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COMPARATIVE STUDY OF DESFLURANE VERSUS SEVOFLURANE AND POST ANESTHESIA RECOVERY OF PATIENTS IN LAPAROSCOPIC CHOLECYSTECTOMY

Anesthesiology

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ABSTRACT

BACKGROUND: General anesthesia (GA) using agents like desflurane or sevoflurane are beneficial for early recovery especially for ambulatory procedures. The present study was undertaken to study the postoperative recovery of patients is faster with desflurane as compared to sevoflurane and to study the cognitive function (clear headedness) recovery of patients. **METHOD:** A total 60 patients of either sex, ASA grade I/II, age between 20-50 years, who were posted for elective laparoscopic cholecystectomy were enrolled and randomly divided into two equal groups. Group S received sevoflurane and group D received desflurane for maintenance of GA. Early recovery of parameters e.g. Eye opening, Oro-pharyngeal Reflex, Movement of limbs and orientation to utter his/ her own name were noted. Digital Symbol Substitution Test (DSST) score was assessed at 15 minutes and 30 minutes on arrival of patients at post anaesthesia care unit (PACU). **RESULTS:** The demographic data and duration of surgery was comparable in both the groups, ($p>0.05$). Intra-operatively cardiovascular stability was observed in both the groups. Group D had early recovery of parameters e.g. Eye opening, Oro-pharyngeal Reflex, Movement of limbs & orientation to utter his/ her own name as compared to group S. The DSST score (cognitive function) recovery was much earlier in group D (at 15min= 25.96±1.40 and at 30min= 29.6±1.54) as compared to group S (at 15min= 24.96±1.12 and at 30min= 28.93±1.33). **CONCLUSION:** Desflurane provides faster and early recovery as compared to sevoflurane. Also desflurane provides early intermediate recovery over sevoflurane as seen by higher DSST scores at 15 min and 30 min.

KEYWORDS

Desflurane, Sevoflurane, Recovery, Laparoscopic Cholecystectomy, DSST Score, Anaesthesia

INTRODUCTION

Laparoscopic cholecystectomy are routinely performed in all set up due to minimized incision size and trauma with reduced postoperative discomfort, shortened recovery rates, and a lower incidence of postoperative wound infections. These factors all contribute to shorter in-patient stay and reduced perioperative morbidity. Also, many laparoscopic surgeries are being increasingly performed on day case basis. While providing a standardized balanced anaesthesia, rapid and early recovery is desirable not only by relatives but even by anaesthesia and surgical team to reduce complications and early discharge of patient from operation theatre complex [1]. Local and regional anesthesia techniques are increasingly used in the ambulatory setting because they allow a more rapid recovery; general anesthesia is still the most common anesthetic technique [2].

Inhalation anesthetics are the most common drugs used for the provision of general anesthesia. The newest generation of inhalational agents includes sevoflurane, desflurane, and isoflurane. Both sevoflurane and desflurane have shorter emergence time as compared to isoflurane based anaesthesia techniques [3]. However, these agents have distinct advantages over the older anaesthetics but are more expensive. Because of pharmacological properties, desflurane appears to yield a rapid early and intermediate recovery compared with sevoflurane. In addition, desflurane has a number of action on body systems, causing general anesthesia and analgesic effect; hypotension and tachycardia, prolonged respiratory depressant and sympathetic stimulation leading to broncho-dilatation, hepatic dysfunction and decrease in renal cortical blood flow and inhibition of myometrial concentration at higher concentrations [4]. Desflurane is halogenated ether. Low solubility of desflurane in blood and body tissues (Blood: Gas partition coefficient of 0.42 and Fat: Blood solubility 27 at 37°C) leads to rapid induction and recovery. Sevoflurane, a volatile anaesthetic agent, is also halogenated ether which has two useful properties: it is non-irritant, pleasant smelling and is rapid-acting. It is used for induction and maintenance of general anaesthesia in adults and pediatric patients. Also it has rapid induction due to low Blood: Gas partition (Blood: Gas partition coefficient of 0.65 and Fat: Blood solubility 48 at 37°C) [5, 6]. The aim of present study was to assess the maintenance and emergence characteristics after anaesthesia with sevoflurane and desflurane in laparoscopic cholecystectomy.

MATERIALS AND METHODS

After obtaining Institutional Ethical Committee approval, this prospective randomized controlled study was carried out in the Department of Anaesthesia of Government Medical College and Hospital during the period from July 2015 to December 2017. A total 60 patients of either sex, age between 20 – 40 years, ASA Grade I & II undergoing laparoscopic cholecystectomy and those given consent for surgery were included in the study. Patients were randomly divided using sealed envelope method into two equal groups depending upon the inhalational agents they received during the maintenance of general anaesthesia along with 50% Oxygen and 50% Nitrous Oxide. Group D – received desflurane and group S – received sevoflurane. Patient with age < 20 years and > 40 years, ASA Grade III & IV, deranged liver function tests, CVE patients, patients on antipsychotics and those not given consent for study were excluded.

A detailed history was taken, general and systemic examination to rule out presence of any major illness. Thorough airway examination and all relevant investigations including haemoglobin%, complete blood count, blood urea & serum creatinine, blood sugar, liver function test, serum electrolytes, X- ray chest, electrocardiogram and other relevant investigations were done. Night before surgery, patients were kept nil by mouth for 6-8 hours and premedication was given with oral Ranitidine 150mg and overnight sedation with Tab Diazepam 10 mg-Orally for anxiolysis. Informed consent explaining the risk of anesthesia, surgery was obtained from the patient and/or relatives.

On the day of surgery, preanesthetic checkup was reviewed in the waiting area or consent of the patient was checked. On the OT table intravenous access with 18-20 Gauze intravenous catheters was secured and to start with, I.V fluid RL (Ringer lactate) was given. Multipara monitor was attached and baseline heart rate, blood pressure and Spo2 were recorded. Premedication was done with Inj. Glycopyrrolate 0.005mg/kg IV + Inj. Midazolam 0.05mg/kg IV. + Inj. Fentanyl- 1mcg/ Kg IV (slowly). Preoxygenation was done with 100% Oxygen- 3-5 minutes. Induction of general anaesthesia was done with Inj. Propofol 2mg/kg IV + Inj. Suxamethonium 2mg/kg IV. Laryngoscopy and Intubation carried out with appropriate sized oral cuffed endotracheal tube. Maintenance of anaesthesia was done with oxygen (50%) + nitrous oxide (50%) + sevoflurane (Dial concentration of 2- 4 %) or desflurane (Dial concentration of 3-6%) using circle absorber close circuit + Inj. vecuronium bromide (Initial bolus dose - 0.08 mg/ kg IV & later on dose- 0.02 mg/ kg IV & as & when required as per clinical judgment). The observer was blind to the inhalational agent used for maintenance of general anaesthesia. Also, the vaporizers of anaesthesia machine were covered with surgical towel during the study. No other analgesic drugs to be given in premedication, intraoperative period or in the postoperative period till assessment of post anaesthesia recovery of patient by the postgraduate student or researcher.

At the end of surgery, reversal of residual effect of muscle relaxant was to be done by administering – Inj. Neostigmine 0.05mg/ kg IV + Inj.

Glycopyrrolate 10 mcg/kg IV. On return of recovery of patient from general anaesthesia (Adequate spontaneous respiration, Patient responding to verbal commands, Eye opening & extremity skeletal motor tone), extubation (removal of endotracheal tube) was done with proper care & oral/ endotracheal suction. Early recovery was evaluated by time taken from switching off vaporizer to spontaneous eye opening, time taken for return of gag/ oro pharyngeal reflex, time taken for complete return of limb movements, time taken for patient orientation to his/her name. Thereafter patient was shifted to PACU immediately and subsequently intermediate recovery was assessed by Digital Symbol Substitution Test Score upon arrival in PACU at 15 minutes and 30 minutes. Anaesthesia workstation (Datex Ohmeda/ Wipro GE Healthcare, Model: Aspire7100) with ventilator was used for the present study.

Statistical Analysis

The data were analyzed and represented as mean±SD (n=30). All the results were analyzed statistically by one way ANOVA (Tukeys test) and Chi square test by using Graphpad Prism 7.0 (GraphPad Software, Inc., CA, USA). The p value < 0.05 was considered as significant.

OBSERVATION AND RESULTS

The maximum number of patients (43.34%) was between the age group 41-50 years in both the groups. The demographic profile of patients and duration of surgery were comparable and found no significant difference between two groups as shown in table 1.

Table 1: Demographic data and Duration of surgery

Parameters		Group S	Group D	P value
Age	21-30	8(26.66%)	5(16.66%)	>0.05
	31-40	9(30%)	12(40%)	
	41-50	13(43.34%)	13(43.34%)	
Sex	Male	10(33.33%)	12(40%)	0.59209
	Female	20(66.67%)	18 (60%)	
Mean age (Years)		37.53±7.86	37.8±5.90	0.8824
Mean Weight (kg)		59.9±6.18	61.66±7.15	0.316
Duration of Surgery (min)		83.33±5.49	83.92±4.68	0.6506

Preoperatively there was no much difference in mean heart rate (HR) amongst the groups but it was increased in desflurane group as compared to the sevoflurane group except at 0-20 min period as shown in figure 1.

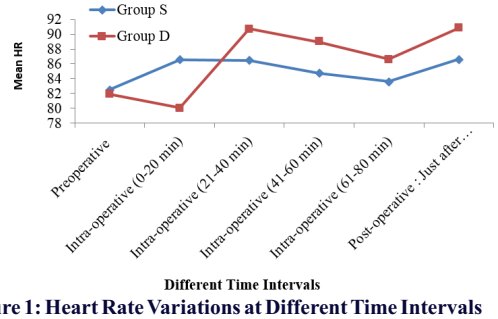

Figure 1: Heart Rate Variations at Different Time Intervals

Preoperatively or preinduction, there was no much difference in mean arterial pressure (MAP) but intra-operatively at 0-20 min, 21-40 min, 61-80 min and postoperatively the difference in MAP was statistically highly significant amongst the group S and group D as depicted in figure 2. Both the desflurane and sevoflurane provided hemodynamic stability intra operatively and no additional boluses of Fentanyl were given. On continuous monitoring, electrocardiogram was within normal limit throughout the intra- operative period in both the groups. There was no desaturation oxygen saturation in both the groups postoperatively.

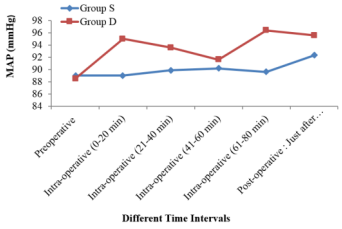

Figure 2: Mean Arterial Pressure (MAP) At Different Time Intervals

As compared to sevoflurane group, the patients of desflurane group had early recovery of parameters e.g. Eye opening, Oro-pharyngeal Reflex, Movement of limbs and orientation to utter his/ her own name as shown in table 2.

Table 2: Mean Time Duration (Min.) From Switching Off Vaporizer to Different Recovery Parameters

Parameters	Group S	Group D	P Value
Eye opening	7.5 ± 2.16	5.51 ± 1.7	<0.001
Oro-pharyngeal Reflex	6.19 ±1.33	4.00 ± 1.35	<0.001
Movement of limbs	12.00 ± 2.51	6.93 ± 1.68	<0.001
Orientation to utter his/ her own name	13.5 ± 3.73	10.96 ± 2.59	<0.01

Figure 3 shows comparison of DSST score at 15 and 30 minutes on arrival of patients at PACU. The DSST score (cognitive function) recovery was much earlier in group D as compared to group S and difference between two groups was statistically significant, (p<0.05).

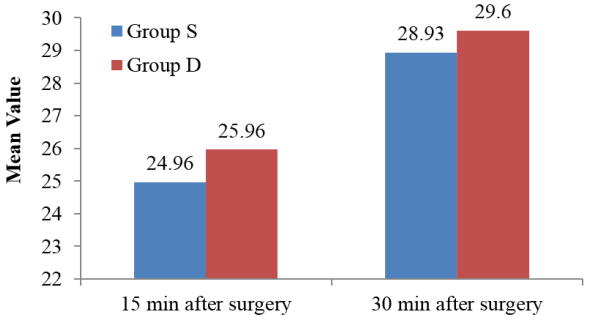

Figure 3: Comparison of Post-Operative DSST Score Amongst the Group

DISCUSSION

Since, the introduction of desflurane in 1992 and sevoflurane in 1994, many studies were carried out by different researchers to know which molecule is better in relation to cardiovascular stability, emergence from anaesthesia/ recovery profile and clear headedness, postoperative nausea and vomiting. They compared these two volatile anesthetics with each other and with other inhalational/ intravenous anesthetic drugs. In the present study, we compared desflurane versus sevoflurane with respect to early and intermediate recovery parameters. The demographic profile and duration of surgery was comparable in both the groups and it was statistically insignificant, which is similar to the study done by Nathanson et al [3]. Both male and female were studied but number of females outnumbered the males, however, the difference was not significant. Similar demography characteristics are reported in previous studies [4, 7, and 8].

Preoperatively there was no much difference in mean heart rate amongst the groups. There was decrease in heart rate in desflurane group in 0-20 min time interval period as compared to sevoflurane group. Although, mean heart rate in the intra-operative and post-operative period was more in the desflurane group as compared to sevoflurane group, the change in mean heart rate in desflurane and sevoflurane group was within ±20% of the baseline values suggesting cardiovascular stability with both desflurane and sevoflurane groups. Pre-operatively MAP was comparable in both the groups. MAP with desflurane was higher throughout the intra-operative period and also in the post-operative period just after extubation. The MAP was constantly near the baseline value in group S in the intra-operative period. Similarly, the increase in MAP value with desflurane post-operatively just after extubation was within 20% of the baseline value. Thus, during the maintenance period MAP and HR were satisfactorily maintained within the 20% of baseline values with both anesthetics. These findings are correlated with the study done by Nathanson et al [3] and Chudasama et al [9]. Chandrasekaran et al [10] showed that in both the groups [i.e. Desflurane and Sevoflurane] heart rate was maintained within 20% of the baseline values. But desflurane required more number of additional doses of fentanyl than sevoflurane. In the present study, we have not administered additional doses of Inj. fentanyl or Inj. atropine was used for balancing HR or MAP within 20% range of the baseline values. Jindal et al [4] observed that intraoperative cardiovascular stability was easily achieved with both sevoflurane and desflurane, with mean heart rate maintained within

±20% of baseline values during the entire maintenance period. In current study there was significant increase in mean heart rate in group D as compared to group S during intraoperative as well as in the postoperative period. This might be due to no use of additional bolus doses of Fentanyl intraoperatively. We have used desflurane in 3-6% and sevoflurane 2-4% whereas the sevoflurane vol. used in Nathanson et al [3] was 1-2%.

After discontinuation of the volatile drug, patients in group D opened their eyes and were extubated earlier than those in the group S. This observation was consistent and comparable with the study conducted by Nathanson et al [3]. However, patients in group D stated their (Orientation to name) name earlier as compared to group S and the difference was statistically significant. While Nathanson et al [3] found no statistically significant differences in the times to stating their name between the groups. The present study also showed sevoflurane and desflurane provided similar intra-operative conditions during the maintenance period, although early recovery was more rapid after desflurane. Thus time to return of eye opening ($p< 0.001$), gag/ oropharyngeal reflex($p< 0.001$), movement of limb($p< 0.001$) and patient orientation to name($p< 0.01$) was shorter in group D which is comparable with Jindal et al [4] and Kaur et al [11]. We did not study the late recovery end points. In addition, post-anaesthesia recovery score (PARS) of Aldrete and Kroulik were noted at the same time intervals by Gergin, et al [7]. This score records vital signs with patients receiving 0-13 points that was 0-3 points for six physiological variables.

The present study used inj. ondansetron 4mg IV just prior to extubation for prophylaxis of nausea and vomiting but no schedule for observations as per protocol of this study. No other analgesic drugs were given in premedication in the intraoperative period at operation room or in the postoperative period at recovery room of operation theatre till assessment of post anaesthesia recovery of patient. The early as well as intermediate recovery was faster with desflurane as compared to sevoflurane and the difference was statistically significant. We have not observed about nausea and vomiting parameters in the postoperative period. The findings of the present study were consistent with the earlier studies [7, 8, 10, 12, and 13] with respect to early recovery parameters. However, the current study showed intermediate recovery was also faster with desflurane as compared to sevoflurane. The above studies found no significant difference between the two volatile anaesthetic in the later recovery period. We have not studied delayed recovery parameters in this study.

CONCLUSION

The desflurane provides faster and early recovery as compared to sevoflurane, (The faster recovery from general anaesthesia can be beneficial in day care cases where quick case turnover and reduced post-anesthesia care unit (PACU) time is essential to ensure a good workflow). Also desflurane provides early intermediate recovery over sevoflurane as seen by higher DSST scores at 15 min and 30 min. The sample size of present study was small; therefore similar study should be conducted on larger sample size to confirm the observations.

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