

Comparison of Postoperative Complications in Using Total Intravenous Anesthesia with Propofol and Sevoflurane Inhalation Anesthesia

Dr. Ashit Kumar Das^{1*}, Dr. Mohammad Abdullah Al Mamun², Dr. Nurul Azim³, Dr. Mohammad Azizul Haque⁴

¹Assistant Professor,
Department of
Anesthesiology & ICU,
Chittagong Medical
College (CMC),
Chattogram,
Bangladesh.
*Corresponding author

Abstract

Background: Total intravenous anesthesia or TIVA is a technique of general anesthesia that generally uses a combination of agents given exclusively by the intravenous route without the use of inhalation agents. Propofol is a short-acting medication that results in a loss of consciousness and lack of memory for events. On the other hand, sevoflurane is a sweet-smelling, nonflammable, highly fluorinated methyl isopropyl used as an inhalational anaesthetic for induction and maintenance of general anesthesia. We have a very few comparative data regarding these two anaesthetic agents. Aim of the study: The aim of this study was to compare the postoperative complications between total intravenous anesthesia with propofol and sevoflurane inhalation anesthesia. **Methods:** This was a retrospective study which was conducted in the department of Anesthesia, Chittagong Medical College Hospital, Chattogram, Bangladesh during the period from January 2019 to December 2019. In total 87 patients who had ENT surgeries previously were finalized as the total study population. Total patients were divided into 2 groups. In Group I there were 39 patients to whom total intravenous anesthesia with propofol (TIVA) had been used and in Group II there were 48 patients to whom sevoflurane inhalation anesthesia (SIA) had been used. Postoperative complications and recovery period were determined as tachycardia, bradycardia, hypertension, hypotension, recovery time, additional analgesia and nausea-vomiting. **Results:** In Group I (TIVA with propofol) hypertension, hypotension, tachycardia, bradycardia, low saturation, additional analgesia and nausea-vomiting were found in 9.30%, 6.98%, another 6.98%, 4.65%, 11.63% 23.26% and 20.93% participants respectively. On the other hand, in Group II hypertension, hypotension, tachycardia, bradycardia, low saturation, additional analgesia and nausea-vomiting were found in 7.84%, 5.88%, another 7.84%, another 5.88%, 13.73%, 19.61% and 33.33% participants respectively. Among all those postoperative complications between both the groups we found significant correlation in nausea-vomiting where the P value was less than 0.05 (P=0.014). **Conclusion:** As it was a retrospective study the results were depended on the records of patient's register only which was a limitation of this study. According to the analysis of complications regarding two different procedures we found near about the similar performance. So physicians can choose any one between the two procedures for patient.

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INTRODUCTION

Total intravenous anesthesia or TIVA is a technique of general anesthesia that generally uses a combination of agents given exclusively by the intravenous route without the use of inhalation agents. Propofol is a short-acting medication that results in a loss of consciousness and lack of memory for events. On the other hand, sevoflurane is a sweet-smelling, nonflammable, highly fluorinated methyl isopropyl used as an inhalational anaesthetic for induction and maintenance of general anesthesia. We have a very few comparative data regarding these two anaesthetic agents. Propofol-based total Intravenous anesthesia (TIVA) has a number of important advantages over volatile techniques. Intravenous drugs can be used as anxiolytic and/or sedation, cause less pollution, and allow free airway access. Generally, propofol markedly decreases the risk of postoperative nausea and vomiting and does not induce malignant hyperthermia. However, propofol did not enhance amyloidosis in pheochromox cells.^[1] There are also several well documented advantages with regards to free radical scavenging as well as immune and organ function. Since 2000,^[2] no article emphasizing on the scientific basis of the optimized clinical practice of TIVA can be found in the literature. The target of the study was to compare the postoperative complications in using total intravenous anesthesia with propofol and sevoflurane inhalation anesthesia. The anesthesia applied with the inhalation of the volatile-gas anesthetics through the respiratory track is known as inhalation anesthesia. Loss of consciousness and analgesia are two components of the general anesthesia and in this procedure, this is provided with volatile anesthetics. Sevoflurane is one of the volatile-

gas anesthetics. TIVA is a widely used method today accepted as an alternative to SIA and was identified as the anesthesia method composed of infused intravenous anesthetics. In this method, hypnosis, one of the two significant components of anesthesia, is provided by giving propofol and the analgesia by giving an opioid analgesic convenient for infusion³. While the drugs could be given with standard infusion pumps at ml h⁻¹, µg kg⁻¹ min⁻¹ and similar settings for infusion speed in TIVA applications, target plasma or brain concentrations chosen with target-controlled infusion devices could also be given at the infusion rates calculated automatically according to personalized data previously entered to the system.^[4] Now a day uses of TIVA procedure is well established and trusted in Bangladesh. Propofol is regarded currently as the most suitable anaesthetic agent for TIVA. It allows rapid changes in anaesthetic depth and a rapid clear-headed recovery.^[5,6] Many prevalence researches have been conducted related with the frequency of post-operative complications for both methods.^[7] During the recovery period, vital finding changes encountered in the follow-up, postoperative pain and postoperative nausea and/or vomiting are among the postoperative complications frequently encountered. Besides these, the recovery periods including the observation period of the patients in the maintenance units after anesthesia are among the parameters evaluated primarily in studies conducted for patient satisfaction and cost. The modified Aldrete scoring system is generally used to define the patients' readiness while they are sent to service from the recovery room.^[8] In this procedure, activity, respiration, circulation, consciousness and oxygen saturation parameters are evaluated.

MATERIALS AND METHODS

This was a retrospective study and was conducted in the department of Anesthesia, Chittagong Medical College Hospital, Chattogram, Bangladesh during the period from January 2019 to December 2019. The study was approved by the ethical committee of the respective institute before the starting of this intervention. Proper informed written consent was obtained from all the patients according to the ethical guidelines of the 2008 Declaration of Helsinki. Totally 87 patients with ASA score I-II, age around 20-60 years with ENT operations were selected as the study population. According to the exclusion criteria of the study patients with insufficient data or reports were excluded. The patients were allocated to two groups as Group I (TIVA) and Group II (SIA). In Group I there were 39 patients to whom total intravenous anesthesia with propofol (TIVA) had been used and in Group II there were 48 patients to whom sevoflurane inhalation anesthesia (SIA) had been used. All the patients were opened vascular access after being taken into the operating room and were given anesthesia induction with 1 $\mu\text{g kg}^{-1}$ fentanyl, 2 mg kg^{-1} propofol and 0.8 mg kg^{-1} rocuronium. The patients in Group II were given 1-2% volume sevoflurane in 50% O₂ and 50% N₂O during maintenance of anesthesia, while the patients in Group I were applied 4-10 mg $\text{kg}^{-1} \text{h}^{-1}$ propofol and 0.05-0.1 $\mu\text{g kg}^{-1}$ fentanyl IV infusion with 50% O₂ and 50% air. Each patient was taken into recovery room after extubation and pulse rate, non-invasive blood pressure (NIBP) and oxygen saturation evaluation were done. Postoperative complication and vital finding tracks of each patient were done as usual and were recorded. Surgery types were divided into two groups as major and minor surgery. Existence of hypoxia, tachycardia, bradycardia,

hypertension and hypotension were determined as vital finding complications. If the oxygen saturation was under 90%, in spite of oxygen support, it was defined as hypoxia. Similarly, if the pulse rate was 20% higher than the preoperative value, then it was described as tachycardia, if 20% lower, then bradycardia; and if NIBP was 20 mmHg lower than the postoperative value, then it was qualified as hypotension, if 20 mmHg higher, then hypertension. For collecting data and analysis MS Excel and SPSS version 20 were used. Results were evaluated in the 95% confidence range, and significance at $p < 0.05$ level.

RESULTS

In our study, total participants were 87 in number. Total study people were divided into two groups. As distributed we found in Group I there were 39 patients whereas in Group II there were 48 patients. Among total participants 56.32% were male and 43.68% were female. In Group I among 39 participants 56.41% were male and 43.59% were female. On the other hand in Group II among 48 participants 56.25% were male and 43.75% were female. In analyzing the baseline characteristics of participants we observed, in Group I the mean (\pm SD) age in year, BMI (kg/m^2), duration of anesthesia (min) and operation period (min) were 56.6 ± 6.4 , 25.5 ± 2.9 , 115.7 ± 16.1 and 83.3 ± 14.5 respectively. On the other hand, in Group II the mean (\pm SD) age in year, BMI (kg/m^2), duration of anesthesia (min) and operation period (min) were 57.4 ± 5.8 , 26.2 ± 3.2 , 116.5 ± 17.3 and 77.6 ± 13.8 respectively. We did not get any significant correlation among all those baseline characteristics between the groups. In this study in analyzing the postoperative complications in Group I hypertension, hypotension, tachycardia, bradycardia, low

saturation, additional analgesia and nausea-vomiting were found in 9.30%, 6.98% another 6.98%, 4.65%, 11.63% 23.26% and 20.93% participants respectively. On the other hand, in Group II hypertension, hypotension, tachycardia, bradycardia, low saturation, additional analgesia and nausea-vomiting were found in 7.84%, 5.88%, another 7.84%, another 5.88%, 13.73%, 19.61% and 33.33%

participants respectively. Among all those postoperative complications between both the groups we found significant correlation in nausea-vomiting where the P value was less than 0.05 (P=0.014). Between both the groups the rate of low saturation, association of additional analgesia and nausea-vomiting were higher.

Table 1: Gender distribution of participants (N=87)

Gender	Group-1		Group-2		Total	
	(n=39)		(n=48)		(n=87)	
	N	%	n	%	n	%
Male	22	56.41	27	56.25	49	56.32
Female	17	43.59	21	43.75	38	43.68
Total	39	100	48	100	87	100

Table 2: Baseline characteristics of participants (N=87)

Variables	Group I	Group II	P Value
Age in year	56.6±6.4	57.4±5.8	0.543
BMI (kg/m ²)	25.5±2.9	26.2±3.2	0.2931
Duration of anesthesia (min)	115.7±16.1	116.5±17.3	0.8254
Operation period (min)	83.3±14.5	77.6±13.8	0.0645

Table 3: Distribution of postoperative complications among participants (N=87)

Complications	Group I		Group II		P value
	n	%	n	%	
Hypertension	4	9.30	4	7.84	0.612
Hypotension	3	6.98	3	5.88	0.662
Tachycardia	3	6.98	4	7.84	0.765
Bradycardia	2	4.65	3	5.88	0.626
Low saturation	5	11.63	7	13.73	0.569
Additional analgesia	10	23.26	10	19.61	0.391
Nausea-vomiting	9	20.93	17	33.33	0.014

DISCUSSION

The aim of the study was to compare the postoperative complications in using total intravenous anesthesia with propofol and sevoflurane inhalation anesthesia. Different anesthesia approaches depending upon various factors are applied to patients who are to be given surgical intervention under

general anesthesia. The factors influencing the anesthesia approach could be the patient's clinic, systemic examination and laboratory values and they display changes as the locality type and period of the surgery as well. The short effective new intravenous hypnotics and analgesics whose cumulative effects are low have recently been put into practice has been rising the interest towards TIVA as an

alternative to inhalation anesthesia.^[9] The cardiovascular stability of TIVA has been reported to be better than inhalation anesthesia, to be sympatholytic to surgical stimuli and to diminish hormonal and metabolic changes.^[10] It was compared in this study the effects of TIVA method, which we made with propofol and fentanyl infusion, on hemodynamics in the postoperative period with the effects of SIA method that we made with sevoflurane and N₂O. The most obvious effect of propofol on cardiovascular system is the arterial hypotension. Researchers have already stated that, with TIVA method, systolic, diastolic and average arterial pressures could decrease 10-30% due to dose, age, infusion speed or the usage of opioid or nitrogen protoxide. In our study in Group I (TIVA with propofol) hypertension, hypotension, tachycardia, bradycardia, low saturation, additional analgesia and nausea-vomiting were found in 9.30%, 6.98%, another 6.98%, 4.65%, 11.63% 23.26% and 20.93% participants respectively. On the other hand, in Group II hypertension, hypotension, tachycardia, bradycardia, low saturation, additional analgesia and nausea-vomiting were found in 7.84%, 5.88%, another 7.84%, another 5.88%, 13.73%, 19.61% and 33.33% participants respectively. In this current study, among all those postoperative complications between both the groups we found significant correlation in nausea-vomiting where the P value was less than 0.05 (P=0.014). This decrease has been explained with the fall in the systemic vascular resistance.^[11] In a study they conducted, in which they compared the effects of propofol and sevoflurane, Scoot Jellish W et al. reported that propofol decreased arterial pressure at a 15-35% rate with regard to sevoflurane.^[12] Fredman et al. found the average blood pressure measurement values similar in all groups in a study they conducted

when they used propofol and sevoflurane on 146 daily patient.^[13] In our study, no significant difference between Group I (TIVA) and Group II (SIA) with regard to hypertension and/or hypotension presence was found. The pulse rate does not usually increase during the anesthesia application with propofol despite the fall in the arterial BP. This is the sympatholytic effect of propofol and it doesn't disrupt the propofol baroreflex sensitivity reported in their studies in which they searched for the effects of intravenous and inhalation agents on hemodynamic response that the pulse rates were lower in Group TIVA during and postoperative periods.^[14] Particularly Watson et al.^[15] found the pulse rate in Group TIVA significantly low during postoperative period. Tanaka et al. reported the pulse rate values to be lower in sevoflurane group in a study in which they compared the effects of inhalation agents (isoflurane, sevoflurane, halothane and enflurane) on hemodynamic response.^[16] In a study in which Aydın et al. compared hemodynamic effects of Group TIVA and Group SA the average pulse rate was found significantly higher in Group TIVA.^[17] In this study, tachycardia and bradycardia risks were quite low in both groups and no difference was observed between the propofol used Group I and the sevoflurane used Group II. Adams et al. compared propofol and isoflurane in their study and found TIVA superior to inhalation agents since it was less toxic, it provided a faster induction, it reduced most the hemodynamic response occurring due to surgical stimulation and protected the cardiovascular stability better and it provided a complete and fast recovery.^[18] However, in another study, Bharti et al. reported that sevoflurane used Group SA was more advantageous than propofol used Group TIVA with regard to its provision for cardiovascular stability without extending the

recovery period.^[19] In this study, no definite reduction was observed for SpO₂ during the recovery period and all hemodynamic parameters progressed within physiological limits. On the other hand, in another study, Watson et al. extensively evaluated the postoperative complications and recovery parameters between the sevoflurane used Group SIA and the propofol used Group TIVA and indicated that there was no difference related with extubation period, eye opening time, coughing, keeping breath, uneasiness, trembling, postoperative pain and nausea-vomiting.^[15] In our findings displayed parallelism with these studies. The nausea-vomiting risk in Group SIA was definitely higher than the risk in Group TIVA. As a result of the studies supporting this finding, inhaler anesthetics have started to be accepted among the other postoperative nausea-vomiting risk factors.^[20] Dashfield et al. indicated that nausea-vomiting was more in sevoflurane used Group TIVA in the 30-min-observation period and that there was no difference with propofol used Group SA when the observation period was extended to 90 minutes.^[21] The opinion of inhaler anesthetics leading to more nausea-vomiting than intravenous anesthetics could be due to short observation periods. Regarding this estimation, studies planning longer postoperative observation are required. The recovery from anesthesia depends upon the reducing speed of the medicine concentration after the medicine is ended. When the intravenous anesthetics are given for a long time in infusion form, this speed is different from the simple life and is expressed as "context sensitive half-life". The reduction of the concentration of the medicine is a pharmacokinetic characteristic. It should not be underestimated that the pharmacodynamics of the medicine and the interaction of it with the other medicines used

together also influence the recovery,^[22] Vuyk et al. In this study, it was used low dose fentanyl infusion for sufficient anesthesia and analgesia besides propofol which is the primary medicine of TIVA procedure. It was observed the recovery period to be longer in Group I. According to the analysis of complications regarding two different procedures we found near about the similar performance. So physicians can choose any one between the two procedures for patient.

Limitations of the study

This was a single centered study with small sized samples. So the findings of this study may not reflect the exact scenario of the whole country.

CONCLUSION

As, it was a retrospective study the results were depended on the records of patient's register only which was a limitation of this study. According to the analysis of complications regarding two different procedures we found near about the similar performance. So physicians can choose any one between the two procedures for patient. But to avoiding the complication like nausea and/or vomiting, selecting sevoflurane inhalation anesthesia may be better choice. To get more specific information we would like to recommend for conducting more studies in several places.

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