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Research paper

# The risk of postoperative nausea and vomiting between surgical patients received propofol and sevoflurane anesthesia: A matched study

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ABSTRACT

*Objectives:* The current consensus guidelines for managing postoperative nausea and vomiting (PONV) suggest that one of anesthetic risk factors is the use of volatile anesthetics. However, in clinical settings, it is rare to perceive propofol to be superior to volatile anesthetics for the prevention of PONV. To assess whether PONV is related to the type of anesthetic delivered, we compared the incidence and duration of PONV between propofol anesthesia and sevoflurane anesthesia.

*Methods:* We performed a retrospective review of an institutional registry containing 21606 general anesthesia cases conducted following ethics board approval. Anesthesia for all patients was managed with propofol or sevoflurane. To avoid channeling bias, a propensity score analysis was used to generate a set of matched cases (propofol anesthesia) and controls (sevoflurane anesthesia), yielding 2554 matched patient pairs. The incidence and sustained rate of symptoms were compared as the primary outcomes.

*Results:* In the unmatched population, a higher incidence of PONV occurred following propofol anesthesia compared to sevoflurane anesthesia (propofol vs. sevoflurane anesthesia: 18.9% vs. 15.3%, respectively, $p < 0.0001$). The sustained rate of PONV over the course after propofol anesthesia was also higher than that following sevoflurane anesthesia ($p < 0.001$). Conversely, less PONV occurred after propofol compared to sevoflurane after propensity matching (propofol vs. sevoflurane anesthesia: 20.4% vs. 23.3%, respectively, $p = 0.01$). However, the sustained rate of PONV over the course after propofol anesthesia did not differ from that following sevoflurane anesthesia ($p = 0.09$).

*Conclusions:* Propofol could decrease the incidence of PONV compared with sevoflurane, although the duration of PONV was not affected as found in previous reports.



## 1. Introduction

Despite impressive advances in the field of anesthesia, 25%–30% of patients continue to experience postoperative nausea and vomiting (PONV).[1] Multiple factors, including the anesthetic agent delivered, are associated with an increased incidence of PONV. Moreover, the optimal strategy for preventing PONV continues to be debated. For example, the current consensus guidelines for managing PONV suggests that one of the anesthetic risk factors is the use of volatile anesthetics and recommends the use of propofol for the induction and maintenance of anesthesia, in addition to the avoidance of volatile anesthetics.[2] However, these statements have not been revised since the former guidelines issued in 2003[3] and all new recommendations in both guidelines are based on the reports issued before the former guideline.[4–6] This may not be inevitable because there have been few new reports that have directly compared the effects of propofol and volatile anesthetics on PONV since the establishment of the current guidelines. Thus, it appears to be difficult to reevaluate these effects using randomized control trials because of the statements in the guidelines, which are liable to believe to be established without doubt. Especially in Japan, an environment for aggressively conducting randomized control trials in this field does not exist and is only achieved by overcoming numerous difficulties. This implies that it is very difficult to gain an understanding of the citizens and dispel their doubts in the wake of scandals found in clinical trials.[7] However, in clinical settings, it is rare to perceive propofol as superior to volatile anesthetics to prevent PONV. This is because propofol is frequently used for

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patients with risk factors for PONV while volatile anesthetics are used for the others.

Instead of randomized control trials, there is a growing interest in the use of propensity score-based methods in observational studies to estimate treatment effects. The propensity score is defined as the conditional probability of assigning a subject to a particular treatment protocol given a vector of measured covariates.[8,9] In our institute, surgical patients managed by the anesthesia department undergo a structured postoperative interview with registered anesthesiologists at the postoperative anesthesia consultation clinic. At this time, the occurrence of any perioperative adverse events is assessed, and the patients can critique perioperative management based on the completion of an interview form. Using these interview data and several perioperative variables, we generated a propensity score for the probability of a patient being assigned to a particular anesthesia method (propofol vs. volatile anesthetics [sevoflurane]). With a propensity score matching method, we retrospectively investigated whether the incidence and duration of PONV were associated with the anesthetics delivered.

## 2. Materials and methods

Approval for the review of patient clinical charts, access to data of the institutional registry of anesthesia, and reporting of the results was obtained from the Nara Medical University Institutional Review Board, Kashihara, Nara, Japan (Chairperson Prof. N Kurumadani). The requirement for written informed consent was waived by the Institutional Review Board (No. 962 approved on March 19th, 2015).

### 2.1. Perioperative patient treatment

Patients were fasted for at least 10 h before the surgery but were allowed to drink clear fluids until 3 h before the surgery. No standardization was made for the methods of induction and maintenance of anesthesia. However, general anesthesia was usually induced with intravenous propofol (1–2.5 mg/kg) plus either fentanyl (1–2 μg/kg) or remifentanil (0.2–0.3 μg/kg/min), and neuromuscular blockade was achieved with rocuronium (0.6–0.9 mg/kg). Tracheal intubation was performed using a Macintosh-type laryngoscope. Anesthesia was maintained with sevoflurane (1.5%–2%) in a 40% oxygen and air mixture or with propofol (6–10 mg/kg/h). Nitrous oxide was not used. Fentanyl (1–2 μg/kg/h) or remifentanil (0.1–0.2 μg/kg/min) were used for analgesia. Rocuronium (0.2–0.3 mg/kg/h) was used for the neuromuscular blockade and sugammadex (2–4 mg/kg) (since August 2010) or neostigmine (40 μg/kg) plus atropine (20 μg/kg) until July 2010 was used to reverse the neuromuscular blockade after evaluating the status of the neuromuscular blockade by a nerve stimulator. Occasionally, postoperative analgesia was provided with intravenous fentanyl or epidural ropivacaine combined with fentanyl using a patient-controlled analgesia (PCA) device (Coopdech Syrinjector PCA Device™ for iv, Coopdech Balloonjector PCA Device™ for epidural, Daiken Medical Co. Ltd., Osaka City, Osaka, Japan). When PCA was used, a low dose droperidol (1.25–2.5 mg/day) was combined with a PCA device. PONV prophylaxisa, including a single dose intravenous steroid, 5-HT-3 blocker, low dose droperidol (except for cases with fentanyl-based PCA) or metoclopramide, was not used at the end of surgery. After the completion of anesthesia, the attendant in charge filled out the form for the institutional registry of anesthesia. This form includes the attendant's name, the name of the person who performed intubation, the patient's demographic variables, information regarding the final diagnosis and surgical procedures (later categorized into three classes based on the modified surgical risk stratification),[10] medical history (e.g., hypertension, diabetes mellitus, coronary artery disease, history of heart failure, and lung disease), the duration of anesthesia and surgery, ASA physical status, urgency of surgery (emergency or elective), anesthesia technique (inhalational or intravenous with or without regional analgesia), intraoperative patient positioning, final airway assessment, requirement of transfusion, implementation of postoperative analgesia, requirement of postoperative intensive care, and adverse intraoperative events (e.g., cardiac events, hypotension, arrhythmia, and hypoxia). The attendant in charge of the case also followed-up the patient and recorded any complications, including PONV over the following postoperative days. In addition, by the 14th postoperative day, the patients completed a questionnaire, including items pertaining to the incidence and duration of PONV. The incidence and duration of PONV were determined by referring to both the patient's report and the postanesthetic round record. The intensity of PONV (nausea or vomiting) was not distinguished but combined and treated as the final answer.

### 2.2. Data handling

Data were collected between January 2009 and December 2013, during which there were 21,606 anesthesia cases. The exclusion criteria for the current study and the subsequent reduction in ineligible patients (initial → final) are as follows: the exclusion criteria for the current study (and reasons for the consequent reductions in ineligible patients) were as follows: 1) cases except for general anesthesia (n = 2,588); 2) cases missing answers on the postoperative questionnaire (n = 2,222); 3) < 15 years old (n = 1,543); 4) cases missing data sets (n = 1,579) (Fig. 1).

### 2.3. Statistical analysis

Continuous variables are presented as mean and standard deviation (SD) if normally distributed, or as the median and interquartile range (IQR) if nonparametric. The categorical variables are presented as the number of patients and frequencies (%). Outcomes of the patients anesthetized by propofol or sevoflurane were compared first for PONV using the initial 13,674 patients. For the overall incident rate, a Fisher's exact test was used to estimate the

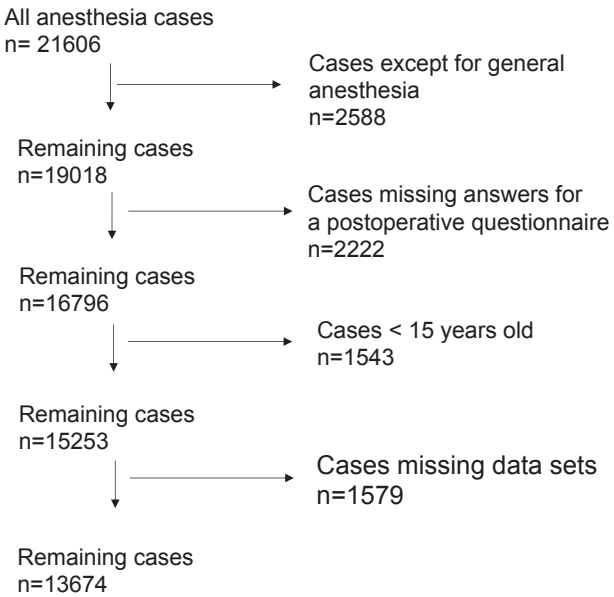


**Fig. 1.** Flow diagram for patient inclusion and exclusion criteria.

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