Original Article

Validation of the Apfel Scoring System for Identification of High-risk Patients for PONV

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Abstract

Background and Aims: Postoperative nausea and vomiting (PONV) still present an important problem in anesthesia. In order to identify surgical patients who may benefit from prophylactic antiemetic medication, it is of interest to evaluate the risk factors for PONV using a simple scoring system. The simplified Apfel score includes four factors: female gender, nonsmoking status, postoperative use of opioids, and previous history of PONV or motion sickness. Each of these risk factors is supposed to elevate the incidence of PONV by about 20%. The aim of this study was to validate Apfel's clinical risk assessment score for identification of patients with high risk for PONV in our hospital. **Materials and Methods:** In a prospective study, 150 patients posted for various elective surgeries under general anesthesia with endotracheal intubation were analyzed and grouped into five groups, based on the Apfel risk scoring system. Each risk was given a score of 1, the total score being 4. PONV was monitored for 24 h and classified as grades 0, 1, and 2. Grades 1 and 2 were considered as PONV. The results obtained were analyzed for total incidence of PONV in each group of Apfel's scores and they were compared with the predicted incidence of PONV as per the documented Apfel's risk assessment. Collected data were analyzed by the Chi-square test, and the scoring system was assessed for sensitivity and specificity. **Results:** Of the 150 patients assessed, a total of 42% had PONV. Patients grouped under Apfel Score I had PONV incidence of 25.5%, the group with Score II had an incidence of 37.8%, the group with Score III had 64.6%, and the group with Score IV had 83.3%. This incidence of PONV corresponded to the predicted approximate values of 20% for Apfel Score I, 40% for Apfel II, 60% for Apfel III, and 80% for Apfel IV. **Conclusions:** The Apfel scoring system is simple and useful for identifying patients with high risk for PONV.

Key words: Apfel score, postoperative nausea and vomiting, simplified Apfel score

Introduction

The incidence of postoperative nausea and vomiting (PONV) is still about 25–30%.[1] Because PONV may result in extreme discomfort, it is unacceptable to neglect the prophylactic potential of antiemetics. However, routine administration of antiemetics to all surgical patients is not feasible because of the potential side effects and costs. Instead, prophylactic antiemetics should be selectively administered to patients at high risk of PONV—those who can be identified before surgery using a scoring system.[2] Several scoring systems have been proposed for predicting PONV within 24 h after surgery.[3-6] The best known scoring systems are those developed by Apfel *et al*.[3] The simplified Apfel score includes four factors: female gender, nonsmoking status, postoperative use of opioids, and history of PONV or motion sickness. Each of these risk factors is supposed to elevate the PONV incidence by about 20%.[7] Before implementing this scoring system as a protocol in our hospital, we wanted to test the applicability in our set of patients under our anesthesia techniques, as it is known that a scoring system generally predicts less accurately in new patients than in the patients and settings from which it was derived.[8,9] The aim of this study was to validate this clinical risk assessment score in identifying patients with high risk for PONV in our setup.

Materials and Methods

In this prospective observational study, 150 consecutive inpatients belonging to the age group 18–60 years and American Society of Anesthesiologists (ASA) grades I and

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II, posted for a wide range of elective surgeries under general anesthesia with endotracheal intubation were included after obtaining ethical clearance and informed consent. Patients posted for laparoscopic, neurosurgical, cardiothoracic, strabismus, and obstetric surgeries; patients whose trachea was not extubated after surgery; and patients who took prophylactic antiemetics were excluded from the study.

Preanesthetic checkup was performed for all patients and written informed consent was obtained. During checkup, patients were grouped based on the given scores as per the simplified Apfel's scoring system.[3] The four risk factors were female gender, nonsmoking status, history of motion sickness or PONV, and the possible use of opioids in the postoperative period. Each risk was given a score of 1; the total risk was 0–4 [Table 1]. All patients received tablet diazepam 5 mg and tablet ranitidine 150 mg the night before the surgery. The patients were kept *nil per os* overnight, and a standard general anesthesia technique with endotracheal intubation was performed in all patients. The induction agent used was thiopentone 5 mg/kg; succinylcholine 1 mg/kg was used for intubation and fentanyl 2 μg/kg was used for intraoperative analgesia. Anesthesia was maintained with nitrous oxide, oxygen, isoflurane, and vecuronium. No prophylactic antiemetic was given. Postoperative pain was managed by intravenous (IV) paracetamol infusion 1 g/100 mL. PONV was monitored for 24 h after surgery and was graded as follows: Grade 0, no nausea or vomiting; Grade 1, only nausea; Grade 2, nausea and vomiting. Grades 1 and 2 were considered as PONV. The antiemetic used in case of PONV was IV ondansetron 4 mg. The results obtained were analysed for the total incidence of PONV in each group of Apfel's scores and compared with the predicted incidence of PONV as per Apfel's risk assessment. Collected data were analyzed by Chi-square test, and the scoring system was assessed for sensitivity and specificity analyses with the help of a blinded statistician.

Results

One hundred fifty patients were included in our study, and the mean age was 40.7 years. Out of the total number of patients, the percentages of patients having each of the four risk factors were as follows: 61.3% were of female gender, 68% were nonsmokers, 28% had history of PONV or motion sickness, and 58% were anticipated to receive postoperative opioids. The total incidence of PONV among all patients within 24 h was 42%. Based on the number of risk factors 0–4, the 150 patients were grouped into five groups. Apfel Group 0 had 8.3%, Apfel Group I had 25.5%, Apfel Group II had 37.8%, Apfel Group III had 64.6%, and Apfel Group IV had 83.3% incidence of PONV.

Table 1: Simplified Apfel scoring system

Risk factors	Points
Female gender	1
Nonsmoker	1
History of PONV	1
Postoperative opioids	1
Total	0-4

PONV: Postoperative nausea and vomiting

Discussion

Apfel *et al*. in the year 1999 published the popular scoring system for identifying patients with high risk for PONV.[4] This scoring system was derived from a combined dataset of 1040 adult surgical inpatients from two centers (Oulu and Wuerzburg). PONV was defined as at least one episode of nausea and/or vomiting within the first 24 h after surgery. The formula of the original scoring system was developed using multivariable logistic regression analysis. This scoring system was simplified to a four-item risk score, which was defined as the number of predictors present. The predictors were female gender, previous history of PONV or motion sickness, nonsmoking status, and postoperative use of opioids. If none, one, two, three, or four of these were present, the predicted risk of PONV was 10%, 21%, 39%, 61%, and 79%, respectively. The original scoring systems and simplified risk scores were internally validated by cross-validation. The average incidence of PONV in the combined dataset was 44%.

The balanced anesthesia technique employed in our study was comparable to Apfel's methods with the use of volatile agents and nitrous oxide with muscle relaxants. In our study the total incidence of PONV was 42%. Female patients (61.3%) and patients who received postoperative opioids (58%) were more in our study population when compared to Apfel's study [female patients (57%) and patients who received post operative opioids (46%)]. But non smokers (68%) and patients with history of PONV/motion sickness (28%) in our study were less than Apfel's study group [nonsmokers(73%) and patients with history of PONV / motion sickness (35%)]. The values in Apfel's study, mentioned above, in this combined dataset of 1040 patients were estimated by averaging the numbers presented for the two original datasets (Oulu and Wuerzburg).

Though the limitation in our study was our sample size, the results we obtained corresponded well to Apfel's predicted results. In our trial, the incidence of PONV in Apfel 0, I, II, III, and IV was 8.3%, 25.5%, 37.8%, 64.6%, and 83.3% respectively, which correlated well to the predicted incidence of 10%, 21%, 39%, 61%, and 79%, respectively [Figure 1].

Our results were comparable to another prospective study conducted by Weilbach *et al*., wherein 93 patients having high-risk preoperative scores for PONV (Apfel scores III and IV) were analysed.[7] The general anesthesia technique was total intravenous anesthesia (TIVA) with mivacurium, propofol, and remifentanil, unlike in our study. In the group with Apfel Score III, PONV occurred in 59.7% of patients, and in the group with Apfel score IV, PONV occurred in 91.3% of patients. The incidence of PONV corresponded to the predicted values of 60% for Apfel III and 80% for Apfel IV, and it was concluded that the Apfel scoring system was a

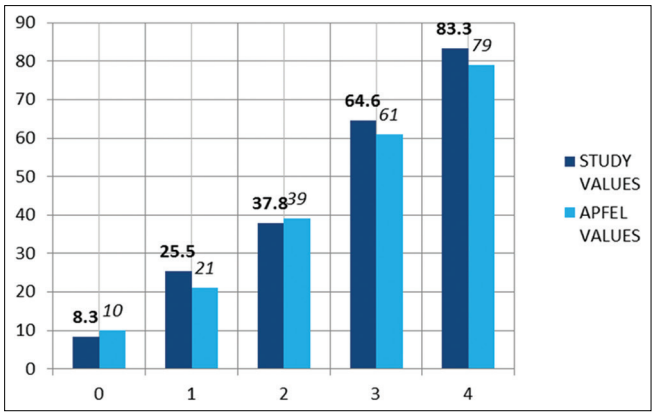

Figure 1: Incidence of PONV

useful and simple tool for stratification of patients with high risk for PONV.

In the present trial, we have only taken into consideration the scoring system published by Apfel and have not compared it with other scoring systems. Van den Bosch *et al*. had validated two scoring systems derived by Apfel *et al*. and Koivuranta *et al*. from 1388 adult patients undergoing a wide range of surgical procedures,[2] and they concluded that, in their original forms, both the scoring systems do not guarantee accurate prediction of the risk of PONV in other patient populations. The scoring system of Koivuranta *et al*. appeared to be more robust across different populations, according to their study. This scoring system also considers duration of a surgery of over 60 min as a predictor.

Another study conducted by Pierre *et al*. compared Apfel's scores with Sinclair's scores for predicting PONV.[10] Five hundred adult inpatients scheduled for throat, thyroid, breast, and gynaecological surgeries under general inhalational anesthesia were studied prospectively over 24 h for PONV; 49.5% of them suffered from PONV. Multivariable analysis revealed that gender, previous history of PONV or motion sickness, and postoperative use of opioids had an impact on PONV. The Sinclair score included, in addition to the above factors, duration, type of anesthesia, and type of surgery. The two scores were compared by calculating the area under a receiver operating characteristic (ROC) curve and plotting calibration curves of the predicted and the observed incidence of PONV. They concluded that the simplified Apfel score presented with favorable discrimination and calibration properties for predicting the risk of PONV when compared to the Apfel score.

Multimodal approaches involving the use of two or more prophylactic antiemetic drugs, avoiding highly emetogenic anesthetics and analgesics, and ensuring adequate hydration are strongly recommended for all patients at increased risk of developing PONV.[11-13] In spite of these approaches, it is obvious from the prospective studies mentioned above that PONV still remains a common problem for high-risk surgical populations. In the trial conducted in our hospital, Apfel's simplified risk scoring system was shown to provide clinically useful information for predicting PONV within 24 h after surgery in patients who did not receive any prophylactic antiemetic drugs. When compared to predicting a patient's risk for PONV based on a history of PONV or the type of surgery alone, the use of this simplified risk-scoring system has been found to be more sensitive and specific.

Conclusions

Our study confirms that the Apfel risk assessment score for PONV is a simple and reliable test to identify patients at high risk, and could thus be used for the development of preventive treatment strategies.

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Conflicts of interest

There are no conflicts of interest.

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