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Original Article

Comparison of Total Intravenous Anaesthesia Versus Balanced General Anaesthesia on Early Recovery and Discharge Readiness After Day-Care Surgical Procedures

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ABSTRACT

Background: Day-care surgical procedures require anaesthetic techniques that provide rapid emergence, early recovery, minimal postoperative complications, and timely discharge. Total Intravenous Anaesthesia (TIVA) using propofol-based techniques has been suggested to provide more predictable recovery characteristics compared with Balanced General Anaesthesia (BGA). This study was conducted to compare the effects of TIVA and BGA on early recovery and discharge readiness following day-care surgical procedures.

Aim: To compare the effects of Total Intravenous Anaesthesia and Balanced General Anaesthesia on early recovery and discharge readiness in patients undergoing elective day-care surgical procedures.

Materials and Methods: This prospective randomized controlled study was conducted in a tertiary care hospital and included 100 patients undergoing elective day-care surgical procedures under general anaesthesia. Patients were randomly allocated into two groups of 50 each: Group T received TIVA and Group B received Balanced General Anaesthesia. Time to emergence from anaesthesia, early postoperative recovery assessed by Modified Aldrete Recovery Score, time to discharge readiness, postoperative nausea and vomiting (PONV), postoperative analgesic requirement, and patient satisfaction were evaluated. Continuous variables were analysed using independent t-test and categorical variables using Chi-square test. A p value <0.05 was considered statistically significant.

Results: Patients receiving TIVA showed significantly faster emergence from anaesthesia compared with BGA (8.80 ± 1.85 minutes vs 11.76 ± 3.15 minutes; p<0.001). Achievement of early postoperative recovery was significantly earlier in the TIVA group (19.40 ± 3.05 minutes vs 25.86 ± 5.09 minutes; p=0.001). The mean time to discharge readiness was significantly lower in the TIVA group compared with the BGA group (94.20 ± 14.12 minutes vs 109.96 ± 17.52 minutes; p=0.001). No significant difference was observed in the incidence of PONV between the groups. TIVA patients required fewer rescue analgesics and reported better satisfaction and quality of recovery.

Conclusion: Total Intravenous Anaesthesia provides superior early recovery characteristics, faster emergence, earlier achievement of discharge readiness, reduced postoperative analgesic requirement, and improved patient satisfaction compared with Balanced General Anaesthesia. TIVA may be considered a favourable anaesthetic technique for ambulatory surgical practice.

Keywords: *Total Intravenous Anaesthesia (TIVA); Balanced General Anaesthesia (BGA); Propofol; Day-care Surgery; Early Recovery; Emergence Time; Modified Aldrete Recovery Score; Discharge Readiness; Postoperative Nausea and Vomiting (PONV); Patient Satisfaction.*

INTRODUCTION

The increasing demand for day-care surgical procedures has led to more demand on anaesthetic techniques that facilitate rapid recovery, early ambulation, minimal postoperative complications, and timely discharge apart from ensuring patient safety and comfort.[1] The ideal anaesthetic technique for ambulatory surgery should provide adequate intraoperative conditions, predictable emergence, minimal residual drug effects, effective postoperative analgesia, and patient satisfaction.[2]

General anaesthesia remains one of the most commonly used techniques for surgical procedures; but, conventional balanced general anaesthesia, which combines intravenous and inhalational agents along with opioids and neuromuscular blocking drugs, may be associated with delayed recovery due to residual effects of volatile anaesthetics, opioids, and other adjunct medications.[3] These effects can cause prolonged post-anaesthesia care unit (PACU) stay, postoperative nausea and vomiting (PONV), dizziness, and delayed readiness for discharge.[4]

Total intravenous anaesthesia (TIVA), based on continuous infusion of intravenous hypnotic agents such as propofol with short-acting opioids, has emerged as an alternative technique with potential advantages in ambulatory anaesthesia. Propofol-based TIVA provides rapid and smooth emergence, reduced incidence of PONV, improved quality of recovery, and better patient satisfaction compared with inhalational anaesthetic techniques in several clinical settings.[5],[6] The use of target-controlled infusion systems and short-acting agents has improved the precision and predictability of TIVA, making it increasingly relevant for day-care surgical practice.[7]

Early recovery after anaesthesia involves not only rapid awakening but also restoration of cognitive function, haemodynamic stability, adequate pain control, absence of significant nausea or vomiting, and the ability to meet standardized discharge criteria.[8]Although several studies have evaluated TIVA and balanced general anaesthesia separately, variations in surgical procedures, anaesthetic protocols, patient populations, and recovery assessment methods have resulted in ongoing debate regarding their relative benefits in ambulatory surgery.

AIM AND OBJECTIVES:

Aim

To compare the effects of Total Intravenous Anaesthesia (TIVA) and Balanced General Anaesthesia (BGA) on early recovery and discharge readiness in patients undergoing day-care surgical procedures.

Objectives

1. To compare the time to emergence from anaesthesia between patients receiving TIVA and balanced general anaesthesia.
2. To assess and compare early postoperative recovery parameters using standardized recovery scores in both groups.
3. To compare the time taken to achieve discharge readiness following day-care surgical procedures between the two anaesthetic techniques.
4. To evaluate and compare the incidence of postoperative nausea and vomiting (PONV) among patients receiving TIVA and balanced general anaesthesia.
5. To compare postoperative pain scores and analgesic requirements between the two groups.
6. To assess patient satisfaction and quality of recovery following the two anaesthetic techniques.

MATERIALS AND METHODS:

Study Design and Setting

This was a prospective randomized controlled study conducted in the Department of Anaesthesiology at a tertiary care hospital. The study aimed to compare Total Intravenous Anaesthesia (TIVA) and Balanced General Anaesthesia (BGA) with respect to early recovery and discharge readiness following day-care surgical procedures.

Study Period

The study was conducted over a period of 4 months from october 2025 to January 2026

Study Population

The study included 100 patients undergoing elective day-care surgical procedures under general anaesthesia. All patients were evaluated preoperatively and optimized before surgery.

Sample Size and Group Allocation

100 patients were enrolled and randomly allocated into two groups of 50 patients each.

- Group T (n=50): Patients receiving Total Intravenous Anaesthesia (TIVA)
- Group B (n=50): Patients receiving Balanced General Anaesthesia (BGA)

$n = 2(Z\alpha/2 + Z\beta)^2 \sigma^2 / d^2$

Where,

n = Sample size required per group
Zα/2 = 1.96 at 5% level of significance (α = 0.05)
Zβ = 0.84 at 80% power of the study
σ = Standard deviation of the outcome variable
d = Expected difference between the two groups

Based on previous studies comparing Total Intravenous Anaesthesia (TIVA) and Balanced General Anaesthesia (BGA), the calculated sample size was found to be approximately 45 patients in each group.

Considering a possible 10% dropout rate and protocol deviations, the sample size was increased to 50 patients in each group.

So the final sample size included in the study was:

Group	Number of Patients
Total Intravenous Anaesthesia (TIVA) Group	50
Balanced General Anaesthesia (BGA) Group	50
Total Sample Size	100

Randomization
Patients were randomly assigned to either group using a computer-generated randomization method. The allocation was done before induction of anaesthesia.

Inclusion Criteria
Patients fulfilling the following criteria were included:

1. Patients aged between 18–60 years.
2. Patients belonging to ASA physical status Grade I and II.
3. Patients undergoing elective day-care surgical procedures.
4. Patients scheduled for surgery under general anaesthesia.
5. Patients willing to participate and providing written informed consent.

Exclusion Criteria
Patients were excluded if they had:

1. ASA physical status Grade III or above.
2. Significant cardiovascular, respiratory, hepatic, or renal disease.
3. Known allergy or contraindication to anaesthetic drugs.
4. Anticipated difficult airway.
5. Emergency surgical procedures.
6. Requirement for prolonged postoperative hospital admission.

Statistical Analysis
Continuous variables were expressed as mean ± standard deviation (SD) and compared using the independent sample t-test. Categorical variables were expressed as frequencies and percentages and analysed using the Chi-square test/Fisher's exact test. A p value <0.05 was considered statistically significant, and p <0.001 was considered highly significant. Statistical analysis was performed to compare recovery parameters, discharge readiness, PONV, analgesic requirement, and patient satisfaction between TIVA and Balanced General Anaesthesia groups.

Ethical Considerations
Written informed consent was obtained from all patients before participation. Confidentiality of patient information was maintained throughout the study.

RESULTS:
Comparison of Time to Emergence from Anaesthesia Among Patients
There is significant difference in mean emergence time from anaesthesia between the two groups.

Group	n	Mean	SD	P Value
TIVA Group	50	8.80	1.85	0.001
Balanced General Anaesthesia Group	50	11.76	3.15	
Total	100	10.28	2.97	

Table 1: Time to Emergence from Anaesthesia Among Patients

Comparison of Early Postoperative Recovery Parameters Among Patients

There is significant difference in early postoperative recovery between the two groups.

Group	n	Mean	SD	P value
TIVA Group	50	19.40	3.05	0.001
Balanced General Anaesthesia Group	50	25.86	5.09	
Total	100	22.63	5.55	

Table 2: Early Postoperative Recovery Parameters Among Patients

Comparison of Time to Achieve Discharge Readiness Among Patients

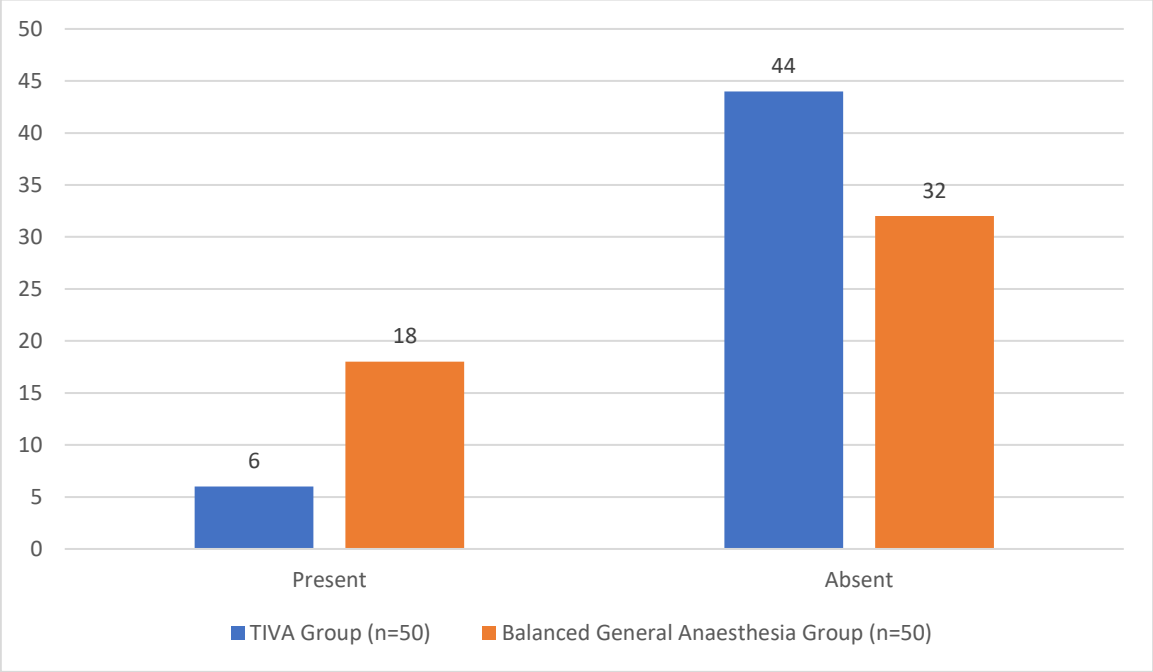
There is significant difference in mean time to achieve discharge readiness between two groups of patients.

Group	n	Mean	SD	P value
TIVA Group	50	94.20	14.12	0.001
Balanced General Anaesthesia Group	50	109.96	17.52	
Total	100	102.08	18.43	

Table 3: Comparison of Time to Achieve Discharge Readiness Among Patients

Comparison of Postoperative Nausea and Vomiting (PONV) Among Patients

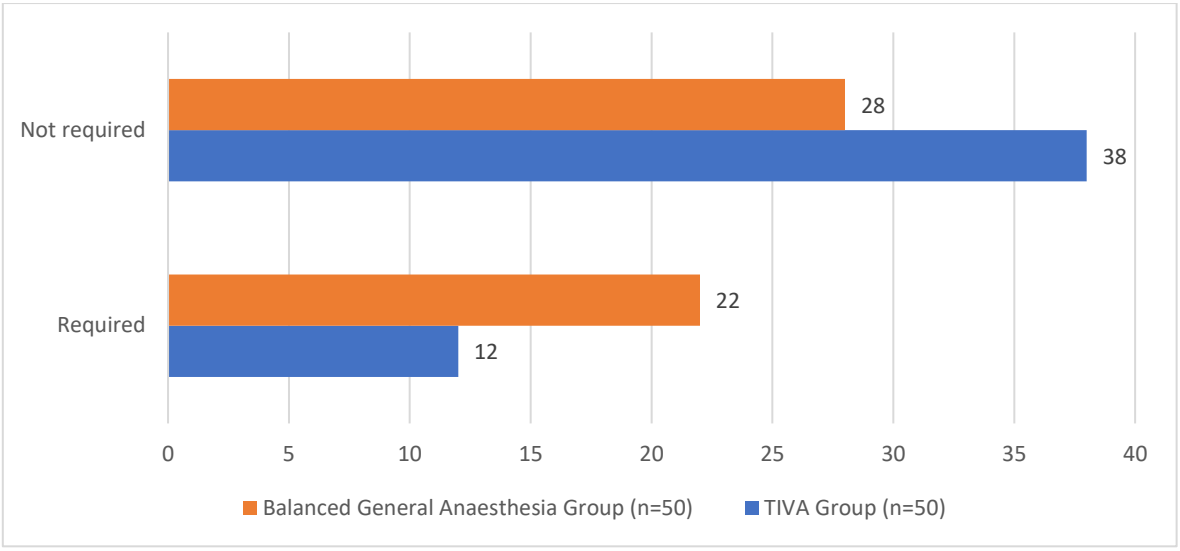
There is no significant difference in Postoperative nausea and vomiting.



Graph 1: Postoperative Nausea and Vomiting (PONV) Among Patients

Comparison of Postoperative Analgesic Requirement Among Patients

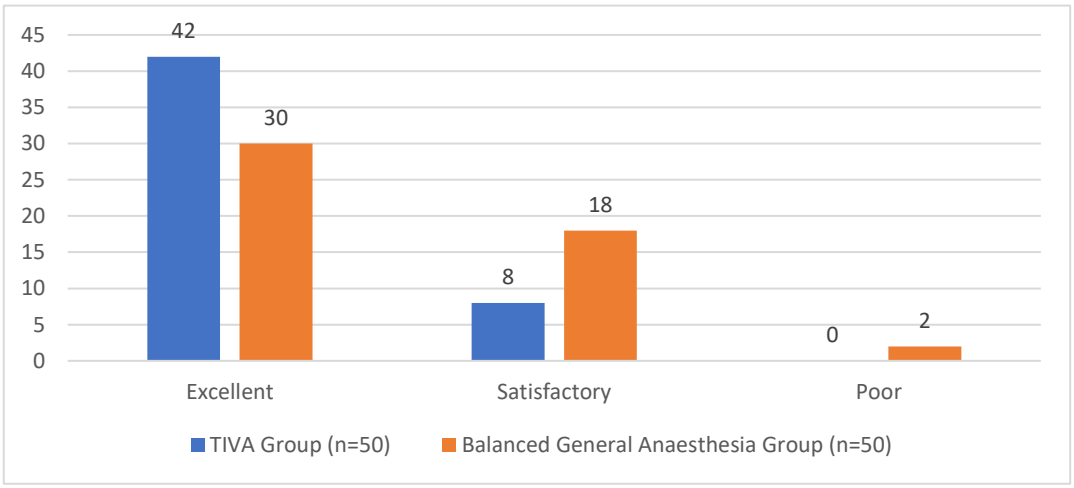
There is significant difference in postoperative analgesic requirement.



Graph 2: Postoperative Analgesic Requirement Among Patients

Comparison of Patient Satisfaction and Quality of Recovery Among Patients

There is significant difference in patient satisfaction and quality of recovery.



Graph 3: Patient Satisfaction and Quality of Recovery Among Patients

DISCUSSION

In the present study, patients receiving Total Intravenous Anaesthesia (TIVA) demonstrated significantly faster postoperative recovery than those receiving Balanced General Anaesthesia (BGA). The mean time to discharge readiness was 94.20 ± 14.12 minutes in the TIVA group compared with 109.96 ± 17.52 minutes **in** the BGA group, indicating that patients who received propofol-based TIVA achieved discharge readiness approximately 15.76 minutes earlier. This finding suggests that TIVA offers superior recovery characteristics, making it a suitable anaesthetic technique for ambulatory surgical procedures where rapid recovery and early discharge are essential.

The findings of the present study are in agreement with those of Gupta et al[9], who systematically reviewed the recovery profiles of propofol, isoflurane, sevoflurane, and desflurane in ambulatory anaesthesia. The authors reported that propofol-based anaesthesia was associated with a more favourable recovery profile, including faster emergence and earlier postoperative recovery, compared with inhalational anaesthetic agents. These observations support the shorter discharge readiness time observed in the present study among patients receiving TIVA.

Schraag et al.[10], in a systematic review and meta-analysis comparing propofol with inhalational agents for maintenance of general anaesthesia, reported that propofol-based anaesthesia was associated with improved postoperative recovery, more patient satisfaction, and a significantly lower incidence of postoperative nausea and vomiting. The authors concluded that propofol is an effective maintenance anaesthetic for both ambulatory and inpatient surgery because of its favourable recovery characteristics. These findings are consistent with the present study, in which patients receiving TIVA demonstrated faster recovery and better overall postoperative outcomes.

The improved recovery associated with TIVA can be attributed to the pharmacological characteristics of propofol, including rapid redistribution, high metabolic clearance, and minimal residual sedative effects. In contrast to volatile anaesthetic agents, propofol allows rapid restoration of consciousness and psychomotor function, thereby facilitating earlier achievement of discharge criteria. These properties make TIVA particularly advantageous for day-care surgical procedures, where efficient patient turnover and early home discharge are important clinical objectives.

Sneyd et al.[11], in their meta-analysis, showed that maintenance of anaesthesia with propofol significantly reduced the incidence of postoperative nausea and vomiting compared with inhalational anaesthetic agents. The present study did not observe a statistically significant difference in postoperative nausea and vomiting between the two groups, but the findings of Sneyd et al. support the antiemetic advantage of propofol. The absence of a significant difference in the present study may be explained by the relatively small sample size, variations in surgical procedures, routine administration of antiemetic prophylaxis, or the use of modern inhalational anaesthetic agents with improved recovery characteristics.

Overall, the findings of the present study, with the available evidence from previous systematic reviews and meta-analyses, indicate that propofol-based TIVA provides superior postoperative recovery compared with balanced general anaesthesia. Earlier recovery, shorter time to discharge readiness, favourable postoperative outcomes, and high patient satisfaction support the use of TIVA as an effective anaesthetic technique for ambulatory surgical practice.

CONCLUSION

The findings suggest that propofol-based TIVA provides a faster and smoother postoperative recovery profile, with earlier achievement of discharge criteria. The reduced recovery time may be attributed to the rapid onset and offset characteristics of intravenous anaesthetic agents, reduced residual sedation, and improved postoperative recovery parameters.

Thus, TIVA can be considered a favourable anaesthetic technique for facilitating early discharge readiness and improving perioperative efficiency when compared with balanced general anaesthesia.

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