Original Research Article

A Hospital Based Prospective Study to Evaluate the Effects of Sevoflurane as an Adjuvant to Propofol Based Total Intravenous Anaesthesia During Ocular Surgery

Chandresh Bhooshan Bhardwaj[1], Kalicharan Bansal[2]

[1]Associate Professor, Department of Anaesthesia,Government Medical College & Attached Group of R.B.M Hospital, Bharatpur, Rajasthan, India.

[2]Associate Professor, Department of General Surgery, Government Medical College & Attached Group of R.B.M Hospital, Bharatpur, Rajasthan, India.

Received: 01-02-2021 / Revised: 23-03-2021 / Accepted: 24-05-2021

Abstract

Background: Propofol is one of the most commonly used intravenous anesthetic drugs both for induction and maintenance of general anesthesia. The present study was conducted to evaluate the effect of sevoflurane as an adjuvant to propofol-based total intravenous anaesthesia during ocular surgery.**Materials and Methods:** The present study was conducted to evaluate the effect of sevoflurane as an adjuvant to propofol-based total intravenous anaesthesia during ocular surgery. The study was conducted over a period of 1 year among 90 patients who were scheduled to undergo ocular surgery by ophthalmologist under GA. Patients were randomized divided into the propofol-based TIVA or propofol /sevoflurane anesthesia groups. All patients were monitored. Data was collected and analysis was done. **Results:** In the present study 90 patients undergoing elective ocular surgery under GA were included and divided into 2 groups 45 in the TIVA group and 45 in the propofol/sevoflurane group. Mean age of TIVA group was 56yrs and propofol/sevoflurane group was 54 yrs. Maximum patients were ASI II in both groups. The operation time for TIVA group was 55.3±20.6 mins and for propofol/ sevoflurane group was 66.4±28.7mins. Anesthesia time for TIVA group was 86.4±24.6mins and propofol/sevoflurane group was 95.4±32.3mins. Extubation time for TIVA group was 5.43±3.12mins and propofol/sevoflurane group was 6.56±3.12mins and the LOC Ce for TIVA group was 2.67±0.76mins and propofol/sevoflurane group was 3.02±0.92mins. The maintenance propofol Ce values were 2.59±0.79 and 2.28±0.89 µg/mL in the TIVA and propofol/sevoflurane groups, respectively. The awakening propofol Ce values were 0.95±0.43 and 0.67±0.28 µg/mL in the TIVA and propofol/sevoflurane groups, respectively. Nasopharyngeal excretion volume was 29.3±19.5 and 15.5±11.8 in the TIVA and propofol/sevoflurane groups, respectively. **Conclusion:** The present study concluded that the combination with 1% sevoflurane anesthesia attenuated propofol-induced excess excretions during ocular surgery. And no prolonged extubation under BIS monitoring, no postoperative endophthalmitis, and no PONV in the 2 groups was found.

Keywords: Ocular Surgery, Propofol, Sevoflurane, Total Intravenous Anaesthesia.

Introduction

Postoperative pain after surgery is still a significant problem, and poor control of postoperative pain can result in increased morbidity, prolonged recovery, reduced patient satisfaction, and increased incidence of chronic postsurgical pain[1,2].Analgesics that improve analgesia, reduce opioid use, and reduce opioid-related side effects can improve outcomes and enhance recovery[3]. It was found that some patients had secretions toward the eye, resulting in contamination of surgical field in propofol-based total intravenous anesthesia (TIVA) during ophthalmic surgery,[4] and it is more common in adults and in prolonged procedures[5]. For this reason, TIVA is not suggested for ocular surgery. However, the incidence of postoperative nausea and vomiting (PONV) and the need for antiemetics were significantly less in the TIVA patients than in the inhalation anesthesia patients in ophthalmic surgery[6]. Because PONV will increase intraocular pressure resulting in wound dehiscence and glaucoma. Therefore, TIVA is suitable for ocular surgery[7,8]. The present study was conducted to evaluate the effect of sevoflurane as an adjuvant to propofol-based total intravenous anaesthesia during ocular surgery.

**Correspondence*
Dr. Kalicharan Bansal
Associate Professor, Department of General Surgery, Government Medical College & Attached Group of R.B.M Hospital, Bharatpur, Rajasthan, India.
E-mail: Kcbansal15@gmail.com

Materials and Methods

The present study was conducted to evaluate the effect of sevoflurane as an adjuvant to propofol-based total intravenous anaesthesia during ocular surgery. Before the commencement of the study ethical approval was taken from the Ethical Committee of the institute and written consent was taken from the patient after explaining the study. The study was conducted over a period of 1 year among 90 patients who were scheduled to undergo ocular surgery by ophthalmologist under GA. Patients were randomized divided into the propofol-based TIVA or propofol/sevoflurane anesthesia groups. Patients with possible pregnancy; emergent surgeries; uremia; and liver disease were excluded from the study. All patients fasted overnight before surgery. To exclude the potential influence of diurnal variations of salivation, the patients were performed uniformly at the time around mid-day. There was no premedication before induction of anesthesia. Regular monitoring, such as noninvasive arterial blood pressure, electrocardiography (lead II), pulse oximetry, and end-tidal carbon dioxide pressure (EtCO2) were applied in each patient. GA was induced with fentanyl, propofol, and rocuronium in all patients, then

intubated and maintained with propofol or propofol/sevoflurane. All patients were monitored under bispectral index (BIS). In the propofol-based TIVA group, anesthesia was induced using intravenous (IV) fentanyl (2mg/kg) and 2% lidocaine (1.5 mg/kg). Continuous infusion of propofol was delivered subsequently using Schneider kinetic model of target-controlled infusion with the effect-site concentration (Ce) of 4.0mg/ml. Rocuronium (0.6mg/kg) was given when patients lost consciousness, followed by tracheal intubation. GA was maintained with TCI propofol infusion and 1.0 L/min flow with 50% oxygen. In the propofol/sevoflurane group, the anesthesia induction was as the TIVA group patients, whereas anesthesia was maintained using propofol infusion and 1% sevoflurane (inhaled concentration) with an oxygen flow of 1mL/ min. Repetitive bolus injections of rocuronium were prescribed as required throughout the procedure in both groups. Maintenance of the Ce for the TIVA and propofol/sevoflurane was adjusted to keep BIS value between 40 and 60, and mean arterial blood pressure at 80 to 100mm Hg. The EtCO2 pressure was maintained at 35 to 45mm Hg. Once neuromuscular function returns, rocuronium (10mg, IV) was administered as required. All patients received IV dexamethasone 5 mg for preventing PONV. At the end of the procedure, propofol or sevoflurane was discontinued, and the lungs were ventilated with 100% oxygen at a fresh gas flow of 6 L/min. Reversal of neuromuscular function was achieved by administrating neostigmine (0.03–0.04mg/kg) with glycopyrrolate (0.006–0.008mg/ kg) once spontaneous breathing returned to prevent residual paralysis. When the patient regained consciousness by name with spontaneous and smooth respiration, the endotracheal tube was removed, and the patient was sent to the postoperative anesthesiacare unit for further care. Total volume of secretions was determined by collecting them with frequent suction via nasal and oral cavities by using the suction apparatus from the end of surgery to extubation of the endotracheal tube. Additionally, loss of consciousness (LOC) Ce of propofol, awakening Ce of propofol, maintenance Ce, maintenance concentration of sevoflurane (%) and awakening concentration of sevoflurane (%), extubation time and the incidence of PONV within 24 hours after surgery was recorded. Data was presented as the mean and standard deviation (SD) or number of patients. Comparison was done using Student t tests or Mann–Whitney U test, chi-square test. Statistical significance was accepted for 2-tailed P values of less than 0.05.

Results

In the present study 90 patients undergoing elective ocular surgery under GA were included and divided into 2 groups 45 in the TIVA group and 45 in the propofol/sevoflurane group. Mean age of TIVA group was 56 yrs and propofol/sevoflurane group was 54 yrs. Maximum patients were ASA II in both groups. The operation time for TIVA group was 55.3±20.6mins and for propofol/ sevoflurane group was 66.4±28.7mins. Anesthesia time for TIVA group was 86.4±24.6mins and propofol/sevoflurane group was 95.4±32.3mins. Extubation time for TIVA group was 5.43±3.12mins and propofol/ sevoflurane group was 6.56±3.12mins and the LOC Ce for TIVA group was 2.67±0.76mins and propofol/sevoflurane group was 3.02±0.92mins. The maintenance propofol Ce values were 2.59±0.79 and 2.28±0.89µg/mL in the TIVA and propofol/sevoflurane groups, respectively. The awakening propofol Ce values were 0.95±0.43 and 0.67±0.28 µg/mL in the TIVA and propofol/sevoflurane groups, respectively. Nasopharyngeal excretion volume was 29.3±19.5 and 15.5±11.8 in the TIVA and propofol/sevoflurane groups, respectively. There were no patient with PONV in both groups.

Table 1: Demographic data

Variables	Group TIVA N=45	Group P/S N=45
Gender		
Male	21	25
Female	24	20
Mean Age (yrs)	56±10.6	54.3±12.4
ASA		
ASA I	9	4
ASA II	26	30
ASA III	10	11

Table 2: Comparison of perioperative characteristics and outcomes for both groups

Variables	Group TIVA N=45	Group P/S N=45
Operation time (min)	55.3±20.6	66.4±28.7
Anaesthesia time (min)	86.4±24.6	95.4±32.3
Extubation time (min)	5.43±3.12	6.56±3.12
LOC C_e(µg/ml)	2.67±0.76	3.02±0.92
Awakening C_e(µg/ml)	0.95±0.43	0.67±0.28
Maintenance C_e(µg/ml)	2.59±0.79	2.28±0.89
Nasopharyngeal excretion volume	29.3±19.5	15.5±11.8
Patients with PONV	0	0
Patients with postoperative endopthalmitis	0	0

Discussion

Propofol is one of the most commonly used intravenous anesthetic drugs both for induction and maintenance of general anesthesia. Advantages of total intravenous anesthesia (TIVA) with propofol also include reduced nausea and vomiting, reduced atmospheric pollution, and a better wake up profile[9].Propofol also has analgesic properties[10].A meta-analysis of 14 clinical trials also found that propofol was associated with lower pain scores 24 hours after surgery[11].Furthermore, TIVA with propofol may reduce incidence of chronic postsurgical pain[12,13]. However, other clinical studies have found no beneficial analgesic effect after surgery with propofol[14,15].The incidence of hypersalivation under propofol anesthesia in elective orthopedic and urological surgery was 60%[16]and in minor gynecological surgery was 25%[17]. Whereas, propofol anesthesia compared with sevoflurane anesthesia would increase salivation in laryngeal microsurgery with unknown incidence[18].The mechanism of hypersalivation might be due to the fact that propofol increases the intracellular concentration of calcium and modulates the activation of P2X4 in submandibular acini[19].

Sevoflurane and propofol had similar efficacy for anesthesia, nevertheless, propofol based TIVA may still be the preferred anesthetic because of its favourable anesthesia characteristics, such

as high patient satisfaction and less frequent incidence of PONV[20-22].Enlund et al. found that propofol-based anesthesia was associated with better survival after colon cancer surgery compared with sevoflurane anesthesia[23].During lengthy surgical procedures, higher than necessary propofol infusion levels may accumulate and be redistributed from the fatty tissue and muscle to the plasma, which leads to delayed recovery. Inhaled DES is also redistributed in the fatty tissue and muscle and may delay emergence in cases where the anesthesia time is increased[24].In addition, Kim et al reported that sevoflurane-induced decrease in airway secretion is due to the impairing chloride secretion indirectly by inhibiting the KCNQ1 channel in the tracheal epithelium and salivary gland[25,26].

For attenuating secretions, an antisialagogue such as glycopyrrolate may be useful to reduce nasopharyngeal excretion, except in prolonged ophthalmic surgery[27,28]. However, anticholinergics have cardiovascular adverse effects, including cardiac dysrhythmias and ischemia[29].

Conclusion

The present study concluded that the combination with 1% sevofluraneanesthesia attenuated propofol-induced excess excretions during ocular surgery. And no prolonged extubation under BIS monitoring, no postoperative endophthalmitis, and no PONV in the 2 groups was found.

References

1. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. Lancet (London, England). 2006;367:1618–25.
2. Rodgers A, Walker N, Schug S et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. BMJ (Clinical research ed). 2000;321:1493.
3. Wick EC, Grant MC, Wu CL. Postoperative multimodal analgesia pain management with nonopioid analgesics and techniques: a review. JAMA Surg. 2017;152:691–7.
4. Lai HC, Wu ZF. Excess nasopharyngeal secretions in ocular surgery under propofol-based total intravenous anesthesia. J Clin Anesth. 2016;34:257–8.
5. Larson SA, Petersen DB, Scott WE. Strabismus surgery complications: prevention and management. Comp Ophthalmol Update. 2003; 4:255–63.
6. Wu ZF, Jian GS, Lee MS et al. An analysis of anesthesia-controlled operating room time after propofol-based total intravenous anesthesia compared with desfluraneanesthesia in ophthalmic surgery: a retrospective study. Anesth Analg. 2014; 119:1393-406.
7. Liu YT, Huang RC, Wu ZF. Wound dehiscence after general anesthesia in a child. J ClinAnesth. 2016; 30:2-3.
8. Gupta S, Chari P, Bala I et al. Phakomorphic glaucoma: an unusual cause of postoperative vomiting. Anaesthesia. 1994; 49:959-60.
9. VasileiouI, Xanthos T, Koudouna E et al. Propofol: a review of its non-anaesthetic effects. Eur J Pharmacol. 2009;605:1–8.
10. Bandschapp O, Filitz J, Ihmsen H et al. Analgesic and antihyperalgesic properties of propofol in a human pain model. Anesthesiology. 2010;113:421–8.
11. Qiu Q, Choi SW, Wong SS et al. Effects of intra-operative maintenance of general anaesthesia with propofol on postoperative pain outcomes: a systematic review and meta-analysis. Anaesthesia. 2016; 71:1222-33.
12. Ogurlu M, Sari S, Kucuk M et al. Comparison of the effect of propofol and sevoflurane anaesthesia on acute and chronic postoperative pain after hysterectomy. Anaesth Intensive Care. 2014;42:365–70.
13. Song JG, Shin JW, Lee EH et al. Incidence of post-thoracotomy pain: a comparison between total intravenous anaesthesia and inhalation anaesthesia. Eur J Cardiothorac Surg. 2012;41:1078–82.
14. Fassoulaki A, Melemeni A, ParaskevaA et al. Postoperative pain and analgesic requirements after anesthesia with sevoflurane, desflurane or propofol. Anesth Analg. 2008 ;107: 1715–9.
15. Pokkinen SM, Yli-Hankala A, Kalliomaki ML. The effects of propofol vs. sevoflurane on post-operative pain and need of opioid. ActaAnaesthesiol Scand. 2014;58:980–5.
16. De Grood PM, Coenen LG, van Egmond J et al. Propofol emulsion for induction and maintenance of anaesthesia. A combined technique of general and regional anaesthesia. Acta Anaesthesiol Sc and. 1987; 31:219-23.
17. Schaer H. Propofol infusion for the maintenance of short-term anesthesia. Anaesthesist. 1988; 37:187-92.
18. Kang JG, Kim JK, Jeong HS et al. A prospective, randomized comparison of the effects of inhaled sevofluraneanesthesia and propofol/remifentanil intravenous anesthesia on salivary excretion during laryngeal microsurgery. Anesth Analg. 2008; 106:1723-7.
19. Fernandez M, Pochet S, Chaïb N et al. Potentiation by propofol of the response of rat submandibular acinar cells to purinergic agonists. Cell Calcium. 2001; 30:167-80.
20. Fredman B, Nathanson MH, Smith I et al. Sevoflurane for outpatient anesthesia: a comparison with propofol. Anesth Analg. 1995; 81:823-8.
21. 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. 1999;91:253–61.
22. Joo HS, Perks WJ. Sevoflurane versus propofol for anesthetic induction: a meta-analysis. AnesthAnalg. 2000;91:213–9.
23. Enlund M, Berglund A, Andreasson K,Cicek C, Enlund A, Bergkvist L. The choice of anaesthetic–sevoflurane or propofol–and outcome from cancer surgery: A retrospective analysis. Ups J Med Sci. 2014; 119:251–61
24. Lu CH, Yeh CC, Huang YS, Lee MS, Hsieh CB, Cherng CH et al. Hemodynamic and biochemical changes in liver transplantation: A retrospective comparison of desflurane and total intravenous anesthesia by target-controlled infusion under auditory evoked potential guide. Acta Anaesthesiol Taiwan. 2014; 52:6–12.
25. Kim JK, Yoo HY, Kim SJ et al. Effects of sevoflurane on the cAMP induced short-circuit current in mouse tracheal epithelium and recombinant Cl- (CFTR) and K+ (KCNQ1) channels. Br J Anaesth. 2007;99:245–51.
26. Puchalski RB, Kelly E, Bachmanov AA et al. NaCl consumption is attenuated in female KCNE1 null mutant mice. PhysiolBehav. 2001; 74:267-76.
27. Hata TM, Moyers JR. Preoperative evaluation and management. In: Barash PG, Cullen BF, Stoelting RK (eds.). Clinical Anesthesia. 6th ed. Philadelphia: Lippincott Williams &Wilkins, 2006, 495-7.
28. Larson SA, Petersen DB, Scott WE. Strabismus surgery complications: prevention and management. CompOphthalmol Update. 2003; 4:255–63.
29. Parlow JL, van Vlymen JM, Odell MJ. The duration of impairment of autonomic control after anticholinergic drug administration in humans. AnesthAnalg. 1997;84:155–9

Conflict of Interest: Nil Source of support:Nil