

ANESTHESIA FOR LAPAROSCOPIC
CHOLECYSTECTOMY: COMPARATIVE
EVALUATION OF

- Desflurane/Sevoflurane vs. Propofol -

GULCAN ERK^{*}, GULAY ERDOGAN^{*}, FAZILET SAHIN^{*},
VILDAN TASPINAR^{*} AND BAYAZIT DIKMEN^{*}

Summary: Laparoscopic techniques, have rapidly increased in popularity because of its various benefits. They are widely used in day-case surgical operations and are extensively published. However, postoperative nausea vomiting (PONV) is a commonly observed phenomenon after laparoscopic procedures. Its occurrence may increase depending on the anesthetic techniques used. Despite the fact that the use of propofol and the new low solubility inhalation anesthetics, lead to faster induction and recovery, their effects on PONV is not sufficiently known. Therefore, the aim of this study is to compare the effects of various anesthetic drugs on recovery characteristics and PONV.

Following informed consent, 300 ASA I-III patients scheduled for laparoscopic cholecystectomy were investigated.

Anesthesia was induced by 1.5 μgkg^{-1} fentanyl, 0.03 mgkg^{-1} midazolam, 1.5 mgkg^{-1} propofol and 0.01 mgkg^{-1} vecuronium for all patients. Anesthesia was maintained with desflurane in group D (n = 100), sevoflurane in group S (n = 100) and propofol infusion in group P (n = 100), beside 50% N₂O/O₂ ventilation. All patients were given 4 mg ondansetron and 8 mg dexamethazone iv for preventing PONV, ten minutes

From Ankara Numune Training and Research National Hospital, Ankara, Turkey.

* MD.

Corresponding Author: Gulcan Erk, Ziya Bey Cad. II. Sok. Yonca Sit. B BL. D 4 06520, Balgat/Ankara, Turkey. Phone: 0 90 312 2870006, 00 90 312 3103030/1150. Fax: 00 90 312 4270467. E-mail: gulcanerk@Hotmail.com

before the end of surgery. At the end of the operation, times for extubation, eye opening, orientation, sitting and walking, and the need of ondansetron in post anesthetic care unit, were recorded. Also, PONV was observed and recorded as early period (first 4 hours) and late period (4-24 hours).

Extubation and eye opening times were meaningfully lower in group D. However, no significant differences were observed in orientation, sitting and walking times and PONV among the three groups. All patients who had PONV were women. A correlation was found between PONV and body weight.

Even though there were no statistically significant differences among the groups regarding PONV, the number of patients who had PONV in group P was lower. Early recovery time was shortest in group D, while delayed recovery time had no differences. It may be said that these anesthetic drugs have no statistically significant difference for PONV and delayed recovery.

Key Words: General Anesthesia, PONV, Laparoscopic Cholecystectomy.

Introduction

Postoperative nausea and vomiting (PONV) is known to become more frequent depending on anesthetic methods, personal characteristics of patient and operation, even though the actual rationale has not been identified yet¹. Since PONV, observed with 40-75% occurrence rate after laparoscopic surgery is increasing, the postoperative stay in hospital, the determination of antiemetic and anesthetic methods for its prevention and treatment, have become a focus for recent research activities²⁻⁵.

For day-case anesthesia applications, the use of anesthetics that provide fast and smooth induction, allowing fast changes in intensity while maintaining anesthesia and early recovery without postoperative side effects, are suggested⁶. Considering these characteristics, for fast induction and early recovery based on low blood/gas partition coefficients, new inhalation agents are being used as alternatives to

propofol in day-case anesthetic applications^{6,7}. Despite the fact that there are many comparative studies regarding propofol and inhalation agents, for the effects of PONV and on recovery criteria^{1,6-8}, there are not much regarding desflurane, sevoflurane and propofol³.

In this study, the effects of desflurane, sevoflurane and propofol, agents frequently used in day-case surgery on recovery and PONV in laparoscopic cholecystectomy, is comparatively investigated.

Material and Method

After procuring the consent of Hospital Ethic Committee, 300 cases (ASA I-III), scheduled for laparoscopic cholecystectomy, were randomly divided into three groups of 100 each. No case with motion disease, history of PONV, obesity or menstruation was included in the study.

To decrease intraoperative and postoperative opioid need, known to increase the PONV risk, all cases received im diclofenac sodium for providing preemptive analgesia 30 minutes prior to operation. Ten minutes before the operation, 0.03 mgkg⁻¹ iv midazolam and sedative premedication was administered.

In all cases, anesthesia was induced with 1.5 µgkg⁻¹ iv fentanyl, 1.5 mgkg⁻¹ iv propofol and 0.1 mgkg⁻¹ iv vecuronium following which endotracheal intubation was performed. At end of operation, a gastric catheter was inserted to evacuate gastric contents.

Anesthesia was maintained with 6 mgkg⁻¹ hr⁻¹ (100 µgkg⁻¹ min⁻¹) propofol infusion and 50% N₂O/O₂ ventilation in group P (n = 100), and with sevoflurane and desflurane (in concentrations providing an average of 1.3 MAC value together with 50% N₂O/O₂ ventilation) in groups S (n = 100) and D (n = 100), respectively. During maintainance, if the hemodynamic values of patients varied more than 15% from pre-induction values, anesthetic concentrations and infusion rates were changed (50-150 µgkg⁻¹ min⁻¹ propofol, 2-8% desflurane and 0.5-3% sevoflurane) to keep them within ± 15% range³.

In all cases, 5 minutes before extubation, 4 mg iv ondansetron and 8

mg iv dexametazone was administered and nausea-vomiting prophylaxis carried out⁹.

To minimize the risk of residual neuromuscular blockage after the operation, reversal was accomplished with 0.01 mgkg⁻¹ neostigmine and 0.01 mgkg⁻¹ atropine⁹.

The following times, as measured from time of discontinuation of anesthetic gases and propofol infusion, were recorded:

- For Early recovery criteria-extubation, eye opening
- For Intermediate recovery-place and time orientations (e.g. date of birth, whereabouts)
- For Late recovery criteria-sitting, walking without help

Postoperative nausea and vomiting were recorded in two stages: early period (0-4 hours) and late period (4-24 hours), separately.

Patients with nausea were asked to identify the level of their nausea on the scale of 0 to 10. Patients who scaled their feelings as level 4 or more, received 4 mg iv ondansetron. Patients with vomiting also received 4 mg iv ondansetron and their postoperative antiemetic needs were recorded.

Statistically, the average values of the groups were used with \pm SD values. The analysis of recovery criteria, differences among groups were investigated by ANOVA variant analysis. For criteria identified as different for groups, Duncan test is used to determine the group which creates the difference.

Postoperative nausea-vomiting (PONV) and postoperative antiemetic needs were analyzed with Chi-Square test. Mann-Whitney U test was used to determine the relation between the PONV and weight, age and gender, regardless of the anesthetic agent used.

Results

Demographic data revealed no identified statistical differences among three groups (Table I).

Table I
Demographic data

	Group P (n = 100)	Group D (n = 100)	Group S (n = 100)	P Value
Age (year)	54.08±13.6	50.28±12.34	51.28±14.08	0.584
Weight (kg)	71.16 ± 12.3	72.12 ± 12.6	71.08 ± 12.8	0.948
Sex (F/M)	55/45	46/54	47/53	
Operating time (min)	58.76 ± 25.19	75.76 ± 26.52	71.32 ± 20.91	0.058
Bile leak spillage (n)	16% (n = 16)	0% (n = 0)	4% (n = 4)	0.062

The recovery criteria (early, intermediate and late) is listed in Table II. As noted, in the as early recovery criteria (times for extubation and eye opening) displayed differences among groups. However, no differences were observed in the intermediate recovery criteria (times for correct declaration of place and time orientation) and none in the late recovery criteria (Times for sitting and walking without help). The times for extubation and eye opening were meaningfully longer for group P cases than groups S and D ($p < 0.05$).

Even though the postoperative antiemetic need was observed to be 8% (n = 8) in group P, 28% (n = 28) in group D and 20% (n = 20) in group S; statistically significant differences were not identified (Table II).

Table II
Recovery times and need for antiemetic treatment

	(min)	Group P (n = 100)	Group D (n = 100)	Group S (n = 100)	P value
Early Recovery	Extubation	6.24 ± 3.15*	2.27 ± 1.6	4.16 ± 2.87	0.00
	Eye opening	9.44 ± 4.16	6.44 ± 2.55*	8.04 ± 3.59	0.01
Interm. Rec.	Orientation	15.56 ± 7.28	13.04 ± 5.34	16.72 ± 8.66	0.19
Late Recovery	Time to sit	54.80 ± 16.92	58.00 ± 24.36	54.00 ± 24.86	0.80
	Time to walk	539.80 ± 279.87	496.64 ± 218.80	430.32 ± 215.75	0.27
Need for antiemetic (n)		8 (8%)	28 (28%)	20 (20%)	0.18

*: $p < 0.05$; Compared with the other groups

Similarly, while in the early period (0-4 hr) postoperative nausea was observed 16% (n = 16) in group P, 32% (n = 32) in group D and 36% (n = 36) in group S, no statistically significant differences were identified ($p>0.05$) (Table III). Postoperative nausea is decreased in late period (4-24 hr) to 4% (n = 4), 8% (n = 8) and 4% (n = 4) for groups P, D and S, respectively, but no differences among groups were identified ($p>0.05$) (Table III).

Table III
Ratio of PONV

		Group P (n = 100)	Group D (n = 100)	Group S (n = 100)	Total (n = 300)	P Value
0-4 hr	Nausea	16 (16%)	32 (32%)	36 (36%)	84 (28%)	0.249
	Vomiting	4 (4%)	16 (16%)	12 (12%)	32 (10.7%)	0.376
4-24 hr	Nausea	4 (4%)	8 (8%)	4 (4%)	14 (5.3%)	0.768
	Vomiting	0	4 (4%)	4 (4%)	8 (2.7%)	0.598

Vomiting was observed in 4% (n = 4) in group P, 16% (n = 16) in group D and 12% (n = 12) during early period (0-4 hr), and by 0%, 4% (n = 4) and 4% (n = 4) in groups P, D and S, respectively, during late period (4-24 hr), with no identified statistical differences.

All vomiting patients were women. The relation between the PONV and age, weight and operation length were analyzed independently from anesthetic methods by using Mann-Whitney U test. While no relations were identified regarding the PONV and age and operation length the possibility of increase in PONV due to increase in weight was statistically determined ($p<0.05$).

Discussion

Popularity of day-case procedures, comprising more than 50% of all operations, increases everyday^{10,11}. Some of the important reasons of popularity are the rapid early recovery, fast return to normal activities and early discharge¹². Although there were many studies on the subject, no

consensus was achieved on most the suitable agent and technique to be used¹⁰.

Propofol has been mentioned as the agent that provides the fastest and earliest recovery¹⁰. In a study that uses propofol-propofol, propofol-sevoflurane and sevoflurane-sevoflurane combinations for inducing and maintaining the anesthesia, respectively, no differences were found among the groups in terms of early, intermediate and late recovery¹³. In most of the studies that used propofol-propofol and propofol-desflurane combinations for inducing and maintaining anesthesia, desflurane groups were found to have faster early and intermediate recovery than propofol groups, while no differences were found among groups in late and psychomotor recovery^{4,15}.

In the present study, in our attempt to find the most suitable anesthetic method for PONV and recovery in laparoscopic cholecystectomy, it was apparent that despite the fact that the desflurane group lead to early recovery with respect to other groups, no differences were observed among groups regarding the intermediate and late recovery criteria. Though eye opening on 5th or 6th minute does not mean much unless it reduces the time for transfer of patient to second stage recovery unit or time for discharge¹⁰. Then these three anesthetics have no differences in recovery from laparoscopic cholecystectomy.

Although PONV has never become a chronic problem and a threat to life, it may become a significant complication by reducing the patient's satisfaction and increasing costs. When patients being prepared for the operation are questioned about their worries, PONV is the first answer (49%), and postoperative pain, is second (27%)^{5,16}, are offered.

Although thiopental, methohexital and propofol can be used in daily anesthetic applications, propofol is more preferred due to low PONV incidences^{12,17}. Beside propofol, new, short duration inhalation anesthetics are also preferred in daily cases for their minimal side effects and fast recovery characteristics. Song et al³, in their study on effects of these three anesthetics on PONV and recovery concluded, similar to our study, that while speed of early recovery is statistically significant for desflurane, late recovery characteristics display no differences among

groups. Also, similar to our study, they observed more PONV cases in desflurane group but without any statistical significance.

While the PONV incidence is reported to be around 70% in laparoscopic surgery^{2,18}, both in Song's³ and in our study, the incidence did not exceed 35% on the average. In another study of Song et al⁴, in which prophylactic antiemetics were not used, they used propofol-sevoflurane and propofol-desflurane techniques in laparoscopic cholecystectomy cases and reported postoperative nausea and vomiting rates as 60% and 47% for sevoflurane and 55% and 47% for desflurane, respectively, with no significant differences among groups. The use of combined prophylactic antiemetic treatment, as was suggested in literature, may be considered as effective reason of low observance rate of PONV both in our study as well as in the study of Song et al^{4,9,19}.

PONV, observed to be 3-4 times more in women than men, has been reduced from 73% to 34% in laparoscopic surgery by the use of prophylactic antiemetic treatment¹⁸. In our study, all the cases of vomiting consisted of women, and an early overall evaluation, disregarding the groups, revealed that nausea and vomiting ratios are kept as low as 28% and 10.7%, respectively.

It has been suggested that PONV risk may be reduced by propofol in ambulatory surgery, but it has not been statistically proven¹⁰. Tramer²⁰, reported that propofol may reduce PONV risk in the absence of prophylactic antiemetic treatment in the high PONV risk cases. In this study, in which prophylactic antiemetic treatment is used for high risk groups, PONV is observed less in propofol group without any statistical difference.

In conclusion, even though early recovery is faster with desflurane in laparoscopic cholecystectomy operations, it should be considered that these three anesthetics have no differences in terms of late recovery and PONV, keeping in mind that propofol may reduce PONV risk¹⁰.

References

1. APFEL CC, KRANKE P, KATZ MH, ET AL: Volatile anaesthetics may be the main cause of early but not delayed postoperative vomiting: a randomized controlled trial of factorial design. *Br. J. Anaesth*; 88(5):659-668, 2002.
2. JORIS LJ: Anaesthesia for laparoscopic surgery In: Miller RD *Anesthesia*. Vol. II, 5th edition. Philadelphia: Churchill Livingstone, p. 2013, 2000.
3. SONG D, JOSHI PG, FARCSI F, WHITE PF: Fast-track eligibility after ambulatory anesthesia: A comparison of desflurane, sevoflurane, and propofol. *Anesth Analg*; 86:267-73, 1998.
4. SONG D, WHITTEN CW, WHITE PF, YU SY, ZARATE E: Antiemetic activity of propofol after sevoflurane and desflurane anesthesia for outpatient laparoscopic cholecystectomy. *Anesthesiology*; 89:838-43, 1998.
5. TRAMER MR: A rational approach to the control of postoperative nausea and vomiting: evidence from systematic reviews. Part I. Efficacy and harm of antiemetic interventions, and methodological issues. *Acta Anaesthesiol Scand*; 45:4-13, 2001.
6. RAEDER J, GUPTA A, PEDERSEN FM: Recovery characteristics of sevoflurane-or propofol-based anaesthesia for day-care surgery. *Acta Anaesthesiol Scand*; 41:988-994, 1997.
7. DASHIELD AK, BIRT DJ, THURLOW J, KESTIN G, LANGTON JA: Recovery characteristics single-breath 8% sevoflurane or propofol induction of anaesthesia in day-case arthroscopy patients. *Anaesthesia*; 53:1062-1066, 1998.
8. KARLSEN KL, PERSSON E, WENNBERG E, STENQVIST O: Anaesthesia, recovery and postoperative nausea and vomiting after breast surgery. A comparison between desflurane, sevoflurane, and isoflurane anaesthesia. *Acta Anesth Scand*; 44:489-493, 2000.
9. TRAMER MR: A rational approach to the control of postoperative nausea and vomiting: evidence from systematic reviews. Part II. Recommendations for prevention and treatment, and research agenda. *Acta Anaesthesiol Scand*; 45:14-19, 2001.
10. POLLARD BJ, ELLIOTT RA, MOORE EW: Anaesthetic agents in adult day case surgery. *EJA*; 20:1-9, 2003.
11. TANG J, CHEN L, WHITE PF, ET AL: Recovery profile, costs, and patient satisfaction with propofol and sevoflurane for fast-track office-based anesthesia. *Anesthesiology*; 91:253-61, 1999.
12. PHILIP BK: What are the best agents for ambulatory general anesthesia, and are they cost effective? *Anesthesiol Clin N A*; 14(4):695-709, 1996.
13. FREDMAN B, NATHANSON MA, SMITH I, ET AL: Sevoflurane for outpatient anesthesia: a comparison with propofol. *Anesth Analg*; 81:823-828, 1995.
14. GRAHAM SK, AITKENHEAD AR: A comparison between propofol and desflurane anaesthesia for minor gynaecological laparoscopic surgery. *Anaesthesia*; 48:471-475, 1993.
15. MANSOUR LMH, PANDIT SK, KOTHARY SP, RANDEL GI, LEVY L: Desflurane versus propofol anesthesia: a comparative analysis in outpatients. *Anesth Analg*; 76:936-941, 1993.
16. EBERHART LHJ, MORIN AM, WULF H, GELDNER G: Patients preferences for immediate postoperative recovery. *Br. J. Anaesth*; 89:760-1, 2002.
17. JOO HS, PERKS WJ: Sevoflurane versus propofol for anesthetic induction: A meta-analysis. *Anesth Analg*; 91:213-219, 2000.
18. WANG JJ, HO ST, LIU HS, HO CM: Prophylactic antiemetic effect of dexametmasone in women undergoing ambulatory laparoscopic surgery. *Br J Anaesth*; 84:459-462, 2000.

19. WANG JJ, HO ST, UEN YH, LIN MT, CHEN KT, ET AL: Small-dose dexamethazone reduces nausea and vomiting after laparoscopic cholecystectomy: A comparison of tropisetron with saline. *Anesth Analg*; 95:229-232, 2002.
20. TRAMER M, MOORE A, MCQUAY H: Meta-analytic comparison of proflactic antiemetic efficacy for postoperative nausea and vomiting: propofol anaesthesia vs omitting nitrous oxide vs total iv anaesthesia with propofol. *Br J Anaesth*; 78:256-259, 1997.