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Research Article

Sensitivity and specificity comparison between *Apfel, Koivuranta,* and Sinclair score as *PONV* predictor in post general anesthesia patient

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ABSTRACT

Post Operative Nausea Vomiting (PONV) are the two most common and unpleasant side effects after anesthesia and surgery. Without proper prophylactic administration, the PONV incidence is currently around 20% -30% in normal patients and 70% in high-risk patients (Butterworth et al., 2013). Recently, many PONV predictor scores have been used to determine the PONV severity and prophylactic administration. Objective: To compare the scores of Apfel, Koivuranta, and Sinclair as predictors of PONV in adult patients after general anesthesia at RSUD Dr. Soetomo. A cross-sectional study design conducted in 100 patients who underwent elective surgery under general anesthesia at RSUD Dr. Soetomo Surabaya. Patients who meet the criteria will be recorded in the clinical research form and being followed to evaluate the assessment using Apfel, Koivuranta, and Sinclair scores when the patient is in the recovery room and the ward. A diagnostic test is performed to assess the accuracy between these scores. In this study, the prevalence of PONV after general anesthesia in elective surgery at GBPT RSUD Dr Soetomo Surabaya is 26%. The Apfel score obtained has a sensitivity value of 79.5%, a specificity of 45.9% with an AUC value of 0.701. The Koivuranta score has a sensitivity value of 96.2%, a specificity of 27% with an AUC value of 0.628. The Sinclair score has a sensitivity value of 73.1%, a specificity of 48.6% with an AUC value of 0.619. Apfel's score is more accurate PONV prediction score and has a simpler score determination variable.

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INTRODUCTION

Post-Operative Nausea Vomiting (PONV) are the two most common and unpleasant side effects after anesthesia and surgery. Without prophylactic administration, the overall incidence of PONV is currently around 20%-30% and in patients at high-risk PONV conditions, this incidence is as high as 70% (Butterworth, J.F., Mackey, D.C., Wasnick, J.D., Morgan, G.E., Mikhail, M.S., Morgan, G.E, 2018).

PONV condition is a simple problem yet often complained by the patient rather than post-operative pain (Tramèr & Fuchs-Buder, 1999). PONV would affect to worse operation's outcome and increase the risk of aspiration (Butterworth, J.F., Mackey, D.C., Wasnick, J.D., Morgan, G.E., Mikhail, M.S., Morgan, G.E, 2018). These effects may increase the morbidity; prolong the hospitalized period, and increase the hospitalized cost. On the other hand, these effects may cause a patient's stress and discomfort (Habib, Chen, Taguchi, Henry Hu, & Gan, 2006).

Recently, PONV predictor score has been used to classify patients based on their PONV risk. This classification would be useful for the clinician to give PONV prophylactic to the patient. Some of these PONV predictor scores are Apfel score, Koivuranta score, Sinclair score, Palazzo score, Gan score, and Scholz score. Unfortunately, there was no literature that compares these scores to know which predictive score can be used as a gold standard in predicting PONV based on its' accuracy. Because of that, the researcher was interested in experimenting with comparing the sensitivity and specificity of Apfel, Koivuranta, and Sinclair score as PONV predictor in post general anesthesia patient in RSUD Dr Soetomo Surabaya, Indonesia. The researcher hoped that the outcome of this study could find the most perfect PONV predictor score to be used in the daily assessment of post general anesthesia patients, especially in RSUD Dr Soetomo Surabaya, Indonesia.

METHODS

This study was observational descriptive with a cross-sectional design study. This study has been ethically approved by Komite Etik Penelitian Kesehatan RSUD Dr. Soetomo Surabaya under the ethical clearance certificate number of 0622/KEPK/Ix/2018. The sample of this study was 100 patients who have undergone an elective operation with general anesthesia in RSUD Dr. Soetomo Surabaya, Indonesia during September – October 2018 that met the inclusion and exclusion criteria. The inclusion criteria of this study were: (1) patient with age of 17 – 65 years old; (2) ASA (American Society of Anesthesiologists) Physical Status Score of 1 – 2; (3) patient with elective surgery in GBPT RSUD Dr. Soetomo Surabaya, Indonesia; (4) the general anesthesia was done with isoflurane inhalation anesthesia. Meanwhile, the exclusion criteria of this study were: (1) patient with antiemetic drugs during the operation (perioperative); (2) patient with high intracranial pressure; (3) patient with pregnancy; (4) patient with TIVA (Total Intra-Venous Anesthesia) general anesthesia procedure; and (5) patient who refused to be included in this study.

The patient that met the criteria were collected as a study's subject with random sampling. These subjects were interviewed to assess the PONV predictor score. The PONV predictor score used were Apfel score, Kovuiranta score, and Sinclair score that were recorded in the clinical research form. All of the study's subjects were fasted for 8 hours before the operation and received isoflurane inhalation and O2 as a general anesthesia procedure during the operation. After the operation, the subjects were observed in the recovery room until the subject gained an Aldrete score of ≥9. When the

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subjects had an Aldrete score of ≥9, the subjects were moved to the inpatient room.

The PONV predictor score was assessed by anesthesiology residents who were in charged of pain and recovery room rotation in 24 hours post-operative. The subjects were classified into PONV if there were vomiting, nausea, and retching in 24 hours. If the subjects experienced the PONV symptoms above, the management given were maintained the airway, tilt the patient's head, give ondansetron 4mg or metoclopramide 10mg as pharmacotherapy, and maintain the hydration state.

The data collected then being analyzed with SPSS software. The descriptive data valued with their frequency, average, and standard deviation. The significance limit was 5% and a confidence interval was 95%. The analytic data were analyzed to find the sensitivity, specificity, and AUC of every score.

RESULTS

100 patients that became the subject of this study consisted of 53 males and 47 females. The characteristic of the subject was described in table 1.

The type of operation undergone by the subjects were ophthalmology operation 15 patients (15%), urology operation 15 patients (15%), ENT (ear, nose, and throat) operation 14 patients (14%), orthopedic operation 11 patients (11%), oncology operation 8 patients (8%), digestive operation 8 patients (8%), head and neck surgery operation 8 patients (8%), plastic surgery operation 8 patients (8%), oral surgery operation 7 patients (7%), and gynecology operation 6 orang (6%).

From this study, 26 patients experienced PONV. 7 (7%) patients among them had nausea, and 19 (19%) patients among them had vomiting. The highest PONV incidence was happened to head and neck surgery patients as many as 4 patients (15%) and digestive patients as many as 4 patients (15%). The incidence of PONV based on gender was 12 patients male and 14 patients female.

Table 1. the characteristic of subjects

	Amount(%)	Mean±SD
Gender		
Male	53 (53)	-
Female	47 (47)	-
Smoking status		-
Not smoking	77 (77)	-
Smoking	23 (23)	
ASA score		
I	25 (25)	-
II	75 (75)	-
Age		
(17-65 years old)	-	43.30±14.046
Body mass		
(40-90 kg)	-	59.38±10.766
History		
Motion Sickness	5 (5)	-
PONV	3 (3)	-

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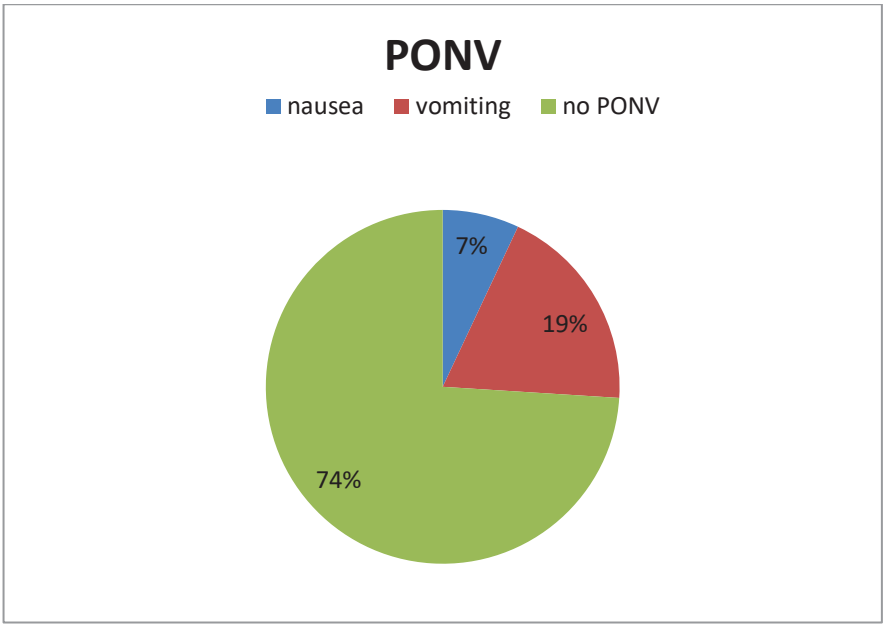

Graphic 1. The frequency of PONV in subjects

Table 2. the frequency of PONV based on the type of operation

Type of operation	Amount	PONV	No PONV
Ophthalmology	15	1 (6.7%)	14 (93.3)
Urology	15	3 (20%)	12 (80%)
ENT	14	2 (14.3%)	12 (85.7%)
Orthopaedic	11	3 (27.3%)	8 (72.7%)
Digestive	8	4 (50%)	4 (50%)
Plastic surgery	8	3 (37.5%)	5 (62.5%)
Oncology	8	3 (37.5%)	5 (62.5%)
Head and neck surgery	8	4 (50%)	4 (50%)
Oral surgery	7	2 (28.6%)	5 (71.4%)
Gynecology	6	1 (16.7%)	5 (83.3%)

The analysis result of sensitivity and specificity of Apfel score were described by figure 1.

Figure 1 shows that the sensitivity of the Apfel score was 79.5%, the specificity was 45.9%, and the AUC score was 0.701 with the cutoff point of >1.

From the ROC curve (Figure 2), the Koivuranta score has a sensitivity of 96.2%, the specificity of 27%, and AUC 0.6 with the cutoff point of >1.

From the ROC curve (Figure 3), the Sinclair score has a sensitivity of 73.1%, the specificity of 48.6%, and AUC 0.619 with a cutoff point of >4.

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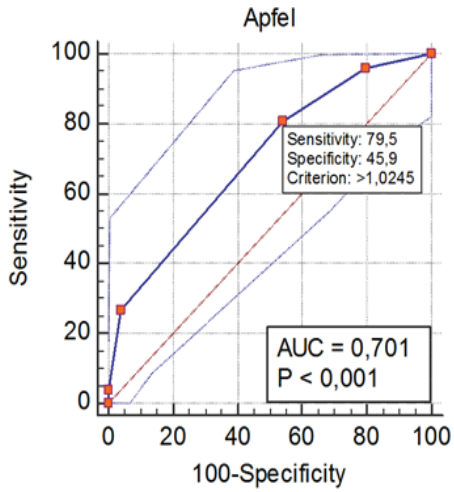

Figure 1. the ROC curve of Apfel score

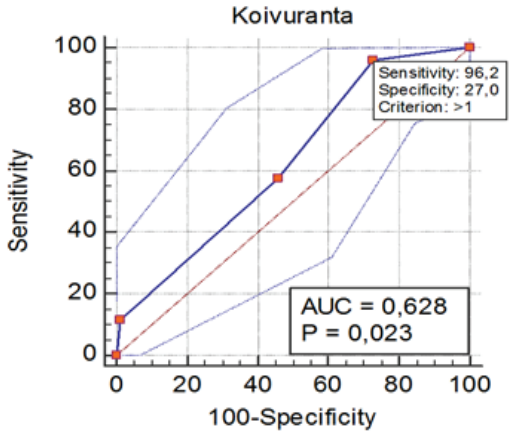

Figure 2. ROC curve of Koivuranta score

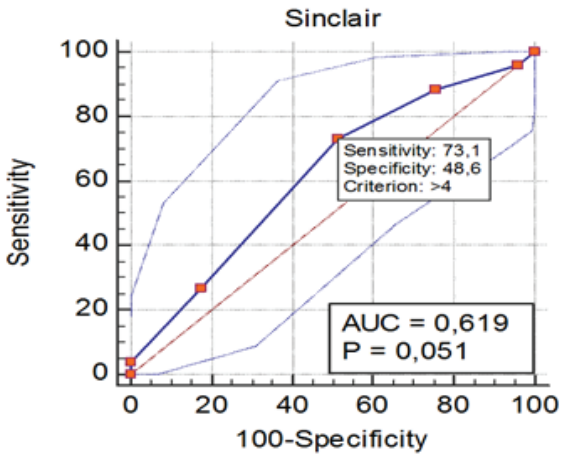

Figure 3. ROC curve of Sinclair score

Table 3. the diagnostic result based on the ROC curve of Apfel, Koivuranta, and Sinclair score

	Sensitivity	Specificity	AUC	p-value
Apfel	79.5%	45.9%	0.701	< 0,001
Koivuranta	95.2%	27%	0.628	= 0,023
Sinclair	73.1%	48.6%	0.619	= 0,051

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DISCUSSION

Recently, PONV predictive score has been used to lower the risk or to prevent the incidence of PONV. With this predictive score, the clinicians could classify the patients based on the PONV risk and quickly decide which patient, the PONV prophylactic should be given. The prophylactic of PONV is only given to those with the high-risk result of the predictive score because the PONV prophylactic given to a patient with low risk of PONV does not have a therapeutic effect (Apfel, Läärä, Koivuranta, Greim, & Roewer, 1999).

Apfel score identified the PONV risk with 4 indicators; women (1), PONV or motion sickness history (1), no smoking (1), and the usage of postoperative opioids inpatient (1). Every point increased on the Apfel score will increase the PONV possibility to 18% – 22%. The patient with Apfel score of 0 – 1 identified as low PONV risk, score 2 as moderate PONV risk, and score 3 – 4 as high PONV risk (Christian C. Apfel et al., 1999).

On the other hand, the Koivuranta score predicted the risk of PONV incidence using 5 criteria; women (1), no smoking (1), PONV history (1), motion sickness history (1), and the operation duration > 60 minutes (1). The patient who gets a score of 0 – 1 identified as low PONV risk, score 2 – 3 as medium PONV risk, and score of 4 – 5 as high PONV risk (Koivuranta, Läärä, Snåre, & Alahuhta, 1997).

Last but not least, Sinclair scores use 7 indicators to predict PONV risk on the patient. These indicators are age < 50 years old (1), women (1), no smoking (1), PONV history (1), motion sickness history (1), the type of operation (ENT, ophthalmology, plastic, abdomen, gynecology, and orthopedic especially the shoulder and knee operation) (1), general anesthesia (1), and the anesthesia duration > 30 minutes. The patient who gets Sinclair score of 0 – 2 identified as low PONV risk, score of 3 – 5 as medium PONV risk, and score of 6 – 7 as high PONV risk (Sinclair, Chung, & Mezei, 1999).

From this study, the incidence of PONV was 26% compared to the late study, where the incidences of PONV were around 20%-30% (Christian C. Apfel et al., 1999). Based on the comparison above, the incidence of PONV in RSUD Dr. Soetomo was still on a normal average.

This study consisted of 53 male patients and 47 female patients with PONV incidences based on gender were 11 PONV incidences on male and 15 PONV incidences of the female. This result showed that female have a 1.8 times higher risk of PONV than male does. The same result also was written by Apfel et al. (2012) that female (gender) is one of the strong predictors of PONV. The study before found that the risk of PONV increases 2.6 times higher in females than in the male (C.C. Apfel, Kranke, Eberhart, Roos, & Roewer, 2002). Even though the mechanism of higher PONV incidences in the female has not able to be explained.

The highest number of operation type that found in this study was ophthalmology operation and urology operation. Nevertheless, the highest incidences of PONV in this study were digestive operation and head and neck surgery operation, with the same amount of 4 PONV incidences each. The treatment done during the digestive operation stimulated the release of substance P and serotonin that led to vomiting response (C.C. Apfel et al., 2012). On the other hand, during the head and neck surgery operation, the passive blood flow from the oral cavity and nasal cavity to the stomach triggered PONV (Erkalp et al., 2014). Based on Sinclair's study (about Sinclair score), the type of operation is included in one of the predictor scores of PONV incidence. Meanwhile, based

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on Apfel's study, the type of operation is not included as the predictor score of PONV as many of the types of operation led to bias score.

The accuracy of PONV score was tested using the Area Under the Curve (AUC) calculation and Receiver Operating Characteristic (ROC) curve method. This curve is the incision between the true positive rate (sensitivity) and the false-positive rate (specificity) from the score tested. The area with a score of 1.0 or 100% identified as the perfect sensitivity and specificity (Dahlan, 2014).

The diagnostic test of this study found that the sensitivity of Apfel, Koivuranta, and Sinclair score consecutively was 79.5%, 96.2%, and 73.1%. The specificity of Apfel, Koivuranta, and Sinclair score consecutively was 45.9%, 27% and 48.6%. While, based on the ROC curve, the AUC of Apfel, Koivuranta, and Sinclair score consecutively were 0.701, 0.628, and 0.619.

From the results above, the most sensitive PONV predictive score was the Koivuranta score with 96.2% and the most specific PONV predictive score was Sinclair score with 48.6%. However, based on the AUC, score Apfel (AUC 0.701) was the best PONV predictive score compared with the Koivuranta dan Sinclair score. From the ROC curve, it concluded that the Apfel score was better than Koivuranta and Sinclair score. Even though, from this study, the best AUC score was less than 0.8 which interpreted that Apfel, Kaoivuranta, and Sinclair score have a moderate level of trust to be used as PONV predictive score.

From another study, Apfel et al. (2002) found that the ROC of the Apfel score is higher than the Koivuranta score (0,68 dan 0,66). Another study was done by Pierre et al. (2002) (Pierre, Benais, & Pouymayou, 2002) also showed the significant difference between Apfel and Sinclair score, where Apfel has better accuracy than Sinclair (0,71 dan 0,64). These two studies support this study result where Apfel has better specificity and sensitivity to be used as PONV predictive score.

Another result from this study was the cutoff point for each PONV predictor score from the ROC curve. This cutoff point is useful as a guide to classify whether a patient needs an antiemetic as PONV prophylactic or not. The cutoff point of Apfel, Koivuranta, and Sinclair score consecutively were 1 point, 1 point, and 4 points. So that, for patients who get a score higher than the cutoff point, the clinicians should consider giving PONV prophylactic agents as the risk of PONV incidence is higher on this patient.

CONCLUSION

The PONV incidence of post elective operation patients with general anesthesia aged 17 – 65 years old in GBPT RSUD Dr Soetomo without prophylactic was 26%. The highest PONV incidence was found in a patient with the digestive operation and head and neck surgery operation. From this study, it is recommended to use the Apfel score, as PONV predictor score, because the Apfel score was more accurate and had a simpler determination variable than Koivuranta and Sinclair score. This study also found that the cutoff point of Apfel score was 1 point, where it is suggested that the PONV prophylactic agent is given to a patient who gets more than 1 point of Apfel score. This study might not perfect, the researcher suggested a larger number of samples in the next study in order to produce more valid results of PONV's best predictor score.

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