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ORIGINAL ARTICLE

Incidence of nausea/vomiting following propofol sedation with adaptive servo-ventilation for atrial fibrillation ablation

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Abstract

Background: Postoperative nausea and vomiting (PONV) following atrial fibrillation (AF) ablation can cause considerable distress.

Aim: Continuous intravenous propofol sedation with adaptive servo-ventilation (ASV) with or without an analgesic, pentazocine, during AF ablation was studied in 272 consecutive patients with paroxysmal, persistent, and long-standing persistent AF. The study objectives were to determine the incidence of PONV after AF ablation and to assess the predictive value of factors for PONV using the area under the receiver operating characteristic curve (AUC).

Results: The present sedation maneuver was successfully accomplished with a low incidence of hypotension and without discontinuation of ablation or switching to general anesthesia, while maintaining an acceptable procedural time (102 ± 32 min). The incidence of PONV was 5.5% (15/272). Nausea occurred in nine patients after an average of 4.6 ± 3.5 h (range: 2–12 h) postablation, and vomiting with nausea occurred in six patients after an average of 4.5 ± 3.1 h (range: 1–9 h) postablation. The postablation interval did not differ significantly between the occurrence of nausea and nausea accompanied by vomiting. AUCs based on various factors, including the Apfel score, ranged from 0.55 to 0.67, indicating low accuracy in predicting PONV occurrence.

Conclusions: The incidence of PONV after propofol sedation with ASV was the lowest (5.5%) reported to date. Scoring systems, which included the Apfel score, were ineffective in predicting PONV. The low PONV incidence in addition to the efficacy of propofol sedation with ASV revealed the adequacy of this regimen for AF ablation.

KEYWORDS
anesthetic, catheter, gastrointestinal symptoms, postoperative complaint, supraventricular arrhythmia

1 | INTRODUCTION

Catheter ablation (CA) is a widely used treatment for atrial fibrillation (AF). The initial approach involved the use of radiofrequency (RF) energy to circumferentially isolate the pulmonary veins (PVs) from the left atrium (LA), a technique known as pulmonary vein isolation (PVI). PVI provides satisfactory AF-free rates for paroxysmal AF.[1] However, for persistent AF and long-standing persistent AF, PVI alone does not yield acceptable success rates or optimal freedom from AF.[2] Thus, various adjunctive ablation techniques have been developed to enhance ablation outcomes. These techniques include linear isolation, regional ablation of electrically high-excitability zones, and ablation of non-PV foci. For instance, structures such as the superior vena cava (SVC), LA posterior wall, crista terminalis, coronary sinus ostium, vein of Marshall, and interatrial septum have been identified as potential non-PV foci.[3–6] In such cases, CA for AF tends to require a longer procedure time than other catheter treatments, such as those for simpler arrhythmias or percutaneous coronary intervention.

A relatively long procedure time requires adequate sedation coupled with stable respiration to ensure a pain- and restlessness-free experience. Therefore, we developed and introduced a system for continuous intravenous propofol infusion combined with a portable adaptive servo-ventilation (ASV) system.[7] The effectiveness and reliability of this combined sedation and respiration control system were demonstrated in our previous studies on AF ablation. Thus, these studies showed that the system supports clinically appropriate procedure durations and successful AF ablation outcomes, and does not result in significant complications.[8,9]

One issue associated with sedation, analgesics, and anesthesia is the occurrence of nausea and vomiting after administration. Sedation with propofol has a lower incidence of postoperative nausea and vomiting (PONV) than that with other agents, including analgesics and anesthetics.[10,11] We hypothesized that using continuous intravenous propofol sedation with the ASV system during the AF ablation procedure might result in a clinically acceptable low incidence of PONV after AF ablation.

The Apfel score is widely used to predict the likelihood of nausea and vomiting after treatments involving sedation, analgesics, and anesthetics.[12,13] The Apfel score is based on female gender, history of motion sickness/PONV, nonsmoking, and the use of postoperative opioids.[13] By identifying patients at high risk for PONV, timely interventions can be administered to expedite recovery from nausea and vomiting. However, no study has examined the efficacy of the Apfel score in predicting PONV occurrence after continuous propofol infusion sedation during AF ablation. To our knowledge, the applicability of the Apfel score in the context of continuous intravenous propofol infusion for AF ablation has not been explored.

The objectives of this study were twofold: (1) to determine the incidence of PONV after continuous propofol infusion sedation with the ASV system; and (2) to assess the effectiveness of the Apfel score in predicting nausea and vomiting. Additionally, we evaluated the efficacy of the current sedation-with-respiration-control system.

2 | METHODS

This single-center, retrospective, observational study was conducted at the Okayama Heart Clinic in Okayama, Japan. This study included 272 consecutive AF patients who underwent AF ablation between January 2021 and December 2021. The primary endpoint of this study was the occurrence of PONV after deep sedation with continuous propofol infusion during AF ablation. The secondary endpoints were the area under the receiver operating characteristic (ROC) curves (AUC) using various factors in patients with and without PONV after propofol sedation.

The examinations and analytical procedures adhered to the guidelines of the Declaration of Helsinki. This study was approved by the Institutional Ethics Committee for Human Research at Okayama Heart Clinic (Approval number, HS1). All patients provided written informed consent for the use of their data, and personally identifiable information was removed.

2.1 | Sedation and ASV

The details of the methods for sedation and respiration have been described in our previous report.[7] After the induction of deep sedation, ablation was performed by four staff members, namely an operator, a specialized nurse, and two medical engineers. The specialized nurse monitored the sedation level and hemodynamic status and provided appropriate treatment when needed under the direction of the operator. Sedation was performed by intravenous infusion of propofol. For analgesia, the decision to use premedication with pentazocine or any additional dose was at the discretion of the operator. The dosage for continuous intravenous administration of propofol was adjusted to maintain a sedation level of 6 on the Ramsay sedation scale with a maximum level of 10. Additionally, a brain monitoring system (A-3000 BIS XP Platform™; Aspect Medical System, Natick, MA, USA) was used to ensure an appropriate depth of sedation and prevent excessive sedation or unexpected awakening.

Respiratory control was performed with ASV, which augments inspiratory pressure when the expiratory positive airway pressure (EPAP) is low; this ventilatory support intensifies when the breathing effort is reduced or diminished. ASV was administered using a full-face mask (Mirage Quattro™; ResMed Ltd.). The standard settings during treatment were as follows: EPAP, 5 cmH_2O; inspiratory positive airway pressure, 3–10 cmH_2O. To prevent hypoventilation, the ASV system constantly monitored both tidal and minute volumes. Supplemental oxygen was administered at a rate of 6 L/min. Throughout the AF ablation procedure, vital signs such as heart rate, blood pressure, and arterial oxygen saturation were continuously monitored.

2.2 | AF ablation

Methods for PV isolation have previously been documented in the literature.[8,14] During RF delivery, two 20-polar ring catheters (Japan Lifeline Co. Ltd., Tokyo, Japan) were positioned within the ipsilateral superior and inferior PV. The irrigated RF energy was set at a target temperature of 43°C, a power cap of 30–35 W, and an infusion rate of 13 mL/min using the FlexAbility™ catheter (Abbott Japan, Tokyo, Japan). RF energy was applied for 20–30 s until the local electrogram amplitude decreased by 70%, or until double potentials were observed. The irrigated RF ablation was performed 0.5–1.0 cm away from the PV ostia, encircling the ipsilateral PV, guided by an electroanatomic mapping system (EnSite NavX™ system; Abbott, St Paul, MN, USA).

After PV isolation, additional ablation was performed as required. This included prophylactic cavotricuspid isthmus ablation, superior vena cava isolation, LA linear ablation, LA low-voltage area ablation, and ablation of complex fractionated atrial electrograms in the right and left atria. The choice and execution of these procedures were at the discretion of the operator.

2.3 | Complications

Major thromboembolic complications were defined as follows: cerebral embolism, transient ischemic attack after ruling out intracranial hemorrhage, pulmonary embolism, and deep venous embolism. Major bleeding complications were defined as follows: bleeding requiring blood transfusion, hematomas requiring surgical intervention, and cardiac tamponade requiring drainage.

2.4 | Postablation nausea and vomiting follow-up

Nausea and vomiting were assessed at 2, 4, 6, and 12 h after ablation during the scheduled nurse rounds. Subjective symptoms, including nausea, were monitored using a nurse call system. The presence or absence of nausea and/or vomiting was initially assessed. Based on the physician's decision, the antiemetic metoclopramide was administered in six out of 15 patients with PONV.

2.5 | Statistical analyses

Statistical analyses were conducted using R, version 3.2.2 (R Foundation for Statistical Computing, Vienna, Austria). To detect an incidence of ~5%, a sample of 60 patients is sufficient according to the rule of three.[15] Student's *t*-test was used to compare data between patients with and without nausea and/or vomiting, based on data distribution. Data normality was assessed using the Kolmogorov–Smirnov test and histograms. Variance homogeneity was verified using the *F*-test. For categorical variables, chi-square tests with 2×2 tables and two-tailed tests were used to compare the two groups. To predict PONV, the AUC and optimum cutoff level were determined using ROC curve analyses to evaluate the predictive ability based on the sum of the scores from various factors, including scores advocated by Apfel.[13,16] Although the number of patients with PONV was small and multivariate analysis may have had low accuracy, a ROC curve using propensity scores derived from multiple logistic regression analysis was used as a reference. Data are presented as means ±1 standard deviation (SD) or as medians with 25th and 75th percentiles. Statistical significance was set at $p < .05$.

3 | RESULTS

3.1 | Patient background characteristics

Table 1 presents the background characteristics of the patients with and without PONV. Female gender and a history of motion sickness/PONV were significantly associated with a higher incidence of PONV. Other clinical factors, including age, body mass index, creatine clearance, left atrial diameter, and left ventricular ejection fraction, did not differ between the two groups.

3.2 | Sedation with ASV ventilation

Deep sedation with propofol combined with ASV was successfully maintained throughout ablation, and none of the patients required a switch to inhalation anesthesia with intubation. Discontinuation of ablation did not occur in any of the patients. The occurrence of hypotension requiring etilefrine hydrochloride was acceptably low, and not significantly different between patients with PONV (15%, 2/13) and those without PONV (14%, 31/226). No significant differences were observed in the procedural time of AF ablation or the total volume of propofol administered between patients with and without PONV.

3.3 | Ablation and complications

Ablation was successfully performed in all patients with acceptable procedural times (Table 2). Major thromboembolic and bleeding complications were not observed in any of the enrolled patients.

3.4 | PONV occurrence

In this study, 15 patients developed PONV. The incidence of PONV was 5.5% (15/272). Nausea occurred in nine patients after an average of 4.6±3.5 h (range: 2–12 h) following the completion of ablation. Vomiting accompanied by nausea was observed in six patients after an average of 4.5±3.1 h (range: 1–9 h) postablation. No significant difference was observed in the number of hours postablation

TABLE 1 Patient characteristics.

	Total	PONV (+)	PONV (–)	*p*-value
Number of patients	272	15	257	
Patient background characteristics				
Age (years)	69 ± 10	69 ± 10	66 ± 10	0.250
Gender (female)	84 (31%)	8 (53%)	76 (30%)	0.081
Body mass index (kg/m^2)	24.1 ± 3.9	22.7 ± 3.3	24.2 ± 3.9	0.160
Creatinine clearance (mL/min)	74 ± 26	73 ± 19	74 ± 26	0.910
Left atrial diameter (mm)	42 ± 7	39 ± 6	42 ± 7	0.107
Left ventricular ejection fraction (%)	65 ± 9	63 ± 9	65 ± 9	0.631
Apfel score-related factors				
History of motion sickness/PONV 0: 1: 2	228 (84%): 28 (10%): 16 (6%)	8 (53%): 6 (40%): 1 (7%)	220 (86%): 22 (8%): 15 (6%)	0.002
Drinking 0: 1: 2	123 (45%): 42 (15%): 107 (40%)	4 (27%): 6 (40%): 5 (33%)	119 (46%): 36 (14%): 102 (40%)	0.036
Smoking (+)	33 (12%)	2 (13%)	31 (12%)	0.701
Procedural factors				
Procedural time (min)	102 ± 32	103 ± 31	102 ± 32	0.916
Use of etilefrine hydrochloride (+)	36 (13%)	2 (13%)	34 (13%)	0.999
Use of pentazocine (+)	128 (47%)	8 53%)	120 (47%)	0.791
Total pentazocine administered (mg)	7.3 ± 8.6	9.0 ± 10.7	7.2 ± 8.5	0.420
Total propofol administered (mL)	102 ± 40	83 ± 27	103 ± 40	0.064
Complications				
Major thromboembolic complications	0 (0%)	0 (0%)	0 (0%)	1.000
Major bleeding complications	0 (0%)	0 (0%)	0 (0%)	1.000

Abbreviation: PONV, postoperative nausea and vomiting.

TABLE 2 Area under the curve of the receiver operating characteristic curve and factors included in the analysis.

								AUC obtained by sum of scores			AUC obtained by propensity scores derived from multiple logistic functions		
Factors	Gender	History of PONV/ motion sickness	Smoking	Analgesic: Pentazocine hydrochloride	Drinking	BMI	Age	AUC	AUC 95% CI		AUC	AUC 95% CI	
	in	in	in	in	ex	ex	ex	0.664	0.514	0.815	0.678	0.508	0.840
	x 2 in	x 2 in	x 1 in	x 1 in	ex	ex	ex	0.671	0.515	0.828	N/A	N/A	N/A
	in	in	in	in	in	ex	ex	0.675	0.559	0.792	0.693	0.543	0.841
	in	in	in	in	in	in	ex	0.547	0.392	0.703	0.731	0.589	0.837
	in	in	in	in	in	in	in	0.608	0.472	0.744	0.751	0.620	0.882
	in	in	in	in	in	ex	in	0.616	0.486	0.746	0.712	0.560	0.864

Abbreviations: AUC, area under the receiver operating characteristic curve; BMI, body mass index; CI, confidence interval; ex, not input into the ROC analysis; in, input into the ROC analysis; PONV, postoperative nausea and vomiting.

between the patients with nausea and those with nausea accompanied by vomiting. Owing to the small number of patients with PONV, it was impossible to conduct a statistical analysis of the relationship between occurrence time and other factors. The comparative analysis of factors between patients experiencing PONV and those without PONV is summarized in Table 1. Female gender tended to be associated with PONV occurrence and history of motion sickness/PONV was significantly associated. A drinking habit was also found to be associated with the occurrence of PONV. The administration of analgesics with pentazocine did not show a significant association with the occurrence of PONV.

Metoclopramide was administered to six out of 15 patients who experienced PONV at the physician's discretion. Metoclopramide was not administered randomly, and the number of patients who

received metoclopramide was limited. The nonrandomization and limited number of patients receiving metoclopramide prevented us from evaluating its efficacy on PONV.

No patients experienced nausea/vomiting after discharge.

3.5 | AUC

The ROC curve analysis was conducted on 272 patients, including 15 with PONV and 257 without PONV. Table 2 summarizes the AUCs of the ROC curves. The Apfel scoring system included four factors, namely female gender, history of motion sickness or PONV, smoking status, and the use of postoperative opioids. As our current sedation protocol did not include the use of opioids, we conducted an analysis using pentazocine hydrochloride instead of opioids. The AUCs obtained by the sum of various factors ranged from 0.547 to 0.664, which indicated a low accuracy in predicting PONV (Figure 1). The use of pentazocine did not result in improvement in the AUCs.

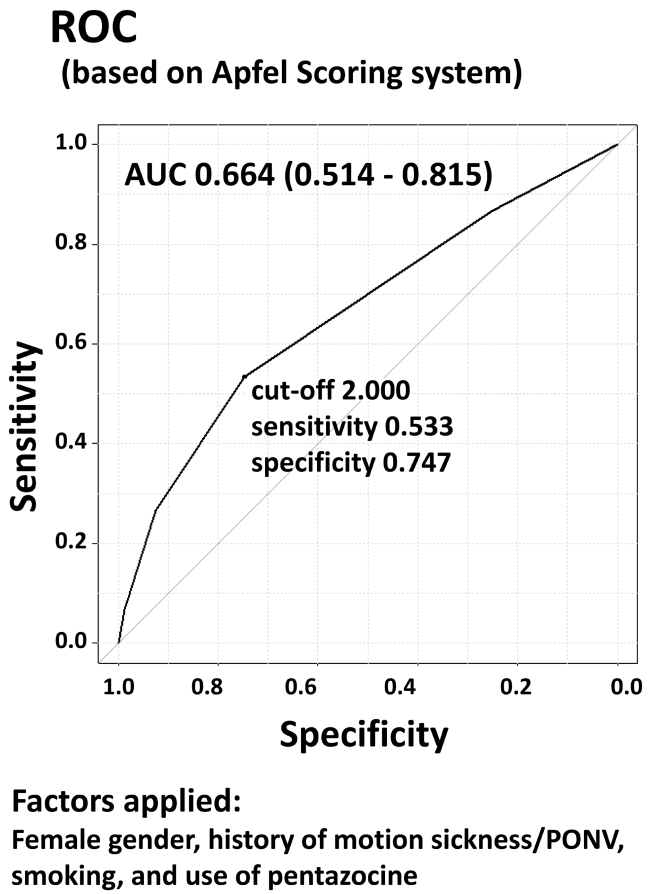

FIGURE 1 Representative ROC curve based on Apfel scoring system. Apfel scoring systems involve the use of opioids as a factor for analgesia. However, the present sedation maneuver, pentazocine was employed for analgesia instead. Therefore, ROC analysis was conducted considering pentazocine as analgesic factor rather than opioids. UC, area under the receiver operating characteristic curve; PONV, postoperative nausea and vomiting; ROC, receiver operating characteristic.

The AUCs, obtained using propensity scores derived from multiple logistic functions as a reference, ranged from 0.676 to 0.751, still indicating low-to-moderate accuracy.

4 | DISCUSSION

The present study was the first to examine PONV after propofol sedation with ASV for AF ablation. Our results were the following: (1) the incidence of PONV was 5.5%; and (2) the AUCs determined using various scores, including scores advocated by Apfel, could not accurately predict the occurrence of PONV in the present sedation maneuver.

The results demonstrated the adequacy of the current sedation-and-respiration-control system. Furthermore, the results of AF ablation and its associated complications revealed that the ablation maneuver was also effective. These fundamental findings from the sedation and ablation procedures justify an analysis of PONV incidence and warrant further discussion.

This observational study revealed a low incidence of PONV after sedation with continuous intravenous infusion of propofol during AF ablation. To the best of our knowledge, no studies have examined PONV after using the present sedation-with-respiration-control system, and the results can thus not be directly compared with those of previous studies. However, a retrospective study analyzing 3483 patients who underwent CA, based on a database provided by Medical Data Vision Co., Ltd., Tokyo, Japan, revealed that the incidence of PONV varies widely, ranging from 6% to 79% (Table 3).[17] Various combinations of sedative agents, including dexmedetomidine (DEX), diazepam, propofol, flunitrazepam, midazolam, pethidine, pentazocine (PTZ), thiamylal, and thiopental (TIO), were used in these cases. The combination of propofol, DEX, and pethidine or dexmedetomidine alone resulted in PONV incidences of 4.5% and 5.6%, respectively. The incidence of PONV observed in this study (5.5%) was comparable to these rates. In contrast, the database results indicated a higher PONV incidence for propofol sedation combined with other agents, with incidence rates of 20–40%. Specifically, the combination of propofol with DEX, TIO, and PTZ showed a PONV incidence of 43%, whereas propofol with TIO and PTZ showed a PONV incidence of 24%. These findings, juxtaposed with the database results, suggest that the combination of agents with propofol plays a significant role in increasing the incidence of PONV. Unfortunately, the database did not provide additional information, such as methods of respiratory maintenance, procedural time of ablation, or the volume of propofol administered. This limitation prevented further discussion regarding the factors influencing PONV incidence. Beyond the low incidence of PONV, ablation under propofol sedation with ASV demonstrated clinically satisfactory immediate and follow-up results, as shown in our previous studies.[8,18] Thus, the observed incidence of PONV, along with our reported ablation outcomes, suggests that propofol sedation is clinically effective for CA.

In other operational contexts, continuous intravenous propofol sedation results in a lower incidence of PONV than that with

TABLE 3 Comparison of reported PONV incidences with incidence observed in the present study.

Sedation	Total number of patients	Number of patients with PONV	Incidence of PONV (%)		
DEX + PF + TIO + PTZ	300	128	42.7		
PF + TIA + PTZ	225	53	23.6		
DEX + TIA + PTZ	181	142	78.5		
DEX + PF + PTZ	157	7	4.5		
DEX	107	6	5.6		NS
The present study PF +/-PTZ	272	15	5.5	NS	NS

Note: NS indicates no significant difference with the incidence observed in the present study, 5.5%.

Abbreviations: DEX, dexmedetomidine; PONV, postoperative nausea and vomiting; PF, propofol; PTZ, pentazocine; TIA, thiamylal; TIO, thiopental.

inhalation anesthesia with isoflurane in elective surgeries.[11] PONV was observed in 20%–40% of patients undergoing propofol sedation; this incidence was higher than that observed in the present study. Another study, which analyzed the incidence of PONV in a systematic review by searching MEDLINE, reported that approximately 10%–20% of patients experienced PONV after maintenance of sedation with propofol.[10] This was lower than the rates observed in the control groups treated with other agents.[10] These studies suggest that propofol sedation generally results in a lower incidence of PONV than that with sedation/anesthesia with other agents. Consistent with these findings, the incidence of PONV observed in our study was lower than that reported in other surgeries.

Of note, the present study did not identify significant relationships between PTZ use and PONV. The Apfel scoring system includes the use of opioids as one of the factors associated with PONV, indicating that analgesics play a role in the occurrence of PONV. A previous study reported a significant relationship between pentazocine usage and PONV.[19] Another studied protocol suggested that the reduction of morphine hydrochloride dosage through acupuncture-assisted anesthesia may prevent the incidence of PONV.[20] The reason for the lack of correlation in our study remains unclear. Deep sedation with propofol resulted in a low frequency of pentazocine use and a low dose, which were associated with a low occurrence of PONV. This may explain the insignificant relationship between the use of PTZ and the occurrence of PONV.

The primary aim of this study was not to elucidate the mechanisms underlying the low incidence of PONV during sedation with continuous propofol infusion. Sub-hypnotic doses of propofol have been shown to reduce the incidence of PONV after minor elective surgeries, suggesting that propofol has a direct antiemetic effect.[21,22] Propofol has also demonstrated antiemetic effects against narcotic-induced nausea and vomiting through the chemoreceptor trigger zone.[23] Beyond its direct antiemetic effects, more extended and stressful inversional treatments require larger doses of propofol, often combined with other analgesics or anesthetics. Sedation with propofol and ASV was performed by well-trained nurses under the supervision of an anesthesiologist. Factors such as restlessness, body movements, and respiration were effectively controlled, allowing for smooth catheter adjustments. These sedation practices, combined with the direct antiemetic effects of propofol, may have contributed to the observed low incidence of PONV following AF ablation in this study.

In the present study, the AUCs obtained using the Apfel scoring system to predict PONV following continuous intravenous propofol sedation ranged from 0.55 to 0.67. These AUC values reflected a weak predictive value for PONV after propofol sedation. The Apfel scoring system considers four factors, namely female gender, history of motion sickness and/or PONV, smoking status, and the use of postoperative opioids. Notably, the Apfel scoring system, which was originally derived from patients undergoing inhalation general anesthesia for various surgical procedures, demonstrated AUC values ranging from 0.63 to 0.77 in previous studies.[13,16,24] When considering these previous AUC results alongside our current findings, it is apparent that the Apfel scoring system offers only low accuracy in predicting PONV. The AUC values obtained from the sum of various scores, in addition to the propensity scores from a multiple logistic regression model, ranged from 0.68 to 0.75. This range also indicates low-to-moderate accuracy for PONV prediction. Thus, prediction of PONV using clinical, procedural, and sedation-related factors, including those in the Apfel scoring system, is not clinically reliable. Consequently, predicting PONV remains challenging, underscoring the importance of vigilant observation and efficient nursing call systems for the early detection of PONV.

The reasons for the low capability of Apfel scores to predict PONV after deep sedation with propofol during atrial fibrillation ablation remain unclear. Patient-related factors, including Apfel scores and PONV mechanisms, have been previously reported.[25] In our study, among the factors considered in the Apfel scoring system, female gender and a history of motion sickness/PONV both tended to be higher and significantly higher, respectively, in patients with PONV than in those without PONV, aligning with findings previously reported by Apfel.[13] However, smoking habits and the use of analgesia, specifically pentazocine, did not differ between patients with and without PONV, contrasting with the results reported by Apfel.[13,16] Recently, a decrease in smoking

rates and lessening of high-nicotine cigarette may explain the lack of correlation of these factors with PONV. In another study by Apfel, the postoperative use of opioids was associated with PONV, while in the present study, PTZ showed no such association. As noted above, in the Apfel studies, total anesthesia with inhalation and various surgical/laparoscopic procedures were examined, whereas our study focused on deep sedation with propofol in AF ablation.[13,24] These differences in anesthesia/sedation methods and treatment procedures may contribute to the varying results regarding the factors affecting PONV occurrence. Other factors not included in the Apfel scores, such as drinking habits, body mass index, and age, did not differ between patients with or without PONV and did not improve the AUC in our study. These results aligned with the Apfel scoring system. Further studies are warranted to more comprehensively explain the low predictive value of these factors.

In the present study, the total amount of propofol used tended to be higher in patients without PONV than in those with PONV. As noted above, propofol has been recognized for its antiemetic effects.[26] The administration of sub-hypnotic doses of propofol has been reported to reduce PONV in parturients undergoing cesarean section and in patients undergoing abdominal surgery.[27] Notably, these previous studies administered propofol just before the end of surgery. In contrast, propofol was administered continuously during the AF ablation procedure in our study, and the propofol dosage was adjusted to maintain a sedation level of 6 on the Ramsay sedation scale.

4.1 | Limitations

This study was conducted retrospectively at a single center. Another limitation is that it did not involve randomization or a control group. Therefore, the present study could not directly assess the antiemetic effect of propofol. However, the number of patients included was sufficient to detect a 5% incidence, and the reported antiemetic effects of propofol may also lend support to the observed low incidence of PONV after propofol sedation. Last, it is worth noting that, while the incidence of PONV was low, this study did not examine premedication for PONV prevention or specific PONV medications. These limitations were not major shortcomings in the present study, and exploring these aspects will be our focus in subsequent research.

5 | CONCLUSIONS

The incidence of PONV following continuous intravenous propofol infusion with ASV, with or without pentazocine, during AF ablation was low, at 5.5%. Notably, this rate was among the lowest when compared to other sedation or anesthesia methods used in various medical procedures and surgeries. It is worth noting that scoring systems, such as the Apfel scoring system, were not reliably predictive of PONV in this context. These findings underscore the significance of attentive monitoring and efficient nursing call systems. The low PONV incidence, coupled with the fundamental results of the sedation and ablation parameters, suggests that the present sedation system is clinically valuable for AF ablation.

AUTHOR CONTRIBUTIONS

Substantial contributions to the conception and design or the acquisition, analysis, or interpretation of the data: H.S., Y.Y., O.S., O.K.,Y.F., and S.K. Substantial contributions to the drafting of the article or critical revision for important intellectual content: H.S., H.Y., T.M., and S.K. Final approval of the version to be published: All authors. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the article are appropriately investigated and resolved: S.H., H.Y., S.H., T.M., and S.K.

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FUNDING INFORMATION

None.

CONFLICT OF INTEREST STATEMENT

There are no conflicts of interest in connection with the present study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHIC STATEMENT

Our study complied with the principles stated in the Declaration of Helsinki and was approved by the Institutional Ethics Committee for Human Research of the Okayama Heart Clinic (approval ID, HS1).

PATIENT CONSENT STATEMENT

Written informed consent for the use of data without personally identifiable information was obtained from all patients.

PERMISSION TO REPRODUCE MATERIAL FROM OTHER SOURCES

The present study did not use any material reproduced from other sources.

CLINICAL TRIAL REGISTRATION

The present study is not a clinical trial.

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