ORIGINAL ARTICLE

COMPARISON OF RECOVERY PROFILES OF PROPOFOL & SEVOFLURANE ANESTHESIA WITH BISPECTRAL INDEX MONITORING (BIS) IN GENERAL ANESTHESIA

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ABSTRACT

Background: The aim of the study was to compare the effect of propofol & sevoflurane with respect to hemodynamic changes, recovery profiles and complications in patients scheduled for various elective surgical procedures under general anesthesia.

Method: Fifty ASA physical status I-II patients of either sex, aged between 18 and 60 years were randomly divided into two groups to receive either propofol infusion (group P, n=25) or sevoflurane (group S, n=25). Cardiovascular parameters, SpO_2 and bispectral index (BIS) scores were recorded. Time to eye opening, hand squeezing and achieve modified Aldrete's Score ≥ 9 and the incidence of complications were noted.

Results: Early recovery times [eye opening, hand squeezing and achieve modified Aldrete's Score ≥ 9] were significantly longer in group P ($P < 0.001$). Cardiovascular parameters, SpO_2 and bispectral index (BIS) scores were comparable between the groups ($P > 0.05$). The incidence of post-operative nausea and vomiting was significantly higher in group S.

Conclusions: The present study which adjusted propofol infusion rate and sevoflurane concentration according to BIS scores revealed that maintenance of anesthesia with sevoflurane is associated with faster recovery than anesthesia with propofol. Propofol resulted in a significantly lower incidence of postoperative nausea and vomiting.

Keywords: Propofol, Sevoflurane, Bispectral index, Recovery profile.

INTRODUCTION

Expeditious recovery and shorter hospital stays are necessary to improve efficiency of an ambulatory facility and reduce health care costs. One of the major factors that determine the speed of recovery from anesthesia is the choice of anesthetic technique.[1] General anesthesia is still the most common anesthetic technique.[2,3] Inhalational anesthesia techniques remain the mainstay of modern anesthesia practice. It is believed that inhaled anesthetic technique allows rapid emergence from anesthesia, probably because of ease of titratibility, and exerts some neuromuscular blocking effect [4], which may reduce the requirements of nondepolarizing muscle relaxants.[5] Sevoflurane, a newer shorter-acting inhaled anesthetic offer the potential for rapid recovery from anesthesia. However, with the introduction of propofol and newer delivery systems (e.g., target-controlled infusion), there is increased interest in total intravenous anesthesia (TIVA).[6]

Titrating anesthetic agent's delivery by bispectral index (BIS) monitoring during general anesthesia in adults allows the anesthetists to adjust the amount of anesthetic agent to the needs of the patient, possibly resulting in a more rapid emergence from anesthesia.

Thus the present study was designed to compare recovery profiles of propofol and sevoflurane by adjusting the depth of anesthesia according to BIS in patient undergoing various elective surgical procedures.

MATERIALS AND METHODS

After Hospital's ethical committee's approval and written informed consent from the patient's attendant, the present study was conducted on fifty patients of ASA grade I-II, aged 18-60 years of either sex, who were operated for various elective surgical procedures under general anesthesia. Patients who have known allergy from study drugs, with history of DM, hypertension, ischemic heart disease, aortic stenosis, left ventricular failure and atrio-ventricular conduction block, severe CAD, respiratory problems and patients concomitantly taking methyldopa, beta blocking drugs, benzodiazepines, psychotropic drugs and MAO inhibitors were excluded from study. The selected patients were randomly divided into two groups of 25 patients each to receive propofol infusion (Group P) or sevoflurane (Group S) for maintenance of anaesthesia.

A thorough preoperative check-up, general and systemic examination and routine investigations were done. All the patients were kept nil by mouth after the previous midnight of surgery. In the operating room, standard monitoring including non-invasive blood pressure, Pulse oximetry and ECG leads were attached to the patient. After establishing intravenous access using an 18/20 G cannula, ringer lactate was started and pre –operative vitals were recorded. The skin of the forehead was degreased with 70% isopropanol; after this a BIS electrode (BIS-QUARTO Sensor strips, Aspect Medical System, USA) was placed on forehead. The BIS score was measured by means of an ASPECT A-2000 BIS monitor (Aspect Medical System, USA) with frontal electrode. EEG was continuously recorded using a BIS monitor & depth of sedation was continuously monitored. Skin surface electrodes for neurostimulation were placed on the volar forearm along the course of the ulnar nerve, close to the proximal wrist crease to stimulate adductor pollicis by train-of-four (TOF) Guard acceleromyography monitor (TOF Watch SX, Organon Teknika, Boxels, Netherland). Nerve was stimulated with TOF stimulation (a series of four twitches in two sec, 2 Hz frequency, each 0.2 ms long) every 12 seconds after loss of the eyelash reflex. A current intensity of 50 mA was used.

All patients were premedicated with glycopyrrolate 0.004mg/kg, midazolam 0.03 mg/kg and pentazocin 0.6mg/kg intravenously. After preoxygenation for three minutes, patients were induced with propofol 2 mg/kg. Vecuronium 0.1 mg/kg intravenously was given to facilitate tracheal intubation. Intubation was performed when all four TOF responses from the adductor pollicis muscle were disappeared. All patients ventilated intermittently with 66% N_2O in oxygen via a rebreathing system at a tidal volume of 6-8 ml/kg and a frequency of 10 per minute with an end tidal CO_2 ($EtCO_2$) target of 30-35 mmHg. For maintenance of anesthesia, propofol infusion at 3-12 mg/kg/hr or 0.5-2.5% of sevoflurane was administered. The concentration of sevoflurane used and the infusion rate of propofol were adjusted to keep BIS score between 40 and 60. BIS score were continuously recorded. If BIS score rises over 60, the infusion rate of propofol or concentration of sevoflurane was gradually increased. If it falls under 40, the infusion rate of propofol or concentration of sevoflurane was decreased accordingly. In the case of more than 20% reduction in the mean arterial pressure from baseline levels, the infusion rate of crystalloid solution was increased. If this is not sufficient, the infusion rate of propofol or the concentration of sevoflurane was reduced. Severe hypotension was managed with blood or vasopressors.

About fifteen minutes before the end of surgery, sevoflurane and propofol were reduced to facilitate rapid emergence from anesthesia. They were adjusted to a BIS score of 70. Inj. neostigmine 0.05 mg/kg and Inj. glycopyrrolate 0.01 mg/kg were given immediately after completion of surgery. Patients were extubated when complete neuromuscular recovery was achieved and patient obeyed verbal commands. After extubation, all patients were observed in the Post Anesthesia Care Unit for 30 minute.

The heart rate, mean arterial pressure, SpO_2 and BIS score were noted before premedication, before induction, after induction at 1, 5, 10, 15, 30, 45, 60 minutes and after extubation at 1, 5, 15, 30 minutes.

During recovery following observations were made:-Time to awakening (Time taken for eye opening after cessation of anesthetic drugs), Time to hand squeezing (Time taken for hand squeezing after cessation of anesthetic drugs), and Time taken to discharge patient from PACU (Time taken to achieve modified Aldrete's score ≥9 after cessation of anesthetic drugs). Complications like laryngospasm, apnoea, bronchospasm, postoperative nausea and vomiting (PONV), somnolence, agitation were recorded. Statistical analysis was done using the Student's *t*-test and Chi-square test. A value of $P<0.05$ was considered statistically significant.

RESULTS

The two study groups were comparable with respect to the number of participants, age, weight, gender (P>0.05) [Table 1].

Table 1: Demographic data

Category	Group P (mean ±SD)	Group S (mean ±SD)
Number (n)	25	25
Age (years)	37.92±11.72	32.20±8.6537
Weight (kg)	63.40±11.27	66.56±11.69
Sex (M/F)	10/15	9/16

Table 2: Recovery characteristics

Category	Group P (mean±SD)	Group S (mean±SD)
Eye opening (min)	10.84±1.28*	5.36±1.41
Hand squeezing (min)	12.60±1.55*	7.16±1.43
MAS ≥9 (min)	15.56±1.87*	10.24±1.42

MAS – modified Aldrete's score; *P<0.001group P v/s S

Patients remained hemodynamically stable in both groups. Although there were variations in the heart rate and mean arterial pressure during the study period, all the values were within acceptable limits and there was no significant difference between the groups (Fig 1, 2).

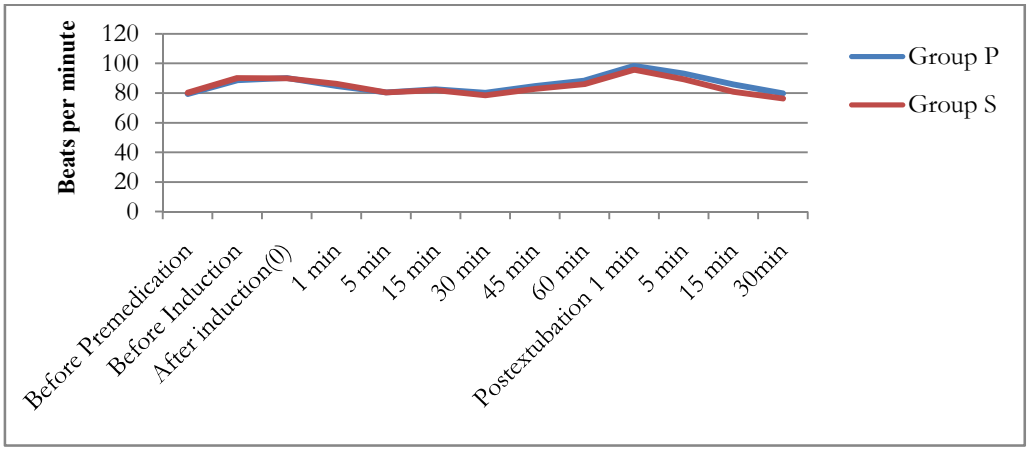

Fig. 1 Changes in mean heart rate

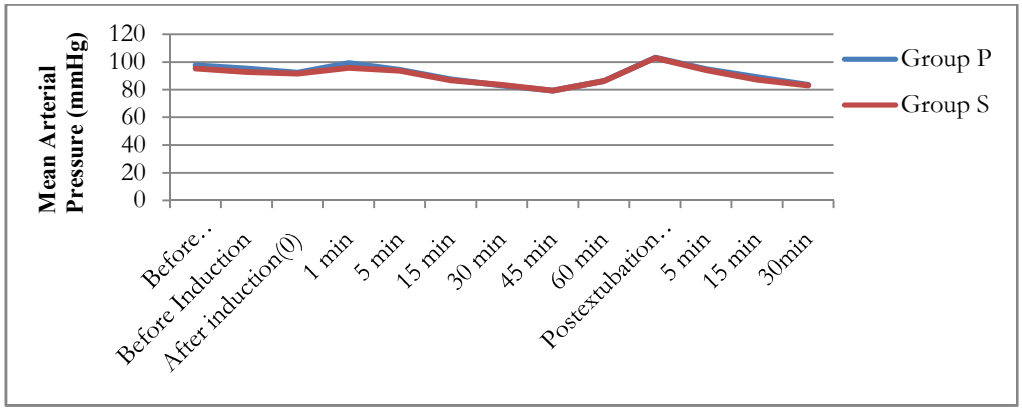

Fig. 2 Changes in mean arterial pressure

BIS scores were extremely stable and similar between the two groups throughout the study (P > 0.05). There were significant differences in recovery time after anesthesia with propofol versus sevoflurane. Compared to propofol group, early recovery times from cessation of anaesthetic agents to eye opening, hand squeezing and modified Aldrete's score ≥9 were significantly shorter in the sevoflurane group (Table 2).

The occurrence of post-operative nausea and vomiting (PONV) in recovery period was significantly higher in sevoflurane group. In sevoflurane group, four (16%) patients developed PONV compared to none in propofol group.

DISCUSSION

Rapid emergence from anesthesia and post-operative recovery of cognitive function as well as hemodynamic stability is important requirements of modern anesthesia. Generally both propofol and sevoflurane meet these criteria. Both propofol and sevoflurane are very popular for day care anesthesia due to their smooth and rapid onset of action with short recovery period.

The depth of anesthesia is usually assessed by monitoring the clinical parameters during anesthesia. The clinical parameters become unreliable in terms of exact titration of anasthetic agents.[7] BIS index offers a direct and accurate method for continuous brain status monitoring and provides a measurement of hypnotic effect of anesthetic agents thereby enable the anesthesiologist to titrate the delivery of anesthetic agent according to depth of anesthesia. Also use of the BIS monitor is thought to reduce the incidence of intraoperative awareness during anaesthesia. [8, 9]

In our study recovery time from discontinuation of the maintenance anesthesia to spontaneous eye opening, hand squeezing and time taken to achieve modified Aldrete's Score ≥9 were significantly shorter in sevoflurane group as compared to propofol group. As observed in our study, many other studies [10-12] had found a faster rate of recovery with sevoflurane. Although Singh SK et al[13]who compared the recovery profiles of propofol and sevoflurane anesthesia did not found any significant difference in early recovery profiles in terms of spontaneous eye opening, response to verbal command and extubation time between these two agents.

However different results were found by Gupta A et al[14]who reported no time difference in eye opening time between sevoflurane and propofol, but the time period to obeying commands was faster in the sevoflurane group. In contrast to our results, Larsen B et al[15] reported that propofol group had better early recovery profile with better cognitive function in intermediate recovery phase as compared to sevoflurane group.

Our study also reinforces the idea that we can titrate the amount of anesthetic given, by monitoring BIS, thereby reducing the amount of drug administered and shortening recovery times, [16, 17] reducing operation theatre pollution and everting even some side effects such as PONV.[18]

As for hemodynamics, results of our study revealed that both propofol and sevoflurane have similar hemodynamic profiles. However, in a previous study, Atici et al[19] compared the effects of sevoflurane and propofol infusion on hemodynamics and observed a significant decrease in heart rate during PCNL in the propofol group. This decrease can be related to the use of alfentanil. In our study, only N_2O was used and no decrease in heart rate was observed in the propofol group.

Post-operative nausea and vomiting (PONV) still remain the major complaint that affects patient overall satisfaction after anesthesia.[20] It also increase the overall cost of treatment as it often prolong the hospital stay. Similar to other studies[14, 21], the incidence of PONV was significantly lower in propofol group as compared to sevoflurane group. The lower incidence of PONV in propofol group may be related to its intrinsic anti-emetic properties[22]. However, Shah A et al[23] had not found any significant difference in the incidence of PONV in propofol and sevoflurane groups.

In conclusion, with titration of propofol infusion rate and sevoflurane concentration, according to BIS scores, sevoflurane anesthesia resulted in faster recovery and discharge from PACU as compared to propofol anesthesia. Propofol associated with significantly lower incidence of post-operative nausea and vomiting. The results revealed that both propofol and sevoflurane are convenient anesthetic techniques, in terms of hemodynamic stability and rapid titration in relation to clinical needs, however, sevoflurane may be considered a useful alternative to propofol in providing anesthesia where rapid emergence and recovery of cognitive functions are desired.

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