofol equivalent)	118 ± 26	82 ± 20	<0.001
Additional/top-up doses (%)	26.7%	10%	0.02

Table 4 presents the haemodynamic changes observed during sedation in both groups. A notable finding is that patients sedated with propofol alone (Group P) experienced a greater tendency toward hypotension. A fall in systolic blood pressure of more than 20% from baseline occurred in 23.3% of patients in Group P, compared with only 8.3% in Group K. A similar pattern was seen with diastolic blood pressure, where 20% of patients in the propofol group had significant drops, compared with 6.7% in the ketofol group. Both differences were statistically significant, suggesting better cardiovascular stability with ketofol. Heart rate changes showed a mild, non-significant trend toward tachycardia in the ketofol group, which is consistent with ketamine's sympathomimetic properties. However, the increase was not clinically concerning. Oxygen desaturation episodes (SpO_2 <94%) were more frequent in the propofol group (15%) compared with the ketofol group (5%), although the difference was not statistically significant.

Table 4: Haemodynamic Changes during the Procedure

Parameter	Group P	Group K	p-value
Drop in SBP >20% from baseline	14 (23.3%)	5 (8.3%)	0.03
Drop in DBP >20% from baseline	12 (20%)	4 (6.7%)	0.04
HR increase >15 bpm	4 (6.7%)	10 (16.7%)	0.09
SpO_2 <94%	9 (15%)	3 (5%)	0.07

Recovery characteristics and satisfaction levels associated with the two sedation techniques is shown in table 5. Patients in the ketofol group demonstrated a significantly shorter recovery time, averaging about 12 minutes compared to 16 minutes in the propofol group. This suggests that the combination of ketamine and propofol not only provides effective sedation but also allows patients to return to baseline alertness more quickly. Patient satisfaction scores were slightly higher in the ketofol group, indicating that patients perceived the sedation experience as smoother and more comfortable.

Surgeon satisfaction showed an even more marked difference, with surgeons rating ketofol higher than propofol alone. This likely reflects better intraoperative conditions, fewer interruptions for top-up doses, and overall more stable sedation. Although the incidence of adverse events was higher in the propofol group (21.7% vs 10%), the difference did not show statistical significance.

However, the trend still favours ketofol, suggesting a potentially safer and more predictable sedation profile.

Table 5: Recovery and Satisfaction Scores

Parameter	Group P (n=60)	Group K (n=60)	p-value
Recovery time (min)	16.4 ± 4.1	12.1 ± 3.5	<0.001
Patient satisfaction (1–10 scale)	8.2 ± 0.9	8.7 ± 0.8	0.01
Surgeon satisfaction (1–10 scale)	8.0 ± 1.0	8.9 ± 0.7	<0.001
Adverse events (%)	21.7%	10%	0.08

Figure 1 illustrates the trend in mean systolic blood pressure (SBP) at different time points—baseline, 5 minutes, 10 minutes, and at the end of the procedure—in both study groups. The graph shows that patients receiving propofol alone (Group P) experienced a more pronounced decline in systolic blood pressure over time. Their SBP dropped from a baseline value of 124±11 mmHg to 108±10 mmHg at 10 minutes, indicating a significant hypotensive effect commonly associated with propofol. In contrast, the ketofol group (Group K) demonstrated more stable haemodynamics. Their SBP showed only a mild reduction from 126±12 mmHg to 118±11 mmHg at 10 minutes. The comparatively flatter slope of the line representing Group K reflects smoother blood pressure control during sedation. Overall, the figure highlights that ketofol maintains better cardiovascular stability than propofol alone, with fewer fluctuations in systolic blood pressure throughout the procedure.

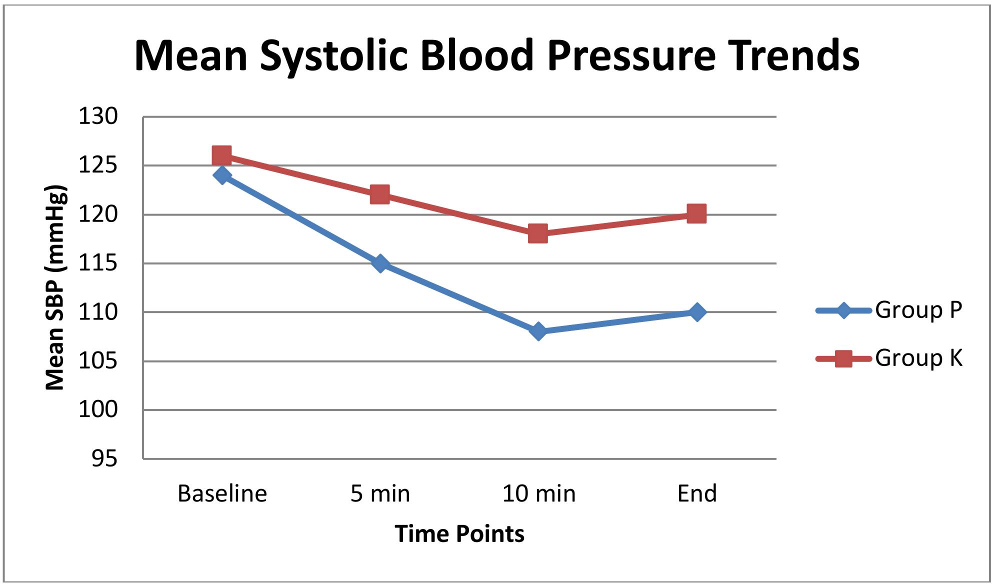

Figure 1: Mean Systolic Blood Pressure Trends in Both Groups

Discussion:

The present study compared ketofol with propofol alone for sedation in short surgical procedures and demonstrated that the ketamine–propofol combination provides several clinical advantages. Both groups were comparable in demographic characteristics, allowing the observed differences to be attributed mainly to the sedative technique. Ketofol showed faster onset of sedation, reduced drug requirement, greater haemodynamic stability, and quicker recovery.

In our analysis, patients receiving ketofol achieved adequate sedation significantly faster, accompanied by a lower total dose requirement.

This mirrors the findings of Gorlin et al. [9] and supports earlier work where ketamine's sympathomimetic effect counterbalanced propofol's cardiovascular depression. [1,3] Similar dose-sparing benefits have been demonstrated by Philips and colleagues in emergency procedural sedation[10] and by Andolfatto et al. during orthopaedic manoeuvres.[11]

Haemodynamic stability emerged as a key advantage of ketofol. Propofol alone is known to cause hypotension through vasodilatation and negative inotropy.[2] Our results showed a significantly higher frequency of hypotensive episodes in the propofol group, whereas ketofol maintained blood pressure more consistently. This finding agrees with the observations of Goh et al. [13] and is further supported by trials conducted by Erden et al. [14] and Khajehnasiri et al. [16], all of whom noted improved stability when ketofol was used.

Recovery characteristics were also favourable with ketofol. In our study, patients regained full alertness earlier than those receiving propofol alone. Concerns about prolonged recovery or dysphoria with ketamine did not manifest, likely due to the low doses employed. This aligns with reports by Smischney et al. [17] and Mason [18], both of whom described smoother recovery with balanced ketamine–propofol combinations.

Surgeon satisfaction was higher in the ketofol group, likely due to reduced need for supplementation and more consistent sedation. Similar findings have been reported by Singh and colleagues [19] as well as Weisz et al. [20] who noted high procedural satisfaction with ketofol across various ambulatory and office-based surgeries.

Although the overall incidence of adverse events did not differ significantly between groups, ketofol showed a favourable trend toward fewer complications. This corroborates the safety profiles described by Hegde et al. [22] and by Aouad et al. in paediatric cohorts.[23] Even in resource-limited and high-risk settings, ketofol has been shown to maintain a reliable safety margin, as highlighted by McQueen et al. [24] and Tandon et al. [25].

In summary, our findings reinforce the growing preference for ketofol as a balanced sedative agent for short and minimally invasive surgical procedures. With superior haemodynamic stability, lower drug consumption, rapid onset, quicker recovery, and high user satisfaction, ketofol offers multiple practical advantages over propofol alone. Larger multi-centre studies would be valuable for establishing standardised dosing protocols and optimising patient selection.

Conclusion

Ketofol demonstrated clear advantages over propofol alone for sedation in short surgical procedures. The combination achieved faster onset of sedation, required lower total drug doses, and provided more stable haemodynamic parameters, particularly with fewer episodes of hypotension. Patients in the ketofol group experienced quicker recovery and reported slightly higher satisfaction, while surgeons also favoured ketofol due to smoother intraoperative conditions and reduced need for supplemental dosing. Although adverse events were comparable between the two groups, ketofol showed a favourable trend toward fewer complications. Overall, ketamine–propofol combination offers a balanced, effective, and safe sedation option for short surgical procedures, making it a valuable alternative to propofol alone in routine clinical practice.

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