

Effectiveness of ketofol versus propofol induction on hemodynamic stability in adult elective surgery

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ABSTRACT

Introduction: A serious side effect of anaesthesia is haemodynamic instability, which can be brought via induction, intubation, surgical wounds other stress, hypovolemia, anaesthesia medications, even volatile anaesthetics. Pain from the surgical incision raises your pulse & arterial pressure. Individuals with ischaemic heart disease, valvular heart disease, and various other cardiovascular conditions have this difficulty more frequently. Blood pressure is sharply lowered by medications used to induce anaesthesia. Through a number of methods, propofol lowers blood pressure, whereas ketamine raises it and vice versa. [1]. Propofol & ketamine are frequently used as induction agents for adult surgical patients in the operative room; however, cardio respiratory depression may caused during the induction of anesthesia by the propofol drug, while raises arterial blood pressure and heart rate may caused by ketamine. However, it appears that ketamine and propofol have complementing clinical effects. One of the most common drug used frequently for procedural sedation is the ketofol drug, it will be crucial to investigate its efficacy for induction in order to provide surgical patients with clinical care [2].

Method and Materials: This study's primary goal aimed to examine the hemodynamic impacts of propofol drug with ketofol drug during the elective surgery patients within fifteen minutes after general anesthesia induction. The research was conducted among 92 patient divided in two groups propofol and ketofol group who using the standard procedure of general anesthesia in Baghdad teaching hospital in Baghdad City. Study participants will be selected from all patients who have inclusion criteria using Convenience Sampling from November 2024 in Baghdad teaching hospital. **Inclusion criteria:** All patients who was ASA I and ASA II and the patient was between the ages of 18 to 65 all these patient met the inclusion criteria who utilized from general anaesthesia during the elective surgery. **Exclusion criteria:** Patients who had undergone ENT surgery, neurosurgery, long-term opioid usage, sedative preoperative adjunctive medicines, psychiatric drug use, known ketamine or propofol allergies, or were in discomfort were not included.

Findings: in our study we found the Mean± standard deviation of the age of the ketofol group was (38.41± 12.54). the Mean± standard deviation for age of propofol group was (40.16± 12.60) . (63%) of ketofol group were male. (67.4%) of propofol group were male. The Mean± standard deviation of the weight of ketofol group was (74.15 ± 8.64) . The Mean± standard deviation of the weight of the propofol group was (75.24 ± 9.63). (91.3%) of the ketofol group were ASA1. (92.4%)of the propofol group were ASA1. the Mean± standard deviation of the SBP of ketofol group immediately after injection was (129.63±6.45) and for the propofol group was (125.25±13.25) and the p-value was (0.006) there is significant results between the two groups. The Mean± standard deviation of the MAP of ketofol group was (94.78 ± 8.69) and for the propofol group was (87.14±8.33) and the p-value was (0.000) there is statically differences between the two groups. also, the Mean± standard deviation of the SBP of ketofol group immediately after injection was (129.63±6.45) and for the propofol group was (125.25±13.25) and the p-value was (0.006) there is significant results between the two groups. also,

the Mean \pm standard deviation of the SBP of the ketofol group immediately after injection was (126.01 \pm 8.48) and for the propofol group was (120.39 \pm 11.33) and the p-value was (0.003) there is significant results between the two groups of propofol group with ketofol group in this finding.

Conclusion: The findings from our research results lead us to the conclusion which, for the first ten minutes, for better hemodynamic stability during the general anesthesia we used the ketofol drug and it has better stability than using propofol drug. The groups did not vary in terms of postoperative pain or PONV.

Keywords: *hemodynamic, anesthesia, propofol, ketofol, ketamin*

1. INTRODUCTION

A serious side effect of anaesthesia is haemodynamic instability, which can be brought via induction, intubation, surgical wounds other stress, hypovolemia, anaesthesia medications, even volatile anaesthetics. Pain from the surgical incision raises your pulse & arterial pressure. Individuals with ischaemic heart disease, valvular heart disease, and various other cardiovascular conditions have this difficulty more frequently. Blood pressure is sharply lowered by medications used to induce anaesthesia. Through a number of methods, propofol lowers blood pressure, whereas ketamine raises it and vice versa. [1]. Propofol & ketamine are frequently used as induction agents for adult patients who had surgery; however, cardio respiratory depression may be caused during the induction of anaesthesia by the propofol drug, while arterial blood pressure and heart rate may be caused by ketamine. However, it appears that ketamine and propofol have complementing clinical effects. Since ketofol is most frequently used for procedural sedation, it will be crucial to investigate its efficacy for induction in order to provide surgical patients with clinical care [2]. Although propofol is utilised as an induction drug, its usage is restricted due to its adverse effects, which include cardiac depression and dose-dependent hypotension. Therefore, creating ketofol by mixing propofol and ketamine may improve haemodynamic stability. Comparing the haemodynamic alterations and the incidence of shivering, nausea, and vomiting following general anaesthesia with elective surgery the research goal was for using propofol drug with ketofol drug as induction agents [3]. Following the introduction of general anaesthesia, haemodynamic fluctuations are around 23.0% [4]. According to another study, 26% and 20% of people had hypotension (Systolic Blood Pressure under 80 for more than 5 min) with hypertension (Systolic Blood Pressure more than 160 for more than 5 min), respectively [4,5]. Propofol lowers blood pressure by many pathways, whereas ketamine raises blood pressure, according to an induction drug characteristic [6]. Haemodynamic alterations may result from vasodilation or sympathetic inhibition during the onset of anaesthesia [7]. Anaesthesia-induced haemodynamic instability can impair blood flow to important organs and raise oxygen demand and consumption [8,4]. These can result in ischaemia, circulatory shock, and organ hypoperfusion, warning doctors to select the most appropriate induction agent. An essential task for anaesthetists is to maintain haemodynamic stability during the induction and maintenance of anaesthesia. Adequate depth of anaesthesia is necessary for induction of anaesthesia while avoiding hemodynamic disruption [9]. If hemodynamic disturbance-related problems are not addressed, they may result in organ damage and ischemia, which may be followed by cardiopulmonary arrest. Overall, it may result in worse patient outcomes and longer hospital stays, which might jeopardise hospital infrastructure and the nation's health system as a whole. Ketamine can be used as an adjuvant in a balanced anaesthetic and to induce anaesthesia prior to the introduction of other general anaesthetic drugs. [10,11, 12]. With the onset of the ketamin drug between the 45–60 seconds and with 20–25 minutes of the clinical duration of the ketamin drug, it passes the blood–brain barrier due to its high lipid solubility. In the Western world, the most often used intravenous induction drug is propofol (2, 6-diisopropylphenol). Because of its short distribution half-life and high clearance rate, it causes fast unconsciousness followed by a quick and obvious recovery. [13,14]. It lasts for around 10 minutes and has a clinical onset of 30 to 45 seconds. Ketofol is a combination of propofol and ketamine that can be given as a single syringe or separately. Because it requires smaller dosages of both drugs and their opposing effects reduce the likelihood of dose-related adverse effects, one of the best drug combinations to produce analgesia with sedation was the ketofol drug [15]. Propofol and ketamine together offer a number of advantages, including strong post-procedural analgesia, hemodynamic stability, reduced nausea and vomiting, and absence of respiratory depression. [16,17,18,19] However, the dosage and combination ratio of ketofol determine its safety and effectiveness as a sedo-analgesic [20,21].

2. METHOD AND MATERIALS

The research study design A double-blind randomized controlled trial.

The study sample : 92 individuals involved in this study, 46 in each group. Any Adult patients who had GA had undergone with elective surgery, according to situational analysis. During the six months that we collected data, every patient had an equal chance of being a research participant based on our inclusion criteria. We used systematic random selection to choose one patient after jumping another subject in order to reach the needed sample size of 92 patients. This was accomplished by choosing. The research conducted between 1 Nov 2024 and 31 Jan 2025 during cesarean section.

Data collection and the procedure The monitors, vital sign charts, and patient medical records served as the data source. A permission form was created along with an explanation of the study's goals, risks, and benefits. Data was gathered using a questionnaire that includes information on patients' sociodemographics, weight, primary and secondary outcome factors, with the status of ASA, and other pertinent data. The procedure Ketofol drug was used to induce patients in the group of the ketofol for induction, and the propofol group was used propofol drug for induction. In order to manufacture the ketofol group, a 20 mL syringe containing a 1:1 combination of ketamine drug was 5 mg/mL was used and propofol drug used was 5 mg/mL. Following their admission to the operating theatre, patients were observed using monitoring of the blood pressure with non-invasive device, and for monitoring the saturation of O₂ we used the pulse oximetry, arterial lines, electrocardiograms, used for monitoring CO₂ capnography, and the bispectral index (BIS) to determine the degree of anaesthesia. An anesthetist who was blind to the patient group recorded hemodynamic parameters (systolic arterial pressure (SAP), heart rate (HR), and mean arterial pressure (MAP), as well as observed shivering and PONV, at baseline 0 minutes and 3 minutes after induction, and at 5 and 10 minutes after intubation.

Inclusion criteria: All patients who was ASA I and ASA II and the patient was between the ages of 18 to 65 all these patient met the inclusion criteria who utilized from general anaesthesia during the elective surgery. **exclusion criteria:** Patients who had undergone ENT surgery, neurosurgery, long-term opioid usage, sedative preoperative adjunctive medicines, psychiatric drug use, known ketamine or propofol allergies, or were in discomfort were not included.

3. RESULTS

This research reveal **(38.41 ± 12.54)** was the Mean ± SD of the age of ketofol group. **(40.16 ± 12.60)** the Mean ± SD of the age of propofol group. **(63%)** of ketofol group were male . **(67.4%)** of propofol group were male. **also (74.15 ± 8.64)** The Mean ± SD of the weight of ketofol group .in addition **(75.24 ± 9.63)** The Mean ± SD of the weight of the propofol group. **(91.3%/)** of the ketofol group were ASA I. **(92.4%)** of the propofol group were ASA I

(Table 1) socio-demographic with parameters finding in the results of two groups

Patient Characteristics	Ketofol(n=46) Mean ± SD	propofol(n=46) Mean ± SD
Age	38.41 ± 12.54	40.16 ± 12.60
Gender (M/F)	(58/34) (63% / 37%)	(62/30) (67.4% / 32.6%)
Weight	74.15 ± 8.64	75.24 ± 9.63
ASA degree (1/2)	(84/8) (91.3%/8.7)	(85/7) (92.4% / 7.6%)

This table shows that **(4.3%)** of the ketofol had have post operative nausea and vomiting also, in the propofol group they had **(3.3%)**.and the P-value was **(1.000)** there is no significant results.**(6.5%)** among the ketofol group; they suffered from shivering rather than in the propofol group only **(4.3%)** They had shivering and the P-value was **(0.483)** There is no significant results.

(Table 2) Secondary finding of variables between ketofol and propofol

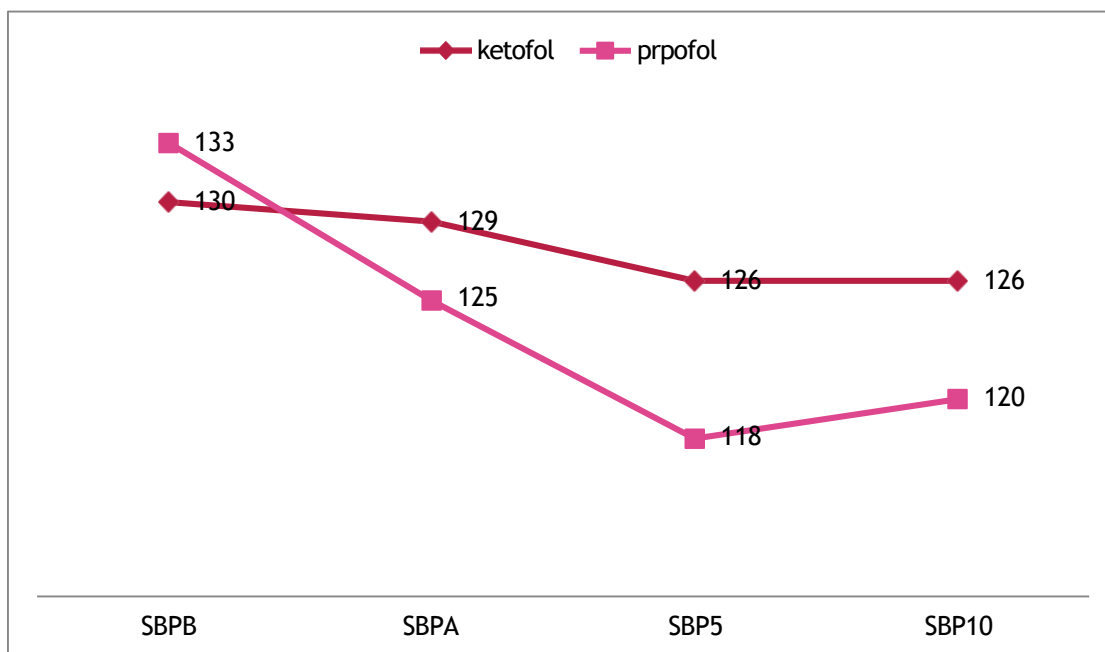
Variables	ketofol(n=46)	propofol(n=46)	P-value
PONV (yes/no)	(4/88) (4.3% / 95.7%)	(3/89) (3.3%/96.7%)	1.000

Shivering (yes/no)	(6/86) (6.5%/95.5%)	(4/88) (4.3%/95.7)	0.483
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This Table 3 explain the hemodynamic change according to time from the base line recording till 10 minute. the Mean± SD of the SBP of ketofol group immediately after injection was **(129.63±6.45)** and for the propofol group was **(125.25±13.25)** and the p-value was **(0.006)** there is significant correlation between the groups. The Mean± SD of the ketofol group of the MAP was **(94.78 ± 8.69)** and for the propofol group was **(87.14±8.33)** and the p-value was **(0.000)** there is statically differences between the two groups. also, the Mean± SD of the SBP of ketofol group immediately after injection was **(129.63±6.45)** and for the propofol group was **(125.25±13.25)** and the p-value was **(0.006)** there is significant results between the two groups. also, the Mean± SD of the SBP of the ketofol group immediately after injection was **(126.01±8.48)** and for the propofol group was **(120.39±11.33)** and the p-value was **(0.003)** there is significant differences between the two groups

(Table 3) The variables of ketofol and propofol from the base line within 10 minute

Groups type		Ketofol(n=46) Mean± SD	Propofol(n=46) Mean± SD	p-value
Base line	MAP	97.27±5.29	99.26±8.33	0.081
	SBP	130.25±7.75	133.26±14.07	0.139
	HR	79.78±8.74	78.45±6.66	0.820
Immediately after injection	MAP	95.96±5.29	93.00±8.22	0.112
	SBP	129.63±6.45	125.25±13.25	0.004
	HR	85.64±8.49	82.02±6.98	0.641
After 5 min.	MAP	94.78 ± 8.69	87.14±8.33	0.000
	SBP	126.61±8.53	118.23±13.83	0.006
	HR	83.76±8.86	84.82±8.65	0.398
After10min.	MAP	94.66±5.91	92.08±4.67	0.057
	SBP	126.01±8.48	120.39±11.33	0.003
	HR	79.70±8.52	78.08±6.77	0.166



(figure 1) the results of systolic blood pressure from the baseline to 10 minutes.

4. DISCUSSION

Both ketamine along with propofol frequently serve as the induction drugs for adult surgical patients; however, cardio respiratory depression may be caused during the induction of anesthesia by the propofol drug, while raises arterial blood pressure and heart rate may be caused by ketamine. Nonetheless, it seems that ketamine and propofol have complementary therapeutic benefits. Examining ketofol's effectiveness for induction will be crucial to the therapeutic management of surgical patients, since it is most commonly utilized for procedural sedation. In this study, we contrasted our results with another researcher's similar notion.

In our research we found the parameters and socio-demographic finding in the results of two groups .the Mean \pm SD of the age in the ketofol group was 38.41 ± 12.54 , the Mean \pm SD in the propofol group was 40.16 ± 12.60 ,there is research slightly below our results produced by **Raman V et al. (2022)[3]** Mean \pm SD of the age in the ketofol group was 33.95 ± 7.84 , the Mean \pm SD in the propofol group was 33.47 ± 8.97 . in our research 63% were male in ketofol group and 67.4% in the propofol group were male, there is another thesis had almost the same finding produced by **Hesham Aboeldahab et al. (2011)[99]** .90% were male in ketofol group ,85% were male among the propofol group. 74.15 ± 8.64 was the Mean \pm SD of weight for the ketofol group also 75.24 ± 9.63 . the results of **Hesham Aboeldahab et al. (2011)[99]** slightly above our finding 79.2 ± 9.8 the Mean \pm SD of the weight for the ketofol group. 81.8 ± 9.26 the Mean \pm SD of the weight for the propofol group.

In the current study 91.3% were ASA 1 in the ketofol group. 92.4% were ASA 1 in the propofol group, there is a finding agree with our results 89.6% were ASA1 in the ketofol group .92.16% were ASA1 in propofol group and this results produced by **Raman V et al. (2022)[3]**. **The Secondary finding of variables between ketofol and propofol** ,in our thesis just 12.88% patient had PONV in ketofol group . 9.66% patient had PONV in the propofol group. there is study done by **Manuel C Vallejo (2011)[100]** 15.3% among the ketofol group had PONV. In the our study 4.3% in the propofol group had shivering and 6.5% of ketofol group had shivering and there is a study agree with just ketofol group produced by **Jalili S, Esmaeili A, Kamali et al.(2019)[102]** the ketofol group had just 3 patients (7%) showed shivering and there is no one had shivering in the propofol group and that don't agree with our results.**The hemodynamic variables of ketofol and propofol from the base line within 10 minute .At the base line** of our results didn't have significant results and the p-value of the MAP was 0.081 , SBP was 0.139 and the p-value of the HR was 0.820 and that's agree with another study produced by **Jahangirifard et al. (2017)[1]** the pre induction results of the MAP,SBP and HR didn't have any differences the p-value was more than 0.05.**Immediately after injection** In the current study there is no statically significant results of the MAP Immediately after injection ,the p-value of the MAP was 0.112.rather than the SBP there is astatically differences Immediately after injection the p-value was 0.004.the HR Immediately after injection didn't have statically differences the p-value was 0.641. according to another study produced by **Seyoum Hailu et al. (2021)[94]** agree with our study there is no significant results with the MAP the p-value was 0.283 Immediately after injection. the same thesis of **Seyoum Hailu et al. (2021) [94]** don't match with our results SBP didn't have significant results Immediately after injection the p-value was 0.068 and the HR agree with our results p-value was 0.556 Immediately after injection. **After 5 min.** of induction there is a highly statically differences

in the MAP the p-value was 0.000 ,also the SBP the p-value was 0.006 and that's agree with the study produced by **Kayalha Hea et al(2017)[95]**. At five minutes, the propofol group's MAP became significantly reduced than the ketofol group's (p=0.015). Additionally, following induction (p=0.001) as well as after five minutes (p=0.017), the propofol group's SBP was considerably lower than that of the ketofol group. with the current study disagree with the same study in the results of the HR .in our study there was no significant results after 5 min. the HR p-value was 0.398 and our results disagree with this thesis at 5 minutes the significantly finding of the HR in the propofol group when we were compared with the group of ketofol and the p-value was (0.001). **After 10 minute** the mean arterial pressure without any statically differences the p-value was 0.057 ,farther more there is statically significant finding with the systolic blood pressure the p-value was 0.003,with in contrast there is no significant finding for the heart rate result the p-value was 0.166.there is thesis conducted by **Seyoum Hailu et al. (2021)[94]** agree with our study after 10 minute there is no statically significant results with mean arterial pressure the p-value was 0.053,also for the systolic blood pressure there is statically significant finding the p-value was 0.016,farther more there is no differences finding for the heart rate the p-value was 0.857. **Anesthesia and surgery-related variables between groups** in our results (33) patients was done general surgery and (13) Gynecological in the ketofol group. Also (35) patients was general surgery and (11) patient Gynecological in the propofol group There was no Complication incidence among the patient during the time of variables and there is study agree with our study in this results conducted by **Seyoum Hailu et al. (2021)[94]** there is 14 patient had general surgery and also 17 patient had 22 patient had gynecological surgery in propofol group. There was no Complication incidence among the patient during the time of variables. during our study there was only one patient suffered from the Psychological disorder in the ketofol group. And there is a study almost agree with our study produced by **Nazemroaya B, Majedi MA, Shetabi H (2018)[103]** the finding was only 4 patient had Psychological disorder in the ketofol group.

5. CONCLUSION

The findings from our research results lead us to the conclusion which, for the first ten minutes, using ketofol to induce general anesthesia has better hemodynamic stability than using propofol. The groups did not vary in terms of postoperative pain or PONV.

Ethical approval

Before initiating this experiment, Tehran University of Medical Science (Tums) clearance was obtained. The committee on ethics accepted the project's use of human participants (IR.TUMS.SPH.REC.1403.268).

Conflicting interests

The authors say they have no competing interests.

The authors' Contributions

Dr. Hamed, Dr. Husam: Conceptualization; Dr. Hamed, Dr. Husam: Methodology; Dr. Hamed, Afaf abdulhasan: Formal analysis; Dr. Hamed, Dr. Husam: Investigation; Dr. Hamed, Afaf abdulhasan: Data curation; Dr. Hamed, Dr. Husam, Afaf abdulhasan: Writing-original draft preparation; Dr. Hamed, Afaf abdulhasan: Writing-review and editing; Dr. Hamed, Dr. Husam: Supervision; Dr. Hamed, Dr. Husam: Project administration. All authors have read and agreed to the published version of the manuscript.

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