ORIGINAL ARTICLE

Recovery Profile - A Comparison of Isoflurane and Propofol Anesthesia for Laparoscopic Cholecystectomy

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ABSTRACT

Objective: To compare the recovery profile in terms of time of extubation, eye opening, orientation and mobility and frequency of Postoperative Nausea and Vomiting (PONV) between propofol and isoflurane based anesthesia in patients undergoing laparoscopic cholecystectomy with prophylactic antiemetic.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Anesthesia, Civil Hospital and Dow University of Health Sciences, Karachi, from January to April 2007.

Patients and Methods: After informed consent, a total of 60 ASA I-II patients scheduled for laparoscopic cholecystectomy were divided in two equal groups I and P. Anesthesia in all patients were induced by Nalbuphine 0.15 mg/kg, Midazolam 0.03 mg/kg, Propofol 1.5 mg/kg and Rocuronium 0.6 mg/kg. Anesthesia was maintained with Isoflurane in group I and propofol infusion in group P, while ventilation was maintained with 50% N_2O/O_2 mixture in both the groups. All patients were given antiemetic prophylaxis. Hemodynamics were recorded throughout anesthesia and recovery period. At the end of surgery, times of extubation, eye opening, orientation (by modified Aldrete score) and mobility (recovery profile) were assessed. PONV was observed and recorded immediately after extubation, during early postoperative period (0-4 hours) and late period (4-24 hours). Antiemetic requirements were also recorded for the same periods in both the groups.

Results: Propofol provided faster recovery (extubation and eye opening times) and orientation in immediate postoperative period with statistically significant differences between the groups ($p<0.0001$). Recovery characteristics were comparably lower in group I. More patients achieved full points (8) on modified Aldrete score at different time until 30 minutes in group P. Postoperative nausea and vomiting in early and late periods were significantly reduced in group P. Moreover, requirement of rescue antiemetic doses were significantly lower in group P in 24 hours ($p<0.0001$).

Conclusion: In this series, recovery was much faster with earlier gain of orientation with propofol anesthesia compared to isoflurane in the early recovery periods. Propofol is likely to be a better choice of anesthesia because of its better anti-emetic property that persists long into postoperative period and reduces the risk of PONV.

Key words: *Propofol. Isoflurane. Anesthesia. Postoperative nausea and vomiting (PONV). Laparoscopic cholecystectomy (LC).*

INTRODUCTION

Postoperative Nausea and Vomiting (PONV) are common phenomenon after laparoscopic cholecystectomy, with a reported incidence from 53% to 72%.[1-2] Because of the multifactorial etiology of PONV and its occurrence associated with anesthetic techniques, there has been an increasing interest in using prophylactic antiemetic and anesthesia with intravenous anesthetic agents like propofol, with known antiemetic properties. A number of studies have shown the use of a multimodal approach incorporating both propofol and dexamethasone.[3-4] The combination is associated with less PONV compared with inhaled agents, especially in the early postoperative period.[5] The association of PONV with propofol is less than 10%. The recovery characteristics (awakening extubation and orientation) of propofol are comparable with new low solubility agents like desflurane and sevoflorane.[6-9] The availability and cost-effectiveness of the agent are important factors for frequent use in the local setup.[10-12]

This trial was therefore, designed to determine the recovery profile and frequency of PONV in early and late postoperative period of propofol compared to the commonly used isoflurane-balanced anesthesia along with PONV prophylaxis and nitrous/oxygen ventilation regimen in patients undergoing laparoscopic cholecystectomy.

PATIENTS AND METHODS

This quasi-experimental study was conducted from January to April 2007 at the Department of Anesthesia Civil Hospital/Dow University of Health Sciences, Karachi.

After obtaining approval from ethical committee of Dow University of Health Sciences and patient's informed consent, adults meeting the inclusion criteria, ASA-I and II, scheduled for laparoscopic cholecystectomy, were randomized to propofol and

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isoflurane groups. The patients undergoing anesthesia were asked to collect sealed envelopes mentioning the type of anesthesia. The process was supervised by the staff nurse, who had no responsibility with the study. Thirty patients were inducted in each group. Patients with history of motion sickness, nausea and vomiting and poorly controlled hypertension were excluded from the study.

All hypertensive patients were given their morning dose of anti-hypertensive medicines on the day of surgery. Intravenous line (I/V) was maintained with 18' gauge cannnula and standard monitors were placed. Baseline heart rate, blood pressures, and SaO_2 were recorded on arrival in operating room. Injection 0.03 mg/kg Midazolam i/v was administered 10 minutes before induction. Anesthesia was induced with intravenous injection of Nalbuphine at 0.15 mg/kg, Propofol at 1.5mg/kg, and Rocuronium at 0.6 mg/kg. Tracheal intubation was performed after 1.5 minutes. An orogastric tube was passed to aspirate the gastric contents in all patients. Anesthesia was maintained with 6 mg/kg/hour (100 µg/kg/min) continuous propofol infusion and 50% N_2O/O_2 ventilation in group P. Anesthesia in group I was maintained with isoflurane 1-2% and 50% N_2O/O_2 ventilation. If heamodynamic values were changed by more than 15% from baseline, anesthetic concentrations were readjusted (propofol 50-150 µg/kg/min, isoflurane 0.6-2.5%). Incisions were infiltrated with 0.25% bupivacaine to reduce the anesthetic concentrations of propofol and isoflurane to one-third of the maintenance doses and to decrease the need for postoperative opioids.[13] Dexamethasone 8 mg i/v, was administered to all patients 15 minutes before the end of surgery as prophylaxis of PONV. Residual neuromuscular block was antagonized with neostigmine 0.05 mg/kg and glycopyrolate 0.2 mg and anesthesia was stopped after restoration of spontaneous breathing. Once an adequate response and spontaneous breathing, regarded as adequate, was obtained the oropharynx was suctioned and trachea was extubated.

Extubation time was noted, which was defined as the time from discontinuation of anesthetics to the recovery of spontaneous respiration and removal of tracheal tube.[14] Patients were asked repeatedly in normal tone of voice to open their eyes. Time duration until spontaneous eye opening was noted. Recovery in term of orientation was assessed in the recovery room using a modified Aldrete scoring system in which activity with moving limbs purposefully scored 2, non-purposeful movements scored 1 and no movement scored 0. Similarly, respiration that needed maintenance of airway scored 0, shallow breathing scored 1, while deep breathing and coughing scored 2. Oxygen saturation <90%, 90-94% and >95% scored 0, 1 and 2 respectively. Consciousness level was assessed, unresponsiveness scored 0, responding to stimuli scored 1 and fully awake scored 2 according to the scoring system. Patients were evaluated for recovery every 10 minutes for the first half hour by anesthetic resident blinded from the anesthetic used. Full awakening was assessed by asking name, spouse name, address and whereabout. Blood pressure and heart rate were recorded at 3 minutes throughout surgery and early postoperative period and at 5 minutes interval in recovery room until patient was fully awake.

Postoperative nausea and vomiting in the surgical ward was assessed by the resident on duty who was also blinded to the method used. Therefore, this part of the study was double-blinded, while the assessment of the recovery was single blinded as the anesthetist was aware of the study group.

Postoperative nausea and vomiting was recorded in two stages, early (0-4 hours) and late (4-24 hours) separately. Grading of nausea was assessed on visual analogue score, 0 considered as no nausea and 10 as worst, grade more than four was taken as significant. Vomiting and nausea of grade more than four in patients were treated with i/v Injection Metaclopromide.

Statistical analysis was done by SAS version 8.2. Categorical data analysis was performed by chi-square or Fisher's exact test and continuous data assessed by t-test. A p-value of <0.05 was taken as significant.

RESULTS

The two groups were comparable in terms of patients demographic characteristics, duration of surgery, baseline heart rate systolic, diastolic blood pressure and SaO_2 (Table I). Among the associated comorbidities, hypertension was the most frequent in both the study groups with 16% and 10% patients having controlled hypertension in group P and group I respectively.

Table I: Demographic characteristics and baseline haemodynamics of patients in the study.

	Group P (n=30)	Group I (n=30)	p-value
Age (years)	43.3 ± 11.6	46.4 ± 2.14	0.9
Gender (female)	29 (97%)	29 (97%)	1.0
Weight (kg)	62.9 ± 7.67	63 ± 8.86	0.9
Height (foot/inches)	5.2 ± 0.17	5.1 ± 0.14	0.48
ASA I	44%	56%	0.29
ASA II	58%	42%	
Baseline systolic BP mmHg	132 ± 15.6	129.2 ± 13.9	0.468
Baseline diastolic BP mmHg	77.06 ± 10.2	80.53 ± 10.8	0.209
Baseline heart rate beats/min	74 ± 3.5	73 ± 10.6	0.595

Mean ± SD, P: Propofol, I: Isoflurane, BP: blood pressure, ASA: American Society of Anesthesiologists.

Propofol provided faster recovery (extubation and eye opening times) and orientation in immediate postoperative period. Extubation and eye opening times after termination of anesthesia displayed statistically significant differences between the groups (p<0.0001, Table II).

Table II: Recovery profile.

	Group P (n=30)	Group I (n=30)	p-value
Extubation time in minutes	2.75 ± 1.19	10.5 ± 2.50	<0.0001
Eye opening time in minutes	3.91 ± 1.38	14.43 ± 3.09	<0.0001

Mean ± SD of extubation and eye opening times in minutes.

Recovery characteristics in terms of activity, respiratory pattern, orientation in time, space and person evaluated after every 10 minutes interval found comparably lower in group I. In group P, 11, 27 and 30 patients, whereas 0, 8 and 23 patients from group I achieved full points at Aldrete score at 10, 20 and 30 minutes intervals respectively. Postoperative nausea and vomiting in early and late periods were noted separately. No patient vomited in propofol group, while 6 (20%) patient had vomiting and 2 patients complained of nausea in isoflurane group during early postoperative period (Figure 1). Fifty percent patients from group I, while only 3.3% from group P vomited in late period (Figure 2). Requirement of rescue antiemetic doses were significantly lower in group P. In group P, 97% patients did not require rescue antiemetic, while in group I, 50% patients demanded antiemetic in 24 hours (p<0.0001).

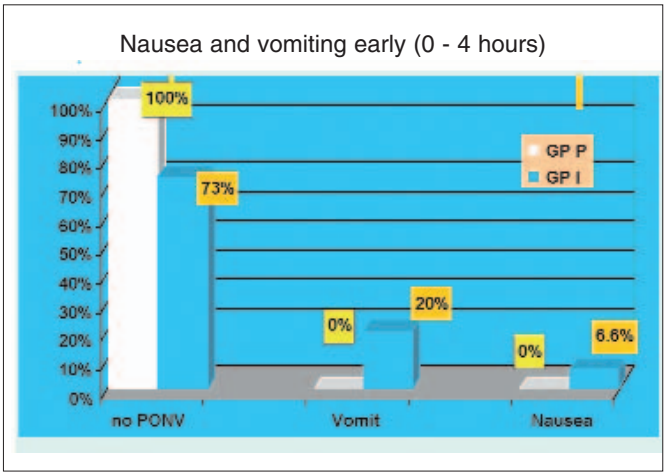

Figure 1: Percentage of patients in group propofol and isoflurane who had PONV in first 4 hours.

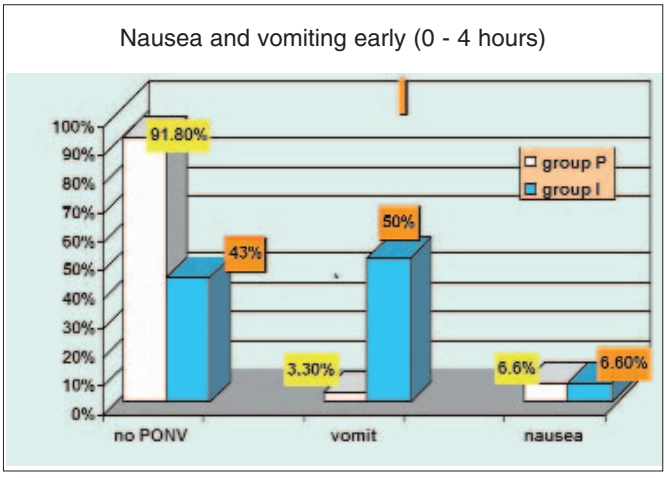

Figure 2: Percentage of patients in group propofol and isoflurane who had PONV during 5th and 24th hours.

DISCUSSION

In this study, maintenance of anesthesia with propofol was well-tolerated by patients undergoing laparoscopic cholecystectomy. Early recovery of the patients was significantly better in propofol group (p<0.0001).[12,14] Orientation in time, space and person were gained earlier by patients in group P, but after one hour, there was no difference in attaining full Aldrete scores in either group. Moreover, there were no significant differences found in late psychomotor recovery.

Collins *et al.* also found satisfactory anesthesia, with good recovery characteristics and a low incidence of postoperative nausea and vomiting with propofol when compared to isoflurane.[15] Gupta *et al.*[16] also compared propofol with isoflurane as well as with faster agents desflurane and sevoflurane. Although, they found significant differences in early recovery in terms of eye opening, when compared with propofol or isoflurane in favor of former, the magnitude of these differences was small (<5 min) and, therefore, of doubtful clinical relevance even in a busy ambulatory unit. The small differences between these anesthetics were seen following strict protocols and not allowing stepwise reduction in anesthetic concentration towards the end of surgery, which is normal in clinical practice. Pain relief was provided by local infiltration of port sites with 0.25% bupivacaine that allowed stepwise reduction in anesthetic concentration of both propofol and isoflurane without significant change in depth of anesthesia that we controlled according to heamodynamic status.[13]

Indeed, recent studies using bispectral index (BIS) as a guide to anesthetic depth have shown that a large number of patients can be fast-tracked, when anesthetic depth is monitored. We evaluated depth of anesthesia on the basis of the haemodynamic responses to pain as our institution lack BIS monitor service.[17] We asked the patients in late recovery period about awareness, no patient reported awareness during anesthesia in both the groups. Adequate depth of anesthesia and concomitant use of midazolam with induction agents prevented awareness during anesthesia. In the previous studies, definitive role of midazolam has been proven in providing anterograde amnesia during general anesthesia.[18] Similarly, Modesti *et al.* found earlier recovery time, better Aldrete score and better haemodynamics with propofol intravenous anesthesia versus balanced anesthesia with isoflurane in even prolonged kidney transplantations that demands more skillful practice and choice of anesthesia.[19]

There is another supporting study by de Grood *et al.* who compared propofol anesthesia with isoflurane with 4 different induction agents. They found rapid recovery and decreased incidence of PONV with propofol and rapid induction with propofol in inhalational anesthesia with isoflurane compared to other 3 induction agents showing its superiority.[20]

Postoperative nausea and vomiting are major concerns that affect patient's satisfaction. It also increases the cost of antiemetic treatment and hospital stay.[21] Although, Thiopentone sodium, Methohexital, and Propofol can be used in daily anesthetic, applications, yet Propofol is preferred for the induction and maintenance of general anesthesia in Laparoscopic Cholecystectomy (LC) due to low incidences of PONV.

There is a strong evidence to suggest that intravenous anesthesia with propofol reduces the PONV.[1,6-9] Meta analysis have also supported that propofol is associated with a lower incidence of PONV than inhalational anesthesia[12] for induction alone has no preventive effect on PONV. Therefore, the difference between the propofol and isoflurane anesthesia could be due to the emetogenic effect of volatile anesthetics, rather than only the antiemetic effect of propofol.

In this study, nitrous oxide was used in ventilation to avoid risk of awareness during anesthesia. Various studies have shown a higher incidence of PONV with N_2O,[22] but some have reported no increase in the incidence of PONV with the use of N_2O.[23] Infact, only the use of propofol and omission of N_2O is less effective than giving an antiemetic agent such as ondansetron, dexamethasone, or droperadol.[24]

Routine PONV prophylaxis has been recommended for patients at high risk for PONV. The reported incidence of nausea and vomiting is upto 70% in LC.[2] Although, PONV may become a significant complication not only by reducing the patient's satisfaction but also by increasing the cost.[25] This led to the suggestion of prophylactic use of antiemtic in laparoscopic cholecystectomy. Prophylactic use of dexamethasone can reduce the occurrence of PONV.[26]

Dexamethasone was used in both the groups before the end of the surgery. In early postoperative period, no patient had vomiting in the propofol group. Only 3.3% patients had vomiting and 6.6% complained of nausea in late period while 56% in isoflurane group had PONV. Goldman *et al.* also reported a 27% reduction in PONV with the use of dexamethasone.[27] Propofol is associated with a lower risk of postoperative nausea and vomiting, thus providing better patient's satisfaction.[6]

CONCLUSION

In this trial, recovery was much faster with earlier gain of orientation with propofol anesthesia compared to isoflurane, in the early recovery periods. Propofol is a better choice of anesthesia because of its antiemetic property that persists long during postoperative period. Furthermore, by using propofol inhalation anesthetic can be replaced, which further reduces the risk of postoperative PONV.

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