International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR)
ISSN: 2582-7618 (Online), Volume-6 Issue-5, August 2026

A Comparative Study of Propofol-Based Total Intravenous Anaesthesia and Isoflurane-Based Inhalational Anaesthesia on Clinical Variables During Recovery from Anaesthesia

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Abstract: ***The process of recovery from general anaesthesia is much more than just a final step in surgical treatment – this is a densely medical period where various aspects such as pharmacology, airway protection, hemodynamics, patient comfort, and hospital performance are concentrated amid difficult conditions. In this paper, we present a comparative analysis of total intravenous anaesthesia with propofol (TIVA) and inhalational anaesthesia with isoflurane, paying particular attention to clinical parameters during the wake-up and recovery periods. The study involved 100 patients who underwent surgery and were randomly distributed into two groups. 50 people received anaesthesia based on propofol, while another 50 patients had anaesthesia based on isoflurane. The parameters studied included the time until the first response, eye opening, extubation, total recovery time, time in the post-anaesthesia care unit (PACU), changes in vital signs, postoperative nausea and vomiting (PONV), and postoperative shivering. According to the baseline characteristics, the two groups were comparable in many respects. Indicators of recovery in the case of propofol were better for all the studied periods: the first response was 7 ± 2 minutes in the propofol group compared to 15 ± 6 minutes in the isoflurane group; the eye opening was 8 ± 3 minutes compared to 18 ± 7 minutes; extubation was 6 ± 2 minutes compared to 12 ± 5 minutes; the total recovery period was 10 ± 4 minutes compared to 25 ± 8 minutes; PACU stay was 4 ± 3 minutes compared to 10 ± 6 minutes. The differences were significant ($p < 0.05$). The PONV and shivering were rarely observed in both groups and did not differ significantly. It can be concluded that TIVA with propofol might have advantages, including faster and easier recovery without additional risks.***

Keywords: ***Propofol, Isoflurane, Total Intravenous Anaesthesia, Recovery from Anaesthesia, Postoperative Nausea and Vomiting, Postoperative Shivering.***

Nomenclature:
TIVA: Total Intravenous Anaesthesia with Propofol
PACU: Post-Anaesthesia Care Unit
PONV: Postoperative Nausea and Vomiting
TIVA: Total Intravenous Anaesthesia

I. INTRODUCTION

The use of general anaesthesia in modern surgical procedures are so prevalent that even its most critical aspects are sometimes considered routine. Nonetheless, recovery of consciousness marks one of the most obvious signs of anaesthesia quality. During this phase, the patient moves from controlled unconsciousness through the restoration of spontaneous breathing, maintenance of protective airway reflexes, responsiveness, and physiologic regulation. While a drug regimen seems efficient during the procedure, it might still suffer from problems during recovery, like delayed eye opening, difficult intubation, vomiting, shivers, hemodynamic instability, and the prolonged stay of the patient in the PACU compared to the schedule of the medical staff. The current research takes place right at this borderline, comparing recovery characteristics associated with propofol TIVA and isoflurane inhalational anaesthesia in terms of the simplicity and relevance of measuring parameters.

First, propofol is the main component of the popular technique of total intravenous anaesthesia. The drug is a fast-working hypnotic agent with predictability of the induction of anaesthesia, relatively short context-sensitive recovery after short surgical procedures, and low risk of postoperative nausea and vomiting. Despite its cardiopulmonary side effects, such as hypotension and respiratory depression in combination with propofol administration, its fast redistribution and elimination justify expectations of medical professionals for faster waking up of patients with less residual sedation and cognitive impairment. Isoflurane, in turn, is one of the volatile anaesthetics used in surgeries for a long time. The drug is easy to adjust in terms of inspired concentration, has high reliability, and is low-cost. Still, its emergence depends on pulmonary elimination, tissue solubility, ventilation, and exposure time, which means slower recovery of patients under isoflurane.

The importance of the comparison is that the current concept of recovery is much more than just a soft result or a matter of patients' preferences. Time of first response, time of eye opening, time of extubation, time of awakening, and the duration of PACU stay are key practical metrics that can be applied in the daily routine of work. Earlier recovery may help avoid congestion in post-anaesthesia care units, increase patient comfort, assist the surgical team in following the schedule of their work, and minimise the small risks associated with prolonged patient sedation. At the same time, speed should never compromise safety and comfort. Fast

Manuscript received on 25 June 2026 | First Revised Manuscript received on 18 July 2026 | Second Revised Manuscript received on 28 July 2026 | Manuscript Accepted on 15 August 2026 | Manuscript published on 30 August 2026.
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awakening along with such complications as vomiting, airway irritation, hemodynamic instability, agitation and shivering is not an improvement at all. The issue here is not which anaesthetic helps to awaken faster, but whether faster awakening can be achieved with an acceptable level of safety and comfort.

This paper creates a journal article based on the attached study materials. The wording of the initial thesis is not used; however, its main message is preserved as it is reformulated through the statement of the clinical problem: propofol-based TIVA seems to shorten the early recovery times of the patients in comparison with the isoflurane-based inhalation anaesthesia; both techniques have similar short-term safety profiles regarding PONV, shivering and vital signs.

II. BACKGROUND AND LITERATURE REVIEW

Literature concerning anaesthetic recovery has moved away from the question of patient safety upon waking up to how and how quickly recovery happens, what problems occur, and what burden is taken out of the postoperative period. This shift in focus is more than superficial – it reflects the shift in the field of perioperative medicine towards trends such as quality recovery, fast mobilisation, day case surgery, and patient-oriented outcomes. In this line of research, anaesthetic choice has become one of the variables which can be modified to improve patients' condition.

Propofol's benefits come from its pharmacology. Firstly, the agent acts mainly by enhancing inhibitory signalling mediated by the gamma-aminobutyric acid type A receptor and provides fast hypnosis. Redistribution from the central compartment to tissues leads to quick early recovery after a bolus, whereas metabolism helps maintain the effect during infusion. As with all drugs, propofol is not completely harmless: the agent causes hypotension, apnea, and injection pain. However, its fast duration of action, ease of adjustment, and decreased risk of postoperative nausea and vomiting (PONV) made propofol a key element of anaesthesia in outpatient and short-duration cases (Budic et al., 2022 [2]; Vandemoortele et al., 2022) [11]. Practically speaking, propofol often allows anesthesiologists to control a situation in accordance with patients' current needs, not their residual effects stored in tissues.

Isoflurane is another substance with a different profile. It is a volatile anaesthetic who's hypnotic and immobilisation effects occur through several receptor systems (potentiation of GABAergic currents and inhibition of NMDA receptor activity, to be more specific) (Qiu et al., 2023) [8]. Advantages of isoflurane include reliable administration, longstanding use, and suitability for maintaining anaesthesia in different surgeries. Of course, isoflurane is not outdated yet – its usage remains high in many situations due to convenience and reliability. However, volatile substances are usually associated with slower recovery than short-acting intravenous techniques if surgery is of brief or medium duration, since the patient has to exhale it through ventilation depending on alveolar ventilation, blood-gas solubility, tissue uptake, and duration of anaesthesia. These factors can be controlled but not immediately.

Postoperative nausea and vomiting deserve separate attention due to their importance and recollection by patients after surgery. Even a perfectly conducted operation can be remembered because of hours of nausea. This issue is so widespread that it affects guidelines, risk scoring, prophylactic measures, discharge planning, and even recommendations concerning both adults and children (Gan et al., 2025 [3]; Kienbaum et al., 2022) [5]. A factorial study proved that changing from volatile anaesthesia to propofol-based total intravenous anaesthesia (TIVA) lowers the risk of PONV to the same degree as some antiemetics (Kampman et al., 2024) [4]. This statement does not mean that propofol does not cause PONV, or that volatile anaesthesia is dangerous – this means that anaesthetic choice can serve as prophylaxis.

Postoperative shivering is a bit less significant but still an important problem. It is possible to dismiss it as an annoyance. Still, the physiology behind it has other implications: shivering increases oxygen consumption, enhances sympathetic activity, interferes with monitoring, and creates an additional strain for patients with poor cardiopulmonary reserve. There are many causes: redistribution, hypothermia, impaired thermoregulation, anaesthetic effect on hypothalamic thresholds, pain, and sometimes specific drugs' mechanism. Reviews say that post-anaesthetic shivering is a common complication of recovery and can be prevented by both thermal and pharmacological methods (Masubuchi et al., 2025 [6]; Munday et al., 2023 [7]; Shirozu et al., 2022 [9]; Simegn et al., 2021) [10]. In this case, even small differences between anaesthetics are more important not as percentual values, but as parts of the overall recovery process.

This research adds information to this discussion by comparing recovery times and common complications after two popular anaesthesia techniques. The value of this work is not in formulating new pharmacological laws. Rather, in its clinical relevance: in the observed sample, propofol-based TIVA resulted in considerably faster recovery times, and the incidence of nausea, vomiting, and shivering remained low and statistically comparable. In many hospitals, especially with limited PACU capacity, this kind of information has practical meaning: it can be used in scheduling, staffing, and improving patient satisfaction.

III. RESEARCH PROBLEM AND OBJECTIVES

The main focus of this study is the effect of different types of anaesthesia on clinical outcomes of emergence from general anaesthesia. While both propofol and isoflurane are well-known anaesthetics, their influence on the recovery process is different. The difference might occur within minutes, but these minutes matter for preparation for extubation, time in PACU, patient comfort, nursing workload, and overall smoothness of care. The clinical question expands further than the preference of intravenous over inhalational technique: is TIVA performed with propofol better in terms of recovery outcomes than inhalational anaesthesia based on isoflurane, without any additional postoperative complications?

The general goal of the study was to compare the effect of propofol-based

TIVA and isoflurane-based inhalational anaesthesia on selected clinical variables during recovery from anaesthesia. Specific goals of the study were as follows: 1) to compare the recovery speed measured with the help of such variables as the first response, eye opening, extubation, total awakening time, and PACU stay; 2) to estimate the rate of postoperative nausea and vomiting (PONV) and postoperative shivering; 3) to assess the implications of these findings in terms of performance of elective surgeries requiring quick and stable recovery.

The directional hypothesis assumed that patients undergoing propofol-based TIVA showed quicker awakening and recovery times than patients receiving isoflurane-based inhalational anaesthesia, with a lower or comparable rate of PONV and postoperative shivering. The null hypothesis was that there were no statistically significant differences in recovery time, PONV, and postoperative shivering between the two groups.

IV. MATERIALS AND METHODS

The study was performed using a prospective comparative design. The study population included surgical patients undergoing elective operations under general anaesthesia at Idlib University Hospital during the defined period. Available study documents reveal that the final study sample included 100 patients, divided into two equal groups according to the anaesthetic technique used. Group 1 consisted of 50 patients who were treated with propofol-based TIVA. Group 2 included 50 patients who were managed with isoflurane-based inhalational anaesthesia. The allocation allowed the comparison of recovery variables after anaesthetic agent discontinuation.

Demographic and clinical characteristics of patients were analysed to determine whether the groups were sufficiently similar before interpreting recovery outcomes. These variables included age, sex distribution, weight, height, ASA classification, and type of surgery. No statistically significant differences in the above-mentioned characteristics between the two groups were found. It is necessary to mention that similarity of the groups is very important because the process of anaesthesia recovery might be affected not only by the anaesthetic drug itself, but also by age, body habitus, surgical stimulation, surgery length, and underlying physiological reserve. Comparing non-equivalent groups would be biased even if all the statistical tables were nicely arranged.

The independent variable was the anaesthetic technique: propofol-based TIVA or isoflurane-based inhalational anaesthesia. Dependent variables included recovery-time parameters, vital sign behaviour, and early postoperative adverse symptoms. Recovery-time parameters included first response to stimulation, eye opening, extubation time, total awakening time, and PACU stay. The vital sign variables included blood pressure and pulse behaviour before, at the end of the operation, and during recovery, with an emphasis on clinical stability. Adverse symptoms included postoperative nausea, vomiting, and shivering. The values were presented as mean ± SD for continuous variables and percentages for categorical variables.

Comparisons were performed using p-values, where $p < .05$ was considered statistically significant. Continuous recovery-time outcomes were compared between the two anaesthetic groups, and categorical symptoms such as nausea, vomiting, and shivering were estimated in terms of frequency and statistical significance. The study materials did not provide the full statistical procedure for independent replication; however, the results tables showed statistically significant differences in recovery-time parameters and non-significant differences in nausea, vomiting, and shivering. The current paper will keep the results in numerical form and restate them in polished journal style.

Ethical considerations were discussed in the study materials. The study was performed in accordance with the accepted ethical principles. It received necessary approvals and informed consent from patients or their guardians before inclusion. The authors reported no external funding and conflicts of interest. The above-mentioned statements are not decorative; in anaesthesia research, even the apparently simplest comparisons require great attention to patient safety because anaesthetic exposure, airway management, and postoperative monitoring represent a direct clinical risk.

V. RESULTS

The results of baseline data analysis revealed that the two study groups were sufficiently similar. The mean age of patients in the propofol group was 18.5 ± 5.4 years and in the isoflurane group – 19.2 ± 6.1 years. There were no statistically significant differences in age between the two groups. There were no statistically significant differences in sex distribution, weight, height, ASA classification, and type of surgery.

Table I: Baseline Demographic and Clinical Characteristics of the Study Groups

Variable	Propofol Group (n = 50)	Isoflurane Group (n = 50)	p Value	Interpretation
Age (mean ± SD)	18.5 ± 5.4 years	19.2 ± 6.1 years	.52	Not significant
Sex distribution	35 male / 16 female	33 male / 18 female	.67	Not significant
Weight (mean ± SD)	65 ± 12 kg	64 ± 11 kg	.71	Not significant
Height (mean ± SD)	165 ± 10 cm	164 ± 9 cm	.58	Not significant
ASA classification	Comparable	Comparable	—	No reported imbalance
Type of surgery	Various elective procedures	Various elective procedures	.81	Not significant

Note. $p < .05$ was considered statistically significant. Baseline variables were reported as comparable between the two anaesthetic groups.

VI. RECOVERY-TIME OUTCOMES

Parameters of recovery showed consistently and obviously better values in the propofol group, providing total intravenous anaesthesia (TIVA). The reaction to the first stimulus occurred after 7 ± 2 minutes in the

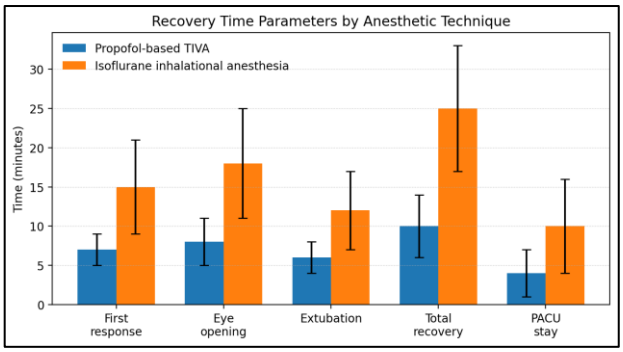
propofol group, compared with 15 ± 6 minutes in the isoflurane group. Eye-opening took place at 8 ± 3 minutes compared to 18 ± 7 minutes. The time until extubation was 6 ± 2 minutes for propofol and 12 ± 5 minutes for isoflurane. The awakening took 10 ± 4 minutes and 25 ± 8 minutes, respectively. The duration of stay at the post-anaesthesia care unit (PACU) was 4 ± 3 minutes for the first group and 10 ± 6 minutes for the second one. All the above-mentioned differences proved to be statistically significant at $p < .05$.

The process of recovery is as important as the values themselves. Propofol has never improved any recovery index without changes in other indices, but shortened all of them. It is quite clear what it means for a patient who reacts faster, opens eyes faster, meets extubation criteria faster, and leaves the recovery room faster. In terms of high-volume practice, it means that the whole process of emergence is shortened, and patients spend less time under observation.

Table II: Comparison of Recovery-Time Parameters Between Propofol and Isoflurane Groups

Recovery Parameter	Propofol Group (mean ± SD, min)	Isoflurane Group (mean ± SD, min)	p Value	Statistical Significance
First response	7 ± 2	15 ± 6	< .05	Significant
Eye opening	8 ± 3	18 ± 7	< .05	Significant
Extubation	6 ± 2	12 ± 5	< .05	Significant
Total awakening time	10 ± 4	25 ± 8	< .05	Significant
PACU stay	4 ± 3	10 ± 6	< .05	Significant

Note. PACU = post-anaesthesia care unit. All recovery-time indicators favoured propofol-based TIVA.



[Fig.1: Comparison of Recovery-Time Parameters Between Propofol-Based TIVA and Isoflurane Inhalational Anaesthesia]

A. Vital Signs and Postoperative Adverse Symptoms

Both anaesthetic regimens have proven clinically stable. The information shows that propofol tends to provide smoother stabilisation of BP and HR. However, most blood pressure differences failed to prove statistically significant. Recovery-related changes in heart rate were evaluated as more favourable with the use of propofol. The comparison table provides statistical significance ($p < .05$) of heart rate changes in the recovery phase. Such information needs to be considered with caution as the study summary does not present all raw data on hemodynamic parameters. However, such a clinical conclusion is possible: none of the methods seems dangerous, and the faster recovery period due to the use of propofol is not accompanied by hemodynamic problems in terms of the presented data.

Postoperative nausea and vomiting were rare in both groups. The frequency of postoperative nausea was 3.9% in the propofol group compared with 7.8% in the isoflurane group. The frequency of vomiting was 2% in the propofol group compared with 5.8% in the isoflurane group. Both differences were more favourable with propofol administration, although they failed to reach statistical significance ($p > .05$). Shivering was minimal and not statistically significant. Moreover, the reported percentage of shivering was higher with propofol (9.8%) than with isoflurane (3.9%). This numerical tendency contradicts expectations regarding propofol use. Although shivering was very mild and statistically insignificant, it should be taken into account as it indicates the biological nature of the process. This means that a shorter recovery period does not necessarily translate into a positive change in the severity of secondary symptoms.

Thus, the results of the research prove the alternative hypothesis concerning recovery time, but only partially in the context of postoperative adverse symptoms. The use of propofol-based TIVA reduces the time required for awakening and discharge from the recovery room. Neither nausea, nor vomiting, nor shivering was statistically less frequent among the patients treated with the propofol-based TIVA. However, it was numerically less frequent in the case of two adverse effects (nausea and vomiting).

Table III: Postoperative Adverse Symptoms and Selected Comparative Observations

Variable / Symptom	Propofol Group	Isoflurane Group	p Value	Clinical Interpretation
Nausea	3.9%	7.8%	> .05	Numerically lower with propofol; not significant
Vomiting	2.0%	5.8%	> .05	Numerically lower with propofol; not significant
Shivering	9.8% (mild)	3.9% (mild)	> .05	Mild and not statistically significant
Blood pressure behaviour	Relatively stable	Mild fluctuation	> .05	No significant difference reported
Heart-rate recovery	Faster normalization	Moderate recovery increase	< .05	Favoured propofol in the comparative table

Note. Percentages are reported as presented in the study documents. The adverse symptoms were low in both groups and clinically mild where described.

VII. DISCUSSION

One of the most obvious outcomes of the research is how much faster recovery occurs with propofol-based TIVA. The difference in total awakening time, namely 10 minutes versus 25 minutes, is significant and is easy to notice by anaesthetists, nursing staff, operating

surgeons, and patients alike. The same tendency applies to the initial reaction, eye-opening, extubation, and PACU admission. All of these results prove the general idea of this study: the use of propofol-based TIVA results in faster early recovery than isoflurane-based inhalational anaesthesia in the current sample (Abdi et al., 2025) [1].

This outcome is supported by pharmacologic reasoning. The effects of propofol disappear quickly after stopping administration because of redistribution and metabolism, depending on the procedure duration. The central nervous system returns to normal function without needing to wait for alveolar washout of volatile anaesthetics. Meanwhile, isoflurane is dependable during maintenance and can be stopped effectively through ventilation. After a certain amount of time, and depending on the tissue uptake of the drug, isoflurane's residual effect will remain for some time, affecting consciousness and airway reflexes. These facts turn pharmacologic reasoning into practice where minutes before eye opening, minutes before extubation and additional minutes before PACU admission make the difference.

The current study is consistent with the existing literature on the topic of using propofol-based techniques to reduce PONV risk. According to Kampman et al. (2024) [4], propofol-based approaches lead to fewer cases of PONV occurrence compared with volatile agents. Consensus guidelines also recognise anaesthetic technique as one of the PONV risk factors (Gan et al., 2025 [3]; Kienbaum et al., 2022) [5]. In the current study, PONV incidence was lower in the propofol group; however, the difference did not reach statistical significance. There may be several explanations for the above fact: insufficient sample size, low baseline PONV risk in both groups, prophylaxis, type of surgery, opioid exposure, hydration, and postoperative analgesia that could have levelled the difference between techniques. The results obtained do not contradict the existing literature. They show that PONV is a complex process influenced by numerous factors rather than by a single drug.

The shivering outcome should be treated with caution. Shivering was mild and statistically similar in both groups; however, it occurred more often in the group using propofol. There might be various reasons for the difference, such as random variability, different warming methods, procedure duration, operating room temperature, postoperative thermoregulation, or even documentation discrepancies. Post-anaesthetic shivering is a complicated thermoregulation phenomenon dependent on multiple factors like hypothermia, pain, anaesthetic drug effects and individual characteristics (Masubuchi et al., 2025 [6]; Munday et al., 2023 [7]; Shirozu et al., 2022 [9]; Simegn et al., 2021) [10]. The minor difference in shivering should not be taken as proof that propofol causes shivering. It is safe to say that both approaches led to low shivering in the current sample.

As far as clinical decision-making is concerned, the study proves that the approach based on propofol-TIVA should be used when fast and stable emergence is a priority, especially in short to intermediate elective procedures. In this way, fast extubation and shorter PACU stay could help to increase the work process efficiency. However, this finding is more suitable for units with small PACU capacity, crowded operating lists, and a need to balance throughput and safety. At the same time, this paper does not encourage giving up on isoflurane because isoflurane remains clinically effective in long procedures, limited-resource conditions, and inhalational anaesthesia maintenance is a priority. An effective report should avoid drawing ideological conclusions. The task is not to prove which drug is better everywhere, but which drug helps to achieve specific aims.

Another implication that could be made here is the definition of recovery quality. A patient is not recovered just because of the procedure completion or switch-off of the anaesthetic vaporiser. Recovery is the whole process of regaining abilities: responsiveness, respiration, airway protection, ability to withstand the post-procedural state and readiness to be transferred/discharged. The advantages of propofol in the current study consist of faster restoration of all these features. However, there is no statistically significant difference in PONV and shivering incidences. This fact emphasises the multidimensionality of recovery quality. Time is important, but comfort, thermoregulation, airway safety, cardiovascular stability and mental clarity are equally important parts of this recovery process.

At the same time, the current study can be used from the institutional point of view. Many hospitals determine their anaesthetic choice depending on cost, staff skills, availability of infusion pumps, drug supply, and other factors. Propofol-based TIVA requires more discipline and titration, while isoflurane is usually familiar and easier to use. So, the superior technique in given research may not be easy to use in a busy operating room. Therefore, such findings should be implemented in protocols carefully, step by step.

A. Clinical Implications for Anaesthetic Practice

The practical importance of these results will be better appreciated once the recovery room itself is seen not as an abstract medical place but as a working unit equipped with beds, monitors, nurses, nervous relatives, and a busy surgical schedule. Reduction in the total awakening time from 25 to 10 minutes is not a big figure by itself; yet, throughout a whole day of surgery, the accumulated difference will be great. Fast awakening and earlier extubation will help to reduce the period of maximum vulnerability. A fast recovery will help avoid overcrowding and provide more predictable progress through the perioperative process. This, however, should not be understood as pushing the patient into the next stage of treatment as soon as possible. In fact, what really matters is that the drug that helps the patient meet the criteria for safe recovery will make treatment both kinder and quicker.

From the anaesthetist's viewpoint, the results of the study will help support the idea that propofol-based total intravenous anaesthesia (TIVA) should be chosen specifically when it is necessary to ensure that the patient will recover fast after surgery. In day surgeries, surgeries performed on children or adolescents, minor general surgeries, and similar procedures, the patient's slow recovery will add to the problems. He or she may be sleepy; the nurses will need to wait until the patient recovers; the surgery will be delayed;

and the antiemetic or airway intervention will be required. Propofol does not make all those risks go away; yet, in the given study, it managed to minimise the time needed for recovery quite consistently. This consistency gives clinicians an additional criterion when choosing the anaesthesia strategy when quick recovery is essential.

Finally, the results will help develop the treatment protocol. No hospital will decide to favour propofol and just follow old habits. The protocol for safe TIVA will require proper intravenous access, exact infusions, a correct analgesic strategy, ready airway criteria, and knowledge of the drug's effects on the cardiovascular and respiratory systems. The protocol for isoflurane also includes proper washout, ventilation, and observation. This means that the anaesthetic agent is only one component of the whole clinical system. The best way to interpret the recommendation from the given study is to choose propofol strategically, not casually. Select the right patients, establish standard monitoring, establish recovery criteria, and audit outcomes.

Finally, the cost and availability issues should be considered. There are still many hospitals where volatile anaesthesia is used due to easy accessibility and ease of sustaining throughout the long procedure. Propofol infusion may prove to be more costly and complex to implement, especially if the equipment, drug availability, and proper training are problematic. The study does not deny any of these facts. However, it does give a good reason to prioritise propofol in cases when the advantage is apparent – short surgeries, fast PACU, high risk of PONV, and the need for quick neurological examination after anaesthesia. This balanced interpretation may be the most useful. The evidence should direct the judgment, but not replace it.

B. Limitations

There are several limitations of the study. The sample of 100 patients is sufficient for a comparative study but relatively small, especially if one takes into account nausea, vomiting, and shivering, which may require a larger sample to prove a statistical difference. Furthermore, the study seems to include various types of surgical procedures, while the type of surgery influences the recovery time, opioid consumption, PONV risk, temperature loss, and PACU stay. A more focused future study should consider stratification by procedure duration and surgery type.

Some physiological parameters were not provided. The levels of oxygen saturation and end-tidal CO2 would have added more information about the respiratory recovery. Similar improvements can be made by including a more detailed description of the operation duration, anaesthesia duration, opioid dosage, antiemetic prophylaxis, temperature management, and discharge criteria. There are lots of small choices that shape the patient's recovery and do not depend on the primary hypnotic agent. Without those, the interpretation should remain clinically sound but prudent.

The other limitation is the absence of follow-up. The study paid attention to the early recovery and the immediate postoperative symptoms. The study did not examine the quality of recovery later, possible PONV, postoperative pain, emergence delirium, patient satisfaction or unplanned admission. These outcomes would be helpful in future research, especially if a protocol for day surgeries or a high-volume elective service is proposed.

VIII. RECOMMENDATIONS

First, propofol-based TIVA should be considered when rapid awakening, fast extubation, and a short PACU stay are required for short and intermediate elective procedures. Secondly, it is still necessary to monitor blood pressure, pulse, oxygenation, and airway readiness despite the faster recovery. Thirdly, PONV prevention should be individualised and not based on the assumption that it will be resolved with the help of the anaesthetic method alone. Patients with PONV risk factors may still need prophylaxis, which should be done in compliance with modern standards (Gan et al., 2025 [3]; Kienbaum et al., 2022) [5]. Fourth, temperature management should be standardised for both techniques to make shivering outcomes interpretable in the future. Finally, large multicenter studies should be conducted with reporting of the type of procedure, anaesthesia duration, antiemetic use, opioid exposure, warming methods, PACU discharge criteria, and follow-up.

Institutionally, hospitals interested in wider implementation of propofol-based TIVA should implement the changes alongside protocol development and training. This technique needs precise dosing, monitoring and recovery assessment. A protocol that consists of replacing the old anaesthetic agent with the new one will not produce the same benefits.

IX. CONCLUSION

This study showed that propofol-based TIVA had significantly faster recovery than isoflurane-based anaesthesia regarding all awakening indicators. The patients in the propofol group recovered faster, opened their eyes faster, met extubation criteria faster, awakened faster, and had shorter PACU stay. Nausea, vomiting, and mild shivering rates were low in both groups and did not differ significantly. Therefore, the evidence supports the use of propofol as a favourable option for short and intermediate elective procedures when rapid recovery is desired.

The importance of the finding is not only in the speed but in the combination of speed and acceptable safety of the process. Propofol did not sacrifice recovery speed for trouble recovery. Isoflurane is still a good anaesthetic agent, but in the given study it proved to be less effective than propofol in terms of recovery. For clinicians and hospitals looking for smooth patient flow, shorter recovery-room stay, and rapid recovery after surgery, propofol-based TIVA proves to be a good choice.

DECLARATION STATEMENT

I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded by any organizations or

agencies. This independence ensures that the research is conducted with objectivity and without any external influence.

- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate, with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed solely.

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