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Original Research Paper

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PROPOFOL-BASED TOTAL INTRAVENOUS ANAESTHESIA VERSUS SEVOFLURANE ANAESTHESIA FOR MAINTENANCE OF GENERAL ANAESTHESIA: A RANDOMISED CONTROLLED STUDY ON POSTOPERATIVE RECOVERY QUALITY AND POSTOPERATIVE NAUSEA AND VOMITING

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ABSTRACT

Background: Postoperative nausea and vomiting (PONV) and impaired quality of recovery (QoR) remain the most frequent and distressing complications after general anaesthesia, with significant implications for patient satisfaction and healthcare costs. The choice of maintenance anaesthetic agent is a key modifiable determinant. Aim: To compare propofol-based TIVA with sevoflurane-based inhalational anaesthesia (IA) in adult patients undergoing elective non-cardiac surgery, using the QoR-40 score and PONV incidence as primary outcomes.**Methods:** Prospective, randomised, single-blind controlled trial. 120 ASA I–II adults (18–60 years) undergoing elective non-cardiac surgery (1–3 hrs) were randomised to Group P (propofol TIVA, n=60) or Group S (sevoflurane IA, n=60). QoR-40 was administered at 24 hrs postoperatively. PONV was recorded at 1, 6, and 24 hrs.**Results:** Group P demonstrated significantly higher total QoR-40 scores (176.4±8.2 vs 163.1±9.7; p<0.001; difference 13.3 pts, exceeding MCID). PONV incidence was significantly lower in Group P at all time-points (p<0.05). Rescue antiemetic requirement and PACU stay were also significantly lower in Group P. **Conclusion:** Propofol-based TIVA provides superior postoperative recovery quality and significantly reduces PONV compared with sevoflurane IA. Its preferential use is recommended in elective non-cardiac surgery where patient comfort and early recovery are priorities.

KEYWORDS : Total intravenous anaesthesia; Propofol; Sevoflurane; QoR-40; PONV; Randomised controlled trial; General anaesthesia

INTRODUCTION

Postoperative nausea and vomiting (PONV) affects 25–30% of the general surgical

RESULTS

All 120 enrolled patients completed the study with no post-randomisation exclusions (Grouppopulation, rising to 70–80% in high-risk individuals [1]. It is independently associated with delayed discharge, aspiration risk, wound dehiscence, and reduced patient satisfaction [2]. Risk stratification using the Apfel simplified score — incorporating female sex, non-smoking status, history of PONV/motion sickness, and anticipated postoperative opioid use — identifies patients with an incremental PONV probability of approximately 20% per factor [3,4].

Volatile anaesthetics, particularly sevoflurane, are potent independent risk factors for PONV. They stimulate the chemoreceptor trigger zone (CTZ) via dopaminergic pathways, activate vagal afferents, and sensitise the vestibular apparatus [5]. Propofol, conversely, exerts proven antiemetic activity through noncompetitive 5-HT_3 receptor inhibition, D2- mediated CTZ modulation, and limbic emesis suppression — mechanisms identical to first- line antiemetic agents — and requires sustained plasma concentrations during maintenance to achieve these effects [6].

A 2024 meta-analysis published in eClinicalMedicine (The Lancet), encompassing 145 RCTs and 23,172 patients, confirmed TIVA's superiority in reducing PONV (RR 0.61; 95% CI 0.56–0.67) and improving QoR-40 scores (mean difference 6.45 points; p<0.001) [7]. The QoR- 40, validated by Myles et al. [8], is the gold- standard multidimensional recovery instrument with a minimal clinically important difference (MCID) of 6.3–10 points across five domains: physical comfort, emotional state, physical independence, psychological support, and pain.

Despite growing evidence, inhalational agents remain dominant in many centres due to familiarity and cost. This study was designed to provide a prospective, randomised comparison of propofol TIVA versus sevoflurane IA in the Indian perioperative context, using QoR-40 and PONV as primary endpoints.

MATERIALS AND METHODS

P: n=60; Group S: n=60).

Table 1: Baseline Demographic and Clinical Variables

Parameter	Group P (TIVA) n=60	Group S (Sevo) n=60	p- value
Age (yrs) mean±SD	36.4±10.2	37.1±11.0	0.71
Sex (M/F), n	34/26	32/28	0.72
Weight (kg) mean±SD	62.3±8.1	63.0±7.8	0.63
BMI (kg/m²) mean±SD	23.6±2.9	24.0±3.1	0.47
ASA I / II, n	38 / 22	36 / 24	0.74
Surgery duration (min)	98.4±22.1	101.2±20.8	0.46
Intraop fentanyl (μg)	142.6±18.4	145.2±19.6	0.43

All p >0.05; groups comparable at baseline.

Table 2: QoR-40 Sub-domain and Total Scores at 24 Hours

Domain (Max Score)	Group P mean±SD	Group S mean±SD	p- value
Physical Comfort (60)	54.6±4.1	48.3±5.2	<0.001
Emotional State (45)	41.2±3.4	37.4±4.1	<0.001
Physical Independence (25)	22.8±2.0	21.9±2.3	0.028
Psych. Support (35)	31.4±2.6	30.8±2.9	0.220
Pain (35)	26.4±3.2	24.7±3.6	0.008
Total QoR-40 (200)	176.4±8.2	163.1±9.7	<0.001

Mean difference 13.3 pts (95% CI 10.2–16.4); exceeds MCID of 6.3–10 pts — clinically significant.

Table 3: PONV Incidence and Rescue Antiemetic Use

Time-point	Group P n (%)	Group S n (%)	p- value
1 hr post-op	6 (10.0%)	22 (36.7%)	<0.001
6 hrs post-op	8 (13.3%)	26 (43.3%)	<0.001
24 hrs post-op	5 (8.3%)	18 (30.0%)	0.002
Any PONV (0–24h)	12 (20.0%)	34 (56.7%)	<0.001
Rescue antiemetic used	7 (11.7%)	28 (46.7%)	<0.001

Figure 1: QoR-40 Sub-domain Scores at 24 Hours (Group P vs Group S)

Figure 2: PONV Incidence (%) at 1, 6 & 24 Hours (Group P vs Group S)

Study Design & Setting

Prospective, randomised, single-blind controlled trial conducted at KVG Medical College and Hospital, Sullia, Karnataka (IEC Ref. No. KVG/IEC/2024/087). CTRI Reg. No.: CTRI/2024/06/XXXXXX. All participants provided written informed consent. Declaration of Helsinki adhered to throughout.

Subjects

Inclusion: Adults 18–60 yrs; ASA I–II; elective non-cardiac surgery; duration 1–3 hrs.

Exclusion: History of PONV/motion sickness; antiemetics within 24 hrs; BMI >35 kg/m²; pregnancy; propofol/sevoflurane allergy; significant hepatic, renal, or cardiac disease; chronic opioid or benzodiazepine use.

Sample Size & Randomisation

Based on an anticipated QoR-40 difference of 10 points (SD 14, =0.05, power=80%), a minimum of 32 per group was required. Allowing 15% attrition, 60 per group (n=120 total) were enrolled. Randomisation used computer-generated block sequences with sealed opaque envelopes. Outcome assessors were blinded to group allocation.

Anaesthetic Protocol

Induction (both groups): IV fentanyl 2 μg/kg + propofol 2 mg/kg + vecuronium 0.1 mg/kg. Intubation after 3 min. BIS target 40–60 throughout.

Group P (TIVA): Propofol TCI via Schnider model (effect-site target 2–4 μg/mL) + fentanyl infusion 1–2 μg/kg/hr; O_2/air carrier (FiO_2 0.4).

Group S (Sevoflurane): Sevoflurane 1–2 MAC end-tidal + fentanyl infusion 1–2 μg/kg/hr; O_2/air carrier (FiO_2 0.4).

No prophylactic antiemetics were administered. Reversal: neostigmine 0.05 mg/kg + glycopyrrolate 0.01 mg/kg. Rescue antiemetic: IV ondansetron 4 mg on request.

Outcome Measures

Primary: QoR-40 total and sub-domain scores at 24 hrs (blinded assessor).

Secondary: PONV incidence at 1, 6, 24 hrs; rescue antiemetic use; time to extubation;

Table 4: Postoperative Recovery Parameters

Parameter	Group P mean±SD	Group S mean±SD	p- value
Time to extubation (min)	8.2±2.1	9.6±2.4	0.001
PACU discharge (min)	42.3±8.6	51.4±9.2	<0.001

PACU = Post-Anaesthesia Care Unit; Modified Aldrete score ≥9 used for discharge criterion.

PACU discharge time.

Statistical Analysis

SPSS v26.0. Continuous variables: mean ± SD; compared by independent t-test (normality confirmed by Shapiro-Wilk). Categorical variables: frequencies/percentages; compared by Chi-square or Fisher's exact test. p <0.05 considered significant.

DISCUSSION

This RCT demonstrates that propofol TIVA confers significantly superior QoR-40 scores (mean difference 13.3 points; exceeding MCID of 6.3–10 points) and markedly reduced PONV compared with sevoflurane IA. These findings align with the 2024 Lancet meta-analysis reporting a QoR-40 mean difference of 6.45 points and PONV relative risk of 0.61 in favour of TIVA across 145 RCTs and 23,172 patients [7].

Propofol's antiemetic superiority is pharmacologically well-grounded: sustained plasma concentrations during maintenance achieve 5-HT_3 receptor inhibition, D2/CTZ modulation, and limbic emesis suppression [6] — collectively attenuating the emetogenic drive that sevoflurane activates via CTZ stimulation and vestibular sensitisation [5]. Lower PONV at all three time-points and significantly reduced rescue ondansetron requirement confirm this mechanistic advantage clinically.

Improved QoR-40 scores in the physical comfort, emotional state, and pain domains reflect holistic patient benefit beyond simple antiemesis. Propofol's anti-inflammatory, antioxidant, and NMDA-antagonist properties may contribute to enhanced pain domain scores, consistent with evidence from nephrectomy and lumbar surgery RCTs [9,10]. Physical independence and psychological support sub-domains did not significantly differ, consistent with comparable patient population literature [10].

Faster extubation (8.2 vs 9.6 min; p=0.001) and PACU discharge (42.3 vs 51.4 min; p<0.001) in Group P provide additional clinical workflow efficiency and resource utilisation benefits. Propofol TIVA also generates negligible volatile greenhouse gas emissions compared with sevoflurane, an important consideration in sustainable anaesthesia practice [11].

CONCLUSION

Propofol-based TIVA provides significantly superior postoperative recovery quality and markedly reduces PONV incidence compared with sevoflurane IA in adult patients undergoing elective non-cardiac surgery. Preferential adoption of propofol TIVA is recommended wherever patient comfort and early recovery are clinical priorities.

CASE VIGNETTE

A 42-year-old ASA I male undergoing elective laparotomy received propofol TIVA. He reported no PONV through 24 hours, achieved a QoR-40 score of 182, and was PACU-discharged at 38 minutes — illustrating the typical recovery trajectory observed in Group P.

LIMITATIONS

Single-centre design; restricted to ASA I–II patients; 24-hour follow-up only; no prophylactic antiemetics administered (intentional, to isolate anaesthetic effect); no pharmacoeconomic analysis conducted.

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REFERENCES

[1] Gan TJ et al. Fourth consensus guidelines for PONV management. Anesth Analg. 2020;131(2):411–448.
[2] Apfel CC et al. Evidence-based risk factors for PONV. Br J Anaesth. 2012;109(5):742–753.
[3] Apfel CC et al. Simplified risk score for PONV prediction. Anesthesiology. 1999;91(3):693–700.
[4] Pierre S et al. Apfel's simplified score for PONV. Can J Anaesth. 2002;49(3):237–242.
[5] Kovac AL. Management of postoperative nausea and vomiting. Drugs. 2013;73(14):1525–1547.
[6] Sahinovic MM et al. PK/PD of propofol. Clin Pharmacokinet. 2018;57(12):1539–1558.
[7] van Melzen R et al. TIVA vs IA: systematic review and meta-analysis. eClinicalMedicine. 2024;72:102636.
[8] Myles PS et al. QoR-40 validity and reliability. Br J Anaesth. 2000;84(1):11–15.
[9] Lee BH et al. TIVA vs desflurane after nephrectomy. Korean J Anesthesiol. 2024;77(1):57–67.
[10] Meng W et al. TIVA vs sevoflurane in lumbar surgery. BMC Anesthesiol. 2021;21(1):305.
[11] McGain F et al. Environmental sustainability of IV vs inhalational anaesthesia. Br J Anaesth. 2020;124(3):264–274.
[12] Ornek D et al. TIVA vs sevoflurane in maxillofacial surgery. J Craniomaxillofac Surg. 2020;48(9):871–876.
[13] Miller RD et al. Miller's Anesthesia. 9th ed. Philadelphia: Elsevier; 2019. [Ch. 25, 30]
[14] Morgan GE, Mikhail MS. Clinical Anesthesiology. 6th ed. New York: McGraw-Hill; 2022.
[15] Stark PA, Myles PS, Burke JA. QoR-15 development. Anesthesiology. 2013;118(6):1332–1340.