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Comparison of recovery characteristics and postoperative nausea and vomiting with total intravenous anesthesia with propofol versus inhalation anesthesia with Isoflurane for short surgical procedures: A randomized controlled study

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Abstract
OBJECTIVE: *The aim of this study was to determine the effects of total intravenous anesthesia with propofol and fentanyl compared with those of isoflurane and fentanyl on recovery characteristics, postoperative nausea and vomiting (PONV) and duration of hospitalization.*
METHODS: *Patients classified as ASA status I or II undergoing elective short surgical procedures, with duration up to one hour were enrolled in the study. Patients were randomly assigned at a 1:1 ratio to receive total intravenous anesthesia with propofol (1.5–2.0 mg/kg) and fentanyl (1.5 μg/kg) or isoflurane (0.8%–1.2%), nitrous oxide and fentanyl (1.5 μg/kg). Extubation time, recovery time, PONV, postoperative antiemetic requirement and duration of hospitalization were recorded.* ***Results:*** *120 patients completed the study. Recovery time was significantly shorter in the propofol group (n = 60) compared with the isoflurane group (n = 60) (7.0 [0.77] vs 8.5 [0.66] min, respectively; P< 0.005). In the propofol group, significantly fewer patients had vomiting episodes compared with those in the isoflurane group (4 [6.7%] vs 32 [53.3%]; P< 0.005). The duration of hospitalization after surgery was significantly shorter in the propofol group than in the isoflurane group (22.60 [3.6]vs. 25.5 [4.1]hours; P = 0.0001).*
CONCLUSION: *Total intravenous anesthesia with propofol and fentanyl was associated with a significantly reduced rate of PONV , shortened recovery time and duration of hospitalization, compared with isoflurane and fentanyl in these patients undergoing surgery up to one hour .*
Keywords: *total intravenous anesthesia, propofol, fentanyl, isoflurane, short surgical procedures*

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I. Introduction

Postoperative nausea and vomiting (PONV) and delayed recovery are the most common reasons for prolonged hospitalization in surgical procedures up to one hour duration. Anesthetic techniques that shorten these effects will help in early discharge from hospital. Total intravenous anesthesia with propofol and fentanyl is increasingly used in short surgical procedures because of its suggested beneficial effects on recovery time and PONV . Studies have indicated that propofol and fentanyl were associated with reduced PONV, duration of hospitalization, and recovery time; however, most of the data were obtained from studies performed on nonelected patients. A meta-analysis found that there was insufficient evidence to conclude that propofol and fentanyl reduced PONV.6-9 This study was conducted to investigate the effects of propofol and fentanyl total intravenous anesthesia on PONV, recovery time, and duration of hospitalization after short surgical procedure compared with the outcomes of patients administered isoflurane and fentanyl anesthesia.

II. Patients And Methods

This study was approved by the hospital Ethics Committee. Patients provided written informed consent before participating in the study. All patients, classified by the American Society of Anesthesiologists as physical status I or II, undergoing elective surgery due tofibroadenoma breast, male gynecomastia, lipoma ,pilonidal sinus and gynaecologicallaproscopic procedures were assessed for inclusion in the study. Patients were recruited for enrollment preoperatively on the day of surgery. Exclusion criteria were allergy to any of the medications used in the study, current symptoms of nausea or vomiting, or treatment with an antiemetic drug or duration of surgery more than one hour. Demographic data, including age, weight, and history of PONV or

motion sickness, were recorded. Patients were randomized into 2 groups. Randomization was performed by a statistical expert who was blinded to the study design. All patients were premedicated with IV midazolam 1 mg, 15 minutes before the induction of anesthesia. In the operating room, patients underwent routine monitoring, including blood pressure (BP), ECG, oxygen saturation, and end-tidal carbon dioxide. In the propofol group, anesthesia was induced with IV fentanyl 1.5 µg/kg and then propofol at 1.5 to 2.0 mg/kg was administered. To maintain anesthesia, propofol was initiated at 140-200µg/kg/min and was reduced after 10 min to 100-140 µg/kg/min . In the group receiving isoflurane, anesthesia was induced with propofol 1.5 to 2.0 mg/kg and fentanyl 1.5 µg/kg and maintained with isoflurane 0.8% to 1.2%. After sufficient anesthesia was achieved, muscle relaxation was achieved with IV vecuronium bromide 0.8-1.0 mg/kg. Endotracheal intubation was performed after 3 min in both groups. Both groups were mechanically ventilated , however where the TIVA group received only oxygen the isoflurane group received 60%nitrous oxide in oxygen. End-tidal carbon dioxide was maintained between 35 to 40 mm Hg in both groups. Antiemetic prophylaxis was not administered to any patient. At the end of surgery, anesthetic agents were stopped and neuromuscular blockade was reversed with IV neostigmine 2.5 mg and glycopyrrolate 0.4 mg. The time of discontinuation of the anesthetic agents and the extubation time were recorded. The time at which each patient responded to verbal commands (recovery time) was recorded. Postoperative analgesia was initially provided with titrated IM pethidine 5 mg/kg. If PONV occurred, patients were administered IVprochlorperazine 10 mg. Patients were blinded to randomization and staff in the postanesthesia care unit collecting the data were blinded to the study protocol. The duration of hospitalization, and number of PONV episodes requiring antiemetic treatment until the time of recovery were recorded. Assessments were recorded 15 minutes and 2, 6, 12,20 and 24,hours after surgery. Postoperative nausea and vomiting were recorded from the medical chart during the hospitalization process. AEs (eg, hypotension, allergic reactions, respiratory depression, agitation, or delirium) were recorded during surgery and hospitalization.

III. Statistical Analysis

We calculated that 60 patients per group were required to provide 80% power ($\beta = 0.2$) based on the intent to detect a reduction in the incidence of PONV, or the requirement for antiemetic treatment, from 60% with inhalational anesthesia with isoflurane and fentanyl to 33% with propofol and fentanyl in the intent-to-treat population. The primary outcome was the incidence of complete response, defined as the absence of nausea and vomiting. The Mann-Whitney and $\chi 2$ tests were used for statistical analysis. $P < 0.05$ was considered statistically significant. Data were expressed as mean (SD). Statistical analyses were calculated using SPSS version 20.0 (SPSS Inc., Chicago, Illinois).

IV. Results

128 patients were assessed for inclusion in the study; 8 were excluded because because duration of surgery exceeded one hour. Therefore, 120 patients (68 women, 52 men) completed the study (Table I). There were no significant differences in patient characteristics, perioperative management, or postoperative pain management between the propofol (n = 60) and the isoflurane (n = 60) groups. Surgery and anesthesia administration were uneventful in all patients

Table 1. Demographic and clinical characteristics of study patients (N=120)

Characteristics	Propofol Group (N=60)	Isoflurane Group (N=60)
Age, mean ,Y	55	56.2
Sex		
Female	35	33
Male	25	27
Weight ,mean,Kg	54.4	65.7
ASA I/II	*44/16*	46/14
Mean Operating Time Min	36	36.6
Mean AnaesthesiaTime Min	48	49

ASA = American Society of Anesthesiologists. *No significant between-group differences were found. Mean operating time and mean anesthesia time did not differ significantly between the 2 groups (Table I)
Mean arterial BP was not significantly different; 101.40 mm Hg (systolic/diastolic, 129/82 mm Hg) in the propofol group and 109.70 mm Hg (126/94 mm Hg) in the isoflurane group. Hypotension (defined as BP <90/60 mm Hg) occurred in significantly more patients in the propofol group than in the isoflurane group 16 vs. 2, respectively; P <0.005). Six patients with hypo- tension in the propofol group received IV ephedrine 5 mg. Mean time to extubation was significantly shorter in the propofol group than the isoflurane group (5.40 [4.20] vs 6.80 [0.68] min, respectively; P < 0.05). Recovery time was significantly shorter in the propofol group than the isoflurane group (4.00 [0.77] vs 6.20 [0.66] min; P < 0.05) . Twenty four patients (40.0%) in the propofol group and thirty patients (50%) in the isoflurane group had nausea during the first 24 hours after surgery, although the difference was not significant. The number of patients who required antiemetic treatment in the first 24 hours after surgery was similar in the propofol group and the isoflurane group (18 [30.0%] vs 22 [36.6%], respectively). Significantly fewer patients in the propofol group had vomiting episodes than in the isoflurane group (4 [6.7%] vs 28 [46.67%]; P < 0.005). Significantly fewer patients in the propofol group required analgesic medication in the first 24 hours after surgery than in the isoflurane group (20 [33.3%] vs 30 [50.0%]; P < 0.005). The mean (SD) VAS score for pain in the propofol group was significantly lower at15 minutes compared with the isoflurane group (5.96 [0.71] vs 8.63 [1.03] min, respectively; P = 0.01) and at 1 hour after surgery (8.13 [1.50] vs 12.70 [0.67]; P < 0.01). Four patients (6.7%) in the propofol group and 16 patients (26.7%) in the isoflurane group required analgesic treatment as rescue medication during the first 4 hours after surgery. After 4 hours, none of the patients in either group required antiemetic medication or analgesic treatment.

Table II Recovery characteristics by treatment group in these patients receiving total intravenous anesthesia with propofol versus inhalation anesthesia with isoflurane for short surgical procedure.

Characteristics (n = 60)	Propofol Group (n = 60)	Isoflurane Group
Time to extubation, min	6.40(4.2)	7.60(0.68)
Recovery time, min	7.00 (0.77)	8.50 (0.66)
Pain VAS† at 15 min‡	2.96 (0.71)	4.63 (1.03)
Pain VAS† at 60 min§	4.13 (1.50)	5.70 (0.67)

------VAS = visual analog scale.
*P < 0.05.
†Scale: 0 = no pain to 10 = unbearable pain.
‡P = 0.01.
§P < 0.01.

Therefore, an oral diet was resumed earlier in the propofol group. The duration of hospitalization after surgery was significantly shorter in the propofol group than in the isoflurane group (22.6 vs. 25.5 hours; P = 0.03) . No patient in either group remained hospitalized >24 hours after surgery because of prolonged nausea and vomiting. Respiratory depression or agitation was not reported by any of the patients. Although 2 patients had fever on day 1 no patients reported headache or lumbar pain.

V. Discussion

The present study found that total intravenous anesthesia with propofol and fentanyl was associated with significantly reduced PONV and analgesic consumption, shortened recovery time and duration of hospitalization, in these patients undergoing short surgical procedures who completed the study when compared with anesthesia with isoflurane and fentanyl. During surgery, anesthesia was uneventful with both anesthethic techniques. However, systolic and diastolic BP were significantly more stable in the isoflurane group. This finding is consistent with the findings of other studies. Hypotension after propofol anesthesia is an expected event and the incidence has been reported to be between 10% and 55%.PONV has been the most common cause of prolonged hospitalization after samedaysurgery, and is experienced in 30% to 50% of the cases In the present study, significantly more patients in the isoflurane group experienced PONV and required antiemetic drug treatment compared with the propofol group (P < 0.001). Sneyd J R 1 reported that propofol as maintenance agent was associated with significantly reduced PONV compared with inhalation anesthesia in patients undergoing short surgical procedures. However, if propofol was substituted for volatile anesthetics, the risk for PONV was reduced by only ~20%. Juckenhöfel et al 16 investigated the effect of propofol and fentanyl,

and balanced anesthesia with sevoflurane in laparoscopic surgery. No significant between-group difference in shivering or PONV was reported. In the present study, we compared isoflurane anesthesia with propofol and fentanyl and found a significantly reduced incidence of PONV. The mean duration of hospitalization was significantly shorter in the propofol group than in the isoflurane group (both, $P < 0.001$). Although the improvement in recovery time in the propofol group in contrast to the isoflurane group may not be important clinically, we suggest that the other advantages (especially reduced PONV and early discharge) support the use of propofol and fentanyl in patients undergoing short procedures. Hypotension is a commonly expected AE associated with propofol and fentanyl; a variety of AEs, including convulsions, seizures, chest tightness, involuntary muscle activities, and tonic-clonic movements, have been observed with propofol.,16, Line infection due to intravenous catheterization is another complication.16 Propofol infusion syndrome involves severe metabolic acidosis, rhabdomyolysis, renal failure, and cardiac failure in association with prolonged propofol infusion, critical illness, and concurrent administration of catecholamines and steroids.17 Although this condition is not expected with short-term infusion, caregivers should be aware of this possible complication because of the high mortality rate associated with it. The major disadvantage of propofol and fentanyl, as reported in the current literature, is its cost.1, 15, 16. We did not assess the cost-effectiveness of propofol and fentanyl, which is a limitation of this study. Another limitation was the small size of the study groups. However, we believe that the lower consumption of antiemetic medications during hospitalization and in the post discharge period, the shorter duration of hospitalization, and the lower rate of post discharge readmission to the hospital in the propofol group should be considered benefits of propofol and fentanyl that help reduce the overall costs associated with these surgeries.

VI. Conclusion

Total intravenous anesthesia with propofol and fentanyl was associated with significantly reduced PONV and analgesic consumption, shortened recovery time and duration of hospitalization without significant AEs compared with isoflurane and fentanyl in these patients undergoing short surgical procedures who completed the study.

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