ORIGINAL RESEARCH

A Comparison of Ketamine-Propofol Versus Propofol as Induction Agents on Hemodynamic Parameters in Patients Undergoing Elective Surgical Procedures Under General Anesthesia

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ABSTRACT
Background: Propofol produces quick induction and recovery, depresses airway reflexes, and is used for sedation and anaesthesia; nevertheless, it is associated with dose-dependent hypotension and respiratory depression.It can produce coughing, hiccups, laryngospasm, and movements when used as a sole agent to provide LMA.In addition to its amnesic and analgesic effects, ketamine raises heart rate and blood pressure through stimulating the sympathetic nervous system.It was shown that a combination of ketamine and propofol decreased patients' use of propofol and opioids and improved their hemodynamic and respiratory stability. **Objectives:**1. Determine whether the ketamine-Propofol combination has more favourable hemodynamics than the gold standard prototypic induction drug (Propofol) in a cohort of healthy patients.2. To compare the additional post-operative analgesia requirements between the two groups.
Materials and Methods: Group KP, the Ketamine-Propofol Group, provided 0.75mg/kg of ketamine and 1.5mg/kg of Propofol to 60 patients with ASA status I who were randomly divided into two groups. Group P – Propofol Group received 2 mg/kg Propofol for induction. The airway is secured with LMA, and patients in both groups were maintained with O2, N2O, and Sevoflurane. For the next 15 minutes, every three minutes, the baseline hemodynamics, heart rate, NIBP, Spo2, and respiratory rate were recorded. Pain scores were measured for each subject post-operatively. Additional analgesia was supplied to all patients with a VAS > 3 who reported pain.
Results: In Group KP, the systolic, diastolic, mean arterial blood pressure, and heart rate changes following LMA implantation were considerably greater than in Group P. Group KP had longer recovery durations, lower VAS scores immediately following surgery, and less analgesic needs. In neither group was there an occurrence of apnea, hypoventilation, or emerging responses.
Conclusion: Ketofol is a mixture of ketamine and Propofol that has multiple advantages.Hemodynamic stability, absence of respiratory depression, rapid recovery, and potent postoperative analgesia. We thus advocate intravenous ketofol as an induction drug, particularly for patients undergoing short surgical operations.
Keywords: Ketofol; Propofol; general anesthesia; induction; hemodynamic changes.

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INTRODUCTION

In short and ambulatory surgical operations requiring general anaesthesia, propofol, a regularly used agent for induction and maintenance of general anesthesia is suitable due to its rapid start and recovery, as well as the fact that it has less undesired side effects than other

anaesthesia agents.[1,2] If it is employed as the sole induction agent, it has the potential to cause a considerable decrease in arterial blood pressure and cardiac output.[3] In addition, it results in a higher reduction in systemic arterial pressure than an equivalent dose of thiopentone.[4] Reduced cardiac contractility and decreased systemic vascular resistance are both contributing factors to the reduction in blood pressure seen. Although arterial pressure has decreased, the heart rate has remained unchanged as a result of the suppression of baroreceptor response.[5,1]Ketamine is a powerful painkiller that also produces catecholamines, causing tachycardia and hypertension as a result of the release of these hormones.Infusion of ketamine into the bloodstream induces an increase in systemic and pulmonary arterial blood pressure, heart rate, cardiac output, and myocardial oxygen consumption.[6]Direct stimulation of the central nervous system, which results in enhanced sympathetic nervous system output, appears to be the most essential mechanism of cardiovascular stimulation, according to current research.When ketamine is administered prior to propofol induction, it has been demonstrated to generate more hemodynamic stability than when propofol is administered alone.[7]It has been successfully utilised in emergency departments for brief, painful operations; for sedation in paediatric situations; for regional anaesthesia; and for anaesthetic applications during electroconvulsive therapy.

Aim
The aim of the clinical trial is to:
1. To study if the Ketamine-Propofol combination would have more favourable haemodynamics than the gold standard prototypic induction agent (Propofol) in a healthy patient population.
2. To compare the additional post-operative analgesia requirements between the two groups.
Patients between the ages of 18 and 60, with American Society of Anesthesiologists (ASA) status I, were scheduled for surgical procedures under general anaesthesia at the Govt Medical College in Siddipet, Telangana, India.

MATERIALS & METHODS
Source of Data:
On the basis of random selection, 60 patients aged 18-60 years with ASA status I will be separated into two groups (KP and P) for surgical treatments.After discussing the treatment and obtaining written informed consent from the patients, pre-anesthesia evaluations will be performed on all patients and they will be divided into two groups:
• Ketamine-Propofol Group (KP).
• Propofol Group (Group P).
Patients in both groups will be kept nil per mouth for 6 hours from solids and 2 hours from clear fluids.Electrocardiogram (ECG) leads, a Non-Invasive Blood Pressure (NIBP) cuff, and Pulse Oximetry will be linked to the patients when they are moved to the operating room. As part of standard protocol, baseline vitals are taken and intravenous fluids are delivered. All patients will be given injections of 0.005mg/kg i.v. glycopyrrolate and 2g/kg i.v. fentanyl and preoxygenated with 8l/min of Oxygen through mask utilising the Bains circuit for 3 minutes prior to induction.

• **KP - (Ketamine-Propofol group):**
Patients in this group will get 0.75mg/kg ketamine and 1.5mg/kg propofol as part of their induction. If any patients respond to stimuli following induction, they will receive 0.25mg/kg ketamine and 0.5 mg/kg propofol, for a total of 1mg/kg ketamine and 2mg/kg propofol.
• **Propofol group (Group P):**

Patients in this group will get 2mg/kg propofol as part of their induction. If the patients respond to the stimulus following induction, they will be given an additional 1mg/kg of propofol, for a total of 3mg/kg.Following induction, patients in either group will receive O2 33%, N2O 66%, and 1 MAC of Sevoflurane (age related iso-MAC values) as anaesthetic maintenance. The patient will be ventilated using aided or spontaneous breathing via the Bains circuit. The baseline hemodynamics, heart rate, NIBP, oxygen saturation, and respiratory rate will all be recorded (0th interval).Laryngeal Mask Airway (LMA) and ETCO2 are coupled to secure the airway. On insertion of the LMA, any apnoeic occurrence, secretions, or adverse events are noted. The patient will be ventilated either aided or spontaneously, and anaesthesia will be maintained with 1MAC Sevoflurane. For the next 15 minutes, baseline hemodynamics are measured at 3 minute intervals.If there is any laryngospasm, it is treated with intravenous succinylcholine (Sch) and the research is continued.If the airway cannot be secured with LMA, I.V. Inj. Sch is given, the patient's trachea is intubated with an Endo Tracheal Tube (ETT), and the patient is removed from the research.If the LMA ventilation is found to be inadequate, the LMA is removed, I.V. Vecuronium (dosage 2ED95) is provided, the airway is secured with ETT, and the patient is removed from the research.Surgical stimulus is avoided during the first 15 minutes of LMA placement (study period). After 15 minutes of LMA insertion, surgery begins, and the duration of the procedure is recorded.After the procedure, the patient is permitted to recuperate from anaesthetic. Following extubation, the events observed were for

1. Secretions.
2. The occurrence of apnea or laryngospasm.
3. Rest period (time from discontinuation of the anaesthetic to spontaneous eye opening, extubation and to stating name and date of birth correctly).
4. Reactions to emergencies.

all patients in the post-anesthesia care unit (PACU) will receive oxygen through a face mask at a rate of 5 L/minute for 30 minutes. ECG, NIBP, and SPO2 are all linked and monitored.As normal analgesia, all patients will receive a fixed dose of oral or parenteral tramadol 50mg every 8 hours or NSAIDs.Each patient's pain level will be measured using the Visual Analogue Scale (VAS), with intervals ranging from VAS0 to VAS10 (immediate post-operatively). Any patient whose VAS is greater than 3 will be noted, and extra analgesia (I.V. Inj. Tramadol 50mg) will be supplied.

Hemodynamics - The presence of hypotension (30% of baseline), bradycardia (20% of baseline), or a rise in NIBP or heart rate (> 30% of baseline) is noticed.Adverse symptoms such as apnea, hypoventilation, desaturation, and emerging responses are observed.

Selection Criteria:
A. Inclusion Criteria:
60 ASA status I patients, aged 18-60 years, will undergo elective general, orthopaedic, plastic, or gynecologic surgery under general anaesthesia.

B. Criteria for Exclusion:
1. Patients under the age of 18 or over the age of 60.
2. Emergency surgery.
3. Patients undergoing neurosurgical procedures.
4. Clinically significant cardiac/renal disease/liver disease.
5. Pregnant or breast feeding women.
6. Patients with significant hemodynamic instability.
7. Patients having significant respiratory disorders.
8. Patient with psychiatric disorders.

9. Any procedure with adjunctive analgesia.
10. Any known contraindications to ketamine or propofol.

Statistical analysis:
The hemodynamic data and demographic data were tested for its distribution through normality tests using kolmogorov – smirnov test. The data was parametric in its distribution Age and weight were compared using student's unpaired t test while sex distribution was compared using Chi square test.Hemodynamic data such as heart rate, mean arterial pressure, SBP, DBP and MAP were analysed using unpaired t test. The intra group variation was tested utilising repeated measures of ANOVA and Bonferroni's multiple comparison, in both the control as well as the ketamine group.

RESULTS
Characteristics of the patient population:
AGE:
Table 1: Comparison* of age between the two groups

Group	Mean Age (years)	C.I.	S.E.M	t	P value
Group P	33.5	- 9.689	2.046	1.123	0.3123
Group KP	35.6	to 3.231	2.432		

Weight:
Table 2: Comparison* of weight between the two groups

Group	Mean weight (kgs)	C.I.	S.E.M	t	P value
Group P	53.56	- 4.219	0.8563	1.230	0.2321
Group KP	55.67	to 1.019	0.9798		

Sex distribution:
Table 3: Comparison* of sex distribution between the two groups

Sex	Group P	Group KP	X^2	p
Male	26	24	0.08221	0.7743

Duration of surgery:
Table 4: Comparison* of duration of surgery between the two groups

Groups	Duration of surgery (mins)	C.I.	S.E.M	t	P value
Group P	25.21	-5.787 to	± 1.192	1.227	0.2174
Group KP	27.01	1.381	± 1.327		

Inference:
Both the groups were comparable in terms of age, weight, sex distribution and duration of surgery.

Haemodynamic Parameters
Heart Rate: [Intergroup]

Table 5: Heart rate comparison between two groups

HR	Group P (Mean±SEM)	Group KP (Mean±SEM)	P value	t	summary
Pre-op	81.63 ± 1.736	78.68 ± 1.321	0.0764	1.821	ns

T0	79.56 ± 1.611	81.76 ± 1.431	0.5927	0.5351	ns
T3	74.82 ± 1.767	92.00 ± 1.797	< 0.0001	6.871	***
T6	72.33 ± 1.587	95.84 ± 1.657	< 0.0001	10.27	***
T9	72.77 ± 1.698	95.36 ± 1.821	< 0.0001	7.98	***
T12	72.45 ± 1.656	93.84 ± 1.931	< 0.0001	8.312	***
T15	72.51 ± 1.423	93.12 ± 1.892	< 0.0001	8.543	***

Heart Rate: (Intragroup)

Table 6: Heart rate comparison (intragroup) Group P

Bonferroni's multiple comparison test	Mean Diff.	T	Significant? P < 0.05?	Summary	95% CI of diff
t0 vs t3	4.843	2.546	No	ns	-0.4957 to 10.35
t0 vs t6	6.981	3.821	Yes	**	1.8667 to 12.52
t0 vs t9	6.712	3.623	Yes	**	1.464 to 12.24
to vs t12	7.011	3.787	Yes	**	1.652 to 12.33
t0 vs t15	7.036	3.7923	Yes	**	1.841 to 12.48

Table 7: Heart rate comparison (intragroup) Group KP

Bonferroni's multiple comparison test	Mean Diff.	t	Significant? P < 0.05?	Summary	95% CI of diff
t0 vs t3	-11.21	5.982	Yes	***	-16.52 to -5.921
t0 vs t6	-15.15	8.022	Yes	***	-20.46 to -9.743
t0 vs t9	-14.46	7.778	Yes	***	-19.98 to -9.376
to vs t12	-13.03	6.972	Yes	***	-18.56 to -7.778
t0 vs t15	-12.45	6.556	Yes	***	-17.70 to -7.133

There was significant difference in the heart rate between the two groups at 3rd minute to 15th minute following induction

There is a significant rise in heart rate in the group KP and a fall in the group P. The peak effect of rise in heart rate in Group KP was seen in the 6th minute (18.73% of baseline) whereas peak fall in heart rate in the P group was in the 6th minute (9.04% of baseline).

SBP Comparison (Intergroup)
SBP values among the patients were compared between both the groups at various intervals using unpaired t test.

Table 8: SBP comparison between the two groups

SBP	Group P (Mean±SEM)	Group KP (Mean±SEM)	P value	t	summary
Pre-op	127.15 ± 1.23	125.0 ± 1.156	0.9218	0.0932	ns
T0	128.5 ± 0.845	127.3 ± 1.032	0.5091	0.6453	ns
T3	108.21 ± 1.034	120.7 ± 1.067	< 0.0001	8.712	***
T6	102.0 ± 0.782	118.0 ± 1.156	< 0.0001	8.883	***
T9	108.32 ± 1.54	120.4 ± 1.109	< 0.0001	8.821	***
T12	110.32 ± 0.8921	124.4 ± 0.9092	< 0.0001	10.21	***
T15	121.62 ± 0.7821	125.2 ± 0.6783	< 0.0001	10.61	***

SBP Comparison (Intragroup) Group P:

Table 9: SBP comparison (Group P)

Bonferroni's multiple comparison test	Mean Diff.	t	Significant? P < 0.05?	Summary	95% CI of diff
T0 vs T3	21.65	17.55	Yes	***	18.32 to 25.25
T0 vs T6	23.67	20.21	Yes	***	21.43 to 28.33
T0 vs T9	21.02	17.19	Yes	***	17.55 to 24.45
To vs T12	17.76	14.37	Yes	***	14.23 to 21.13
T0 vs T15	14.34	12.21	Yes	***	11.23 to 18.13

Group KP:

Table 10: SBP comparison (Group KP)

Bonferroni's multiple comparison test	Mean Diff.	t	Significant? P < 0.05?	Summary	95% CI of diff
T0 vs T3	7.202	5.900	Yes	***	3.745 to 10.65
T0 vs T6	10.32	8.981	Yes	***	7.505 to 14.41
T0 vs T9	7.000	5.736	Yes	***	3.545 to 10.45
To vs T12	3.520	2.884	Yes	*	0.0654 to 6.975
T0 vs T15	2.480	2.032	No	ns	-0.9746 to 5.935

As seen in table above there is a significant difference in the systolic BP between the two groups from the 3rd minute (t3) to 15 minutes following induction. The peak fall in the systolic BP was in the 6thminute in both groups, group P (19.25% of baseline) and Group KP (8.5% of baseline).

DBP Comparison (Intergroup)

Table 11: DBP comparison between the two groups

DBP	Group P (Mean±SEM)	Group KP (Mean±SEM)	P value	t	Summary
Pre-op	81.04 ± 0.4456	81.21 ± 0.5223	0.6421	0.3521	Ns
T0	81.32 ± 0.3521	82.56 ± 0.7235	0.0843	1.677	Ns
T3	68.65 ± 0.5422	79.52 ± 0.7757	< 0.0001	11.53	***
T6	64.70 ± 0.5144	77.24 ± 0.8912	< 0.0001	12.45	***
T9	68.21 ± 0.5721	79.64 ± 0.8443	< 0.0001	11.26	***
T12	70.62 ± 0.5721	81.45 ± 0.6521	< 0.0001	12.32	***
T15	72.45 ± 0.5921	81.56 ± 0.4654	< 0.0001	12.72	***

DBP Comparision (Intragroup) Group P:

Table 12: DBP Comparison (Group P)

Bonferroni's multiple comparison test	Mean Diff.	t	Significant? P < 0.05?	Summary	95% CI of diff

t0 vs t3	13.76	15.31	Yes	***	10.21 to 14.65
T0 vs t6	15.82	20.56	Yes	***	14.22 to 19.12
T0 vs t9	13.78	15.69	Yes	***	10.56 to 15.32
To vs t12	11.72	12.67	Yes	***	8.128 to 12.78
t0 vs t15	8.450	10.32	Yes	***	6.126 to 10.70

Group KP:

Table 13: DBP Comparison (Group KP)

Bonferroni's multiple comparison test	Mean Diff.	t	Significant? P < 0.05?	Summary	95% CI of diff
t0 vs t3	3.023	3.622	Yes	**	0.7125to 5.246
T0 vs t6	5.620	6.665	Yes	***	3.444 to 7.828
T0 vs t9	3.133	3.733	Yes	**	0.73387 to 5.4387
To vs t12	1.021	1.227	No	Ns	-1.208 to 3.126
t0 vs t15	1.094	1.321	No	ns	-1.016 to 3.096

DBP in both the groups was compared at baseline and at various intervals. There is statistically significant lower values of DBP in Group P compared to Group KP at 3rd minute (T3) to 15th minute (T15) following induction. The peak fall in the diastolic BP in Group P was seen in the 6th minute(20.51% of baseline) and a peak fall of 8.5%of baseline was seen in Group KP at the 6th minute.

Mean Arterial Blood Pressure Comparison [MAP]
MAP of both the groups were analysed using students unpaired t test at various intervals.

Table 14: MAP comparison between the two groups

MAP	Group P (Mean±SEM)	Group KP (Mean±SEM)	P value	t	Summary
Pre-op	96.28 ± 0.6820	96.52 ± 0.6859	0.8051	0.2481	Ns
T0	97.36 ± 0.4198	97.96 ± 0.8134	0.5153	0.6555	Ns
T3	81.68 ± 0.6751	93.52 ± 0.8527	< 0.0001	10.89	***
T6	77.92 ± 0.5998	90.64 ± 0.8905	< 0.0001	11.85	***
T9	81.52 ± 0.7328	93.60 ± 0.8266	< 0.0001	10.93	***
T12	84.32 ± 0.6048	96.08 ± 0.7163	< 0.0001	12.54	***
T15	86.72 ± 0.6443	96.36 ± 0.4963	< 0.0001	11.85	***

Mean Arterial Blood Pressure Comparision (intragroup) Group P

Table 15: Mean Arterial Blood Pressure comparison (Group P)

Bonferroni's multiple comparison test	Mean Diff.	t	Significant? P < 0.05?	Summary	95% CI of diff
t0 vs t3	15.68	17.93	Yes	***	13.20 to 18.16
T0 vs t6	19.44	22.23	Yes	***	16.96 to 21.92
T0 vs t9	15.84	18.11	Yes	***	13.36 to 18.32
To vs t12	13.04	14.91	Yes	***	10.56 to 15.52
t0 vs t15	10.64	12.16	Yes	***	8.164 to 13.12

Table 16: Mean Arterial Blood Pressure comparison (Group KP)

Bonferroni's multiple comparison test	Mean Diff.	t	Significant? P < 0.05?	Summary	95% CI of diff
t0 vs t3	4.440	5.076	Yes	***	1.964 to 6.916
T0 vs t6	7.320	8.369	Yes	***	4.844 to 9.796
T0 vs t9	4.360	4.985	Yes	***	1.884 to 6.836
To vs t12	1.880	2.149	No	Ns	-0.5960 to 4.356
t0 vs t15	1.600	1.829	No	ns	-0.8760 to 4.076

MAP in both the groups was compared at baseline and at various intervals. There is statistically significant lower values of MAP in Group P compared to Group KP at 3rd minute (T3) to 15th minute (T15) following induction

Peak fall in Group P was in the 6th minute (19.21% of baseline) and peak fall in group KP was in the 6th minute (7.21 % of baseline).

Comparison of recovery time between the two groups:

Table 17: Comparison of recovery time between the two groups

	GROUP P (Mean±SEM)	GROUP KP (Mean±SEM)	P value	t	Summary
Time for spontaneous eye opening (seconds)	193.6 ± 2.433	219.6 ± 0.6405	< 0.0001	10.32	***
Time for extubation(seconds)Time for orientation (seconds)	201.3 ± 2.444	225.5 ± 0.6955	< 0.0001	9.525	***
	308.4 ± 3.020	401.8 ± 1.650	< 0.001	27.15	***

There was a significant difference between the two groups in the time for recovery and for orientation.

COMPARISON OF ETCO2 MEASUREMENTS BETWEEN THE TWO GROUPS:

Table 18: Comparison of ETCO2 measurements between the two groups

MAP	Group P (Mean±SEM)	Group KP (Mean±SEM)	P value	t	summary
T3	32.64 ± 0.3409	33.12 ± 0.3340	0.4512	0.8326	Ns
T6	30.33 ± 0.3764	31.42 ± 0.3270	0.0243	2.276	*
T9	29.84 ± 0.3772	31.50 ± 0.2559	0.0165	2.294	*
T12	29.62 ± 0.3462	30.90 ± 0.3205	0.0687	1.664	Ns
T15	29.52 ± 0.3718	30.75 ± 0.3312	0.0515	1.012	Ns

There was a significantly lower ETCO2 recorded at 6th (T6) and 9th minute (T9) in Group P compared to Group KP

Comparison of vas scores between the two groups:

Immediate Post OP (VAS0)

Table 19: Comparison of Vas Scores Between the Two Groups

VAS SCORE	Group P (Mean±SEM)	Group KP (Mean±SEM)	P VALUE	t	Summary
(V0)	3.234 ± 0.1023	2.550 ± 0.1022	< 0.0001	4.922	***

Comparision of Categorised Vas Score Between two Groups

VAS SCORES of various intervals were categorised into 3 groups: mild, moderate and severe. VAS scores <4 were considered as mild, VAS score 4 to VAS score 7 were considered as moderate and finally VAS score ≥7 were considered as severe group. Number of patients in mild,moderate and severe groups was tabulated in each group. Theses categorised VAS scores (mild, moderate) were analysed using Chisquare test.

Table 20: Comparison of categorised VAS score between two groups

Time	Group	Mild	Moderate	P value	X^2	Summary
VAS 0	P	23	12	0.00421	6.234	**
	KP	35	0			

Numbers of patients with mild and moderate VAS scores are noted in both the groups at VAS 0, P value is 0.00421 and there is a significant difference between the two groups.Apnea, hypoventilation, desaturation, and emergence reactions are more common than you might think:No episodes of apnea, hypoventilation, desaturation, or emergence reactions were observed in either group of patients.

DISCUSSION

A decrease in arterial pressure is associated with the use of Propofol for general anaesthesia, which is due to a decrease in myocardial contractility, peripheral vascular resistance, and sympathetic tone.[9,10]Propofol's vagotonic effects cause a reduction in heart rate (HR), which can result in severe bradycardia, total atrioventricular block, and cardiac arrest.[8,9]The stimulation of the sympathetic nervous system by ketamine results in an increase in metabolic and vascular resistance, which leads to an increase in arterial pressure and heart rate, respectively. When ketamine is administered intravenously, increases in plasma concentrations of the neurotransmitters epinephrine and norepinephrine occur as early as 2 minutes after the injection and return to control levels 15 minutes after the administration.Propofol and ketamine appear to have complementary clinical effects. Combined administration of propofol and ketamine results in a reduction in the doses of both agents, as well as the reduction of unwanted side effects.[11]An investigation into the effects of subanesthetic ketamine doses on propofol sedation has been conducted by several researchers. A comparison was made between the effects of subanesthetic doses of ketamine in combination with propofol and the effects of propofol alone on respiration, pain relief (including the use of additional analgesics), and recovery from surgery.Literature has documented the use of a variety of ketamine and fentanyl doses. For cervical dilatation pain relief, Hamdani and colleagues found that a dose of 0.3 mg/kg of ketamine was insufficient.[12]With ketamine 0.5mg/kg, Kaushik Saha et al., discovered excellent analgesia.[13] The use of 0.75 mg/kg ketamine was limited to induction because our study involved procedures lasting approximately 30 minutes.According to Kaushik Saha et al, a statistically significant reduction in the induction dose of propofol in combination with ketamine was observed when compared to the induction dose of fentanyl (67+/- 13.25mg Vs 78.16+/- 15.2mg) was observed.[13,14]In light of propofol's vasodilatory properties as well as its apnoeic potential, reducing the induction dosage of propofol has obvious advantages. We used Propofol 1.5mg/kg in Group KP as opposed to Propofol 2mg/kg alone in Group P, as a

result of this comparison.When ketamine was administered prior to Propofol induction for LMA insertion, it was found to maintain hemodynamic stability in both adult and paediatric patients.Turkish researchers found that Ketofol provided Proseal LMA insertion conditions similar to those for Propofol, with a reduced need for anaesthetics in elderly patients (Erdoganetal, 2015).[16]Adding 1mg/kg ketamine or 1 mg/kg fentanil to Propofol for sedation in burn patients, according to Tosuneta,[16]resulted in hemodynamic parameters that were similar in both groups. Additionally, according to Erdenetal, propofol-fentanyl and propofol-fentanyl-ketamine combinations provided comparable hemodynamic stability in children.[17]The Ketamine-Propofol Group experienced an increase in heart rate and a decrease in blood pressure, diastolic blood pressure, and metabolic acidosis following induction, the Propofol Group experienced a decrease in all four parameters following induction. However, when comparing Group KP to Group P, the measurements of SBP, DBP, and MAP were significantly higher in Group KP.After inducing anaesthesia with 2mg/kg Propofol in the double-lumen tube application, Iwata et al18 found that they were unable to achieve hemodynamic stability with either 0.5mg/kg or 1mg/kg ketamine. Both groups were given fentanyl and sevoflurane, which the authors speculated was a contributing factor. A similar mechanism could have been at work in our study, where the administration of fentanyl prior to induction may have impaired the hemodynamic effects of Ketofol.[18]

Subanesthetic doses of ketamine, according to Mortero et al. in 2001, caused volunteers to experience a "euphoric" feeling during their recovery period. According to them, this was due to the NMDA receptor blockade caused by this drug.[19]Comparing Group KP to Group P, we found that recovery times and orientation times were significantly longer in Group KP than in Group P. A slower recovery (17 minutes) was observed in the propofol-ketamine group, and a recovery of 13 minutes was observed in the propofol-fentanyl group, according to J.B.M. Guit et al. Ketamine and fentanyl infusions were used in their research and were responsible for the longer durations of recovery observed in their study participants.[20] Hernandez et al. discovered that the propofol-ketamine (Propofol-fentanyl-midazolam-ketamine) group had significantly longer awakening times. They recommended that the infusion that was used be stopped as soon as possible to allow for early awakening.[21]

Guit et al., discovered improved minute volumes in their research.[20] When Hui et al. compared the use of propofol (P) and ketamine (K) alone to the use of a combination of propofol and ketamine (PK), they discovered that the PK group had fewer instances of apnoea/hypoventilation in the post-operative period than the P group. Rosendo Mortero et al discovered that when a sub anaesthetic dose of ketamine was combined with propofol, the end tidal carbon dioxide (ET CO_2) was significantly lower (30 Vs 47) compared to when propofol was used alone.[19] In our study, the ETCO2 measured in the Propofol Group was significantly lower than the ETCO2 measured in the Ketamine-Propofol Group.There were no episodes of apnea or hypoventilation among the patients in our study, regardless of which group they were in.Increased secretion, delayed recovery, and the emergence of reactions are all reasons for concern when it comes to ketamine.In our investigation, we did not observe any of these negative consequences. The presence of propofol may be able to mitigate some of these negative effects.Patients in the ketamine group received 0.5 mg/kg ketamine I.V. 90 seconds before incision, while those in the control group received distal water. This study, "pre-emptive analgesia: effect of low dose ketamine as pre-emptive analgesia in postoperative pain management after lower abdominal surgery," confirmed the use of small doses of analgesics as pre-emptive analgesics. This study demonstrated that the use of low-dose ketamine in general anaesthesia can delay the onset of the first request for anaesthesia care in the immediate postoperative period by up to 30 minutes. The total amount of rescue analgesia consumed during the first 24 hours following surgery was significant.There have been several other studies that have reported similar findings. A study conducted by Stubhaug

and colleagues found that intravenous infusion of ketamine administered for three days after nephrectomy significantly reduced the area of punctuate mechanical hyperalgesia surrounding the surgical incision for seven days following surgery. 60 Following abdominal surgery, a reduction in post-operative morphine consumption was observed for the first two post-operative days following the administration of ketamine as a preventative treatment.[23,24]Because nitrous oxide, like ketamine, has been shown to exert NMDA receptor antagonist properties, it is possible that the use of nitrous oxide in the present anaesthetic technique increased the amount of NMDA receptor inhibition induced by the drug ketamine.[25]Nitrous oxide was present in the control group, so it is unlikely that our results were influenced by this factor.Analgesia following surgery was significantly improved by the combination of Ketamine and Propofol, according to our findings. In comparison to the Group P, the Group KP experienced less pain immediately after surgery.It is important to note that our study has some limitations. For starters, because we were unable to determine anaesthetic depth, LMA insertion conditions may have been compromised, and changes in hemodynamic parameters may have been observed. Secondly, it is possible that the use of fentanyl prior to induction in both groups reduced the hemodynamic effects of the drugs.

CONCLUSION
Ketofol is a combination of ketamine and propofol that has several advantages over other anaesthetics, including hemodynamic stability, lack of respiratory depression, rapid recovery, and potent post-procedural pain relief. For this reason, especially in patients undergoing brief surgical procedures, intravenous Ketofol is recommended as an induction agent.

Acknowledgement

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