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A PROSPECTIVE OBSERVATIONAL STUDY ON THE PREDICTABILITY OF POSTOPERATIVE NAUSEA AND VOMITING IN PATIENTS UNDERGOING ONCOSURGERIES UNDER GENERAL ANAESTHESIA

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ABSTRACT **Background & Objectives:** Postoperative nausea and vomiting (PONV) is the second most common complaint in the postoperative period. It can lead to medical and surgical postoperative complications, prolong hospital stay and add to healthcare costs. Identification of individuals at high risk for PONV is challenging due to its multifactorial etiology. Objectives of this study were to evaluate the predictability of PONV using Apfel score in patients undergoing oncosurgeries under general anaesthesia and to identify other possible factors contributing to PONV. **Methods:** This prospective observational study was done in 162 patients, in the age group 16 to 60 years, with ASA physical status I and II, who underwent oncosurgeries under general anaesthesia. Pregnant patients, patients who underwent emetogenic chemotherapy and those with hepatic or renal impairment were excluded. After obtaining clearance from institutional review board and informed consent from patients, sample was divided into two groups of 81 each based on Apfel score. Routine conduct of GA was done, with use of anaesthetic drugs according to choice of anesthesiologist. Preoperative, intraoperative and postoperative factors that may affect incidence of PONV and episodes of PONV at different time intervals postop were recorded. In the statistical analysis, association between categorical variables and occurrence of PONV was assessed using Chi-square/Fisher's exact test and that between continuous variables and occurrence of PONV was assessed using student's t test. Multivariate logistic regression analysis usingforward likelihood ratio method was used to identify independent predictors of PONV and these factors were used to set up a risk score to predict the probability of PONV. Accuracy of the score was assessed by calculating the area under the receiver operating characteristics curve. A p value less than 0.05 was considered significant. **Results & Discussion:** The incidence of PONV in the study population was 30.2%. Incidence of PONV in the predicted group and non-predicted group was 37% and 23.5% respectively. There was no significant difference in incidence of PONV between the two groups (p = 0.06). Actual incidence of PONV was less than that predicted by Apfel score. The incidence of PONV did not show a linear relationship with the Apfel score. Significant risk factors for PONV were female gender, non-smoking status, history of motion sicknesss / PONV / vertigo / morning sickness / migraine and use of volatile anaesthetic or nitrous oxide. Independent predictors of PONV were female gender, history of morning sickness or migraine and use of volatile anaesthetic. Use of opiods, duration of pre and postoperative fasting, type and duration of surgery did not show significant association with PONV. A new risk score was proposed in the study with an AUC-ROC of 0.69. **Conclusion:** Apfel score did not prove valid in the population. There were other significant risk factors apart from those in the Apfel score, using which a risk score may be calculated which can more accurately predict PONV in the study population.

KEYWORDS : Postoperative nausea and vomiting; risk factors; general anaesthesia.

INTRODUCTION

Postoperative nausea and vomiting, commonly abbreviated as PONV, is the second most common complaint in the postoperative period, the most common being pain. Incidence of PONV is 20% to 30%.[1]PONV is defined as any nausea, retching or vomiting occurring during the first 24-48 hours after surgery.[2] It is an unpleasant experience which is rated by patients as worse than pain.[3] Moreover, it can lead to rare but serious medical complications such as aspiration of gastric contents, suture dehiscence, esophageal rupture, subcutaneous emphysema, pneumothorax etc.[4,5] It can also prolong the postoperative hospital stay of the patient which is a concern in the modern era of ambulatory anaesthesia and day care surgeries.[6] In addition, PONV adds to the health care costs of the individual which includes medications as well as nursing care.[7] So prevention of PONV leads to multidimensional positive outcome which extends from improved patient well-being and satisfaction to decreased health related financial burden of the individual and the nation.

PONV literally suggests surgery to be its most important direct etiology. But several large prospective cohort studies have come to a conclusion that PONV is multifactorial in origin, with patient related and anaesthesia related risk factors contributing more than the surgical procedure itself.[8] Relative contribution of patient, anaesthetic and surgical factors is less studied. The multifactorial etiology makes it difficult to standardize and compare study and control groups for research purposes. It also hampers effective antiemetic therapy. Hence the incidence of PONV is remaining constant for the past several years despite considerable advances in anaesthetic practice.[9]

So different risk scores have been put forward by various investigators to quantify the preoperative risk of a patient to develop PONV and these scores have been used for research as well as for instituting prophylactic antiemetic treatment, the most popular one being Apfel score. It is simple and can be easily applied to any population. It is available in the public domain and can be accessed by anyone as it is not patented or copyrighted. Validation studies of different scoring systems including Apfel score have mostly been done in foreign populations. [8-16] It is less studied and applied in Indian population. [17]

This study aims to validate Apfel score in the study population and to identify other possible factors contributing to PONV, which will help in identifying high risk patients who can be given more effective antiemetic therapy. The study indirectly aims to reverse the current trend of using anti-emetics at increased frequency and doses as prophylactic treatment for all patients, which carries concerns of cost and side effects. Studies have shown that prophylactic treatment for PONV is beneficial only for high risk population.[18,19]

OBJECTIVES

Primary Objective:

To study the predictability of postoperative nausea and vomiting in patients undergoing various oncosurgeries under general anaesthesia using Apfel score.

Secondary Objective:

To identify other possible factors contributing to postoperative nausea and vomiting in the study population.

METHODOLOGY

Study Design: Prospective observational study

Study Setting: Regional Cancer Centre, Thiruvananthapuram

Study Population: Patients presenting for elective oncosurgeries under general anaesthesia

Inclusion Criteria

1. ASA I and II

2. Age between 16 and 60 years

Exclusion Criteria

1. Patients on drugs with emetogenic properties like chemotherapeutic drugs.

2. Pregnancy

3. Abnormal LFT,RFT (i.e., with values more than twice normal)

Sample Size

Patients were grouped into the PREDICTED GROUP and the NON-PREDICTED group based on total score. Those patients with score > 2 were be included in the predicted group and those with score </=2 were included in the non-predicted group. Assuming 70% prediction rate as per reference, precision 10% and 95% confidence level, sample size was calculated as 81 in each group.

Period Of Study: 6 months

METHODOLOGY

Pre-operative Period: Variables mentioned below were recorded for all patients. They include:

1. History of smoking
2. History of PONV/motion sickness
3. Planned postoperative opioid therapy
4. History of migraine/vertigo/morning sickness

Peri-operative Period:

All patients received oral premedication with Tab.Alprazolam 0.5mg and Tab.Pantoprazole 40mg the night before and at 7 am on the morning of surgery. Additional premedication was given intravenously in the operation theatre with Inj.Midazolam 0.07-0.1mg/kg and Inj.Glycopyrrolate 0.002-0.004 mg/kg. Anaesthesia was induced with Inj.Propofol 2-2.5mg/kg and endotracheal intubation was performed after giving Inj.Vecuronium at 0.08-0.12mg/kg or Inj.Atracurium at 0.3- 0.6mg/kg. The use of nitrous oxide, volatile anaesthetics, opioids and analgesics was according to the choice of the anaesthesiologist. Muscle relaxation was maintained with top up doses of Inj.Vecuronium at 0.02mcg/kg or Inj.Atracurium at 0.08-0.1mg/kg. Intra operative monitoring include ECG, non-invasive BP, pulse oximetry and $ETCO_2$. At the end of surgery, all patients were reversed with Inj.Neostigmine 0.03-0.07mg/kg iv and Inj.Glycopyrrolate 0.2mg iv for each 1 mg of Neostigmine. Intraoperative variables recorded were:

1. Duration of fast
2. Type of surgery – Head & Neck, Breast, Gastrointestinal, Gynaecological, Orthopaedic, Thoracic, Laparoscopic
3. Duration of surgery
4. Opioids used/not
5. Volatile anaesthetics used/not
6. Carrier gas used – N_20/Air

Postoperative Period:

During postoperative period, all patients were assessed for nausea, retching or vomiting at the following postoperative time intervals:

- On reaching PACU
- At 2 hours
- At 6 hours
- At 12 hours
- At 24 hours.

An episode of nausea, retching or vomiting which occur at any time other than the above mentioned intervals was also recorded. These patients received either intravenous Ondansetron 4mg or Metoclopramide 10mg as treatment as per institutional protocol. Other postoperative variables recorded include:

1. Time of first oral intake
2. Opioids used/not
3. Frequency of postoperative anti emetic usage

OBSERVATIONS AND RESULTS

The study sample was selected from patients who underwent various oncosurgical procedures under general anaesthesia at Regional Cancer Centre, Trivandrum from January 2017 to June 2017. The estimated sample size was 162, assuming 70% prediction rate, 10% precision and 95% confidence level as per reference. Out of the 162 study subjects, 81 patients who had an Apfel score > 2, constituted the "predicted group" and the remaining 81 patients with an Apfel score < 2, constituted the "non-predicted group" as the predicted incidence of PONV in the two groups were <50% and >50%.[59] Data was entered in Microsoft Excel and statistical analysis was done using SPSS11.0 software. The categorical variables were represented using frequencies and percentages and continuous variables were represented using mean and standard deviation. The association between categorical variables and the response variable (presence or absence of PONV) was assessed using Chi-square/ Fisher's exact test and the association between continuous variables and the response variable was assessed using student's t test. p value less than 0.05 was considered significant.

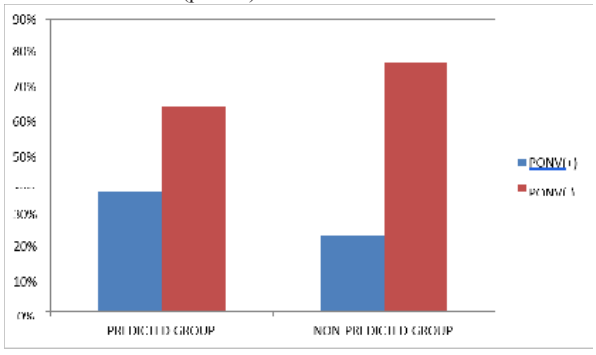
The two groups were comparable with respect to age. (p=0.22) and gender distribution (p=0.6).. In both groups, number of non-smokers were more than that of smokers – 79 (97.5%) in the predicted group and 65 (80.2%) in the non-predicted group. Of the total 162 study subjects, 79 (48.8%) patients had a previous history of motion sickness or PONV whereas 83 (51.2%) did not have a past history of motion sickness or PONV. Number of study subjects with history of motion sickness or PONV was higher (96.3%) in the predicted group and patients without history of motion sickness or PONV was higher (98.8%) in the non-predicted group.Postoperative opioid therapy was planned in 62 (76.5%) patients in the predicted group as compared to 11 (13.6%) patients in the non-predicted group.Frequency distribution and percentage distribution of Apfel score, ranging from 0 to 4, in the study population is depicted in Table 1

Table 1. Frequency Distribution And Percentage Distribution Of Apfel Score In The Study Population.

APFEL SCORE	FREQUENCY	PERCENTAGE
0	7	4.3%
1	16	9.9%
2	58	35.8%
3	45	27.8%
4	36	22.2%

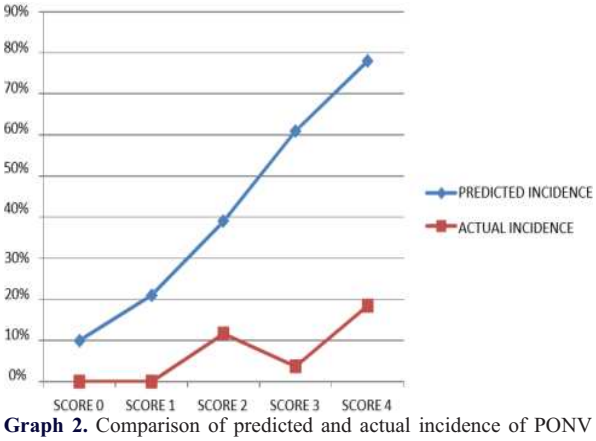
Majority of patients had an Apfel score of 2 followed by 3 which occurred in the frequency of 58 and 45 respectively. In other words, 71.6% of the patients in the non-predicted group had a score of 2 and 55.6% of the patients in the predicted group had a score of 3.

The primary objective of this analysis was to study the predictability of PONV using Apfel score. Out of the total study population, 49 (30.2%) patients experienced PONV whereas 113 (69.8%) did not. The incidence of PONV is maximum during the immediate postoperative period and it decreased with time. In this study, it is observed that 37% and 23.5% of patients experienced PONV in the predicted and non-predicted groups respectively and that, there is no statistically significant difference between the two groups with respect to occurrence of PONV.(p=0.06)



Graph 1: Comparison Of Groups Based On Occurrence Of PONV

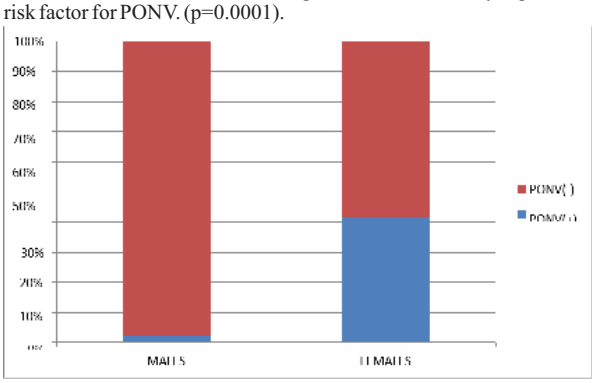
Comparison of predicted and actual incidence of PONV for Apfel scores 0-4 is shown in Graph 2



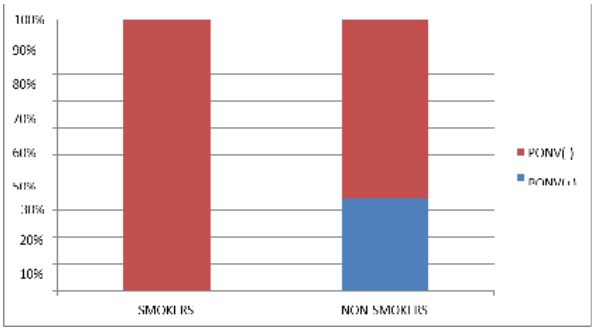
Graph 2. Comparison of predicted and actual incidence of PONV based on Apfel score

As observed, the actual incidence of PONV in the study population is much less compared to the predicted incidence. The incidence also does not show a linear relationship with the Apfel score as predicted.

Out of the total 115 females, 48 (41.7%) suffered from PONV whereas only 1 (2.1%) out of the 47 males suffered from PONV(Graph 3)_. Hence, it is concluded that female gender is a statistically significant risk factor for PONV. (p=0.0001).



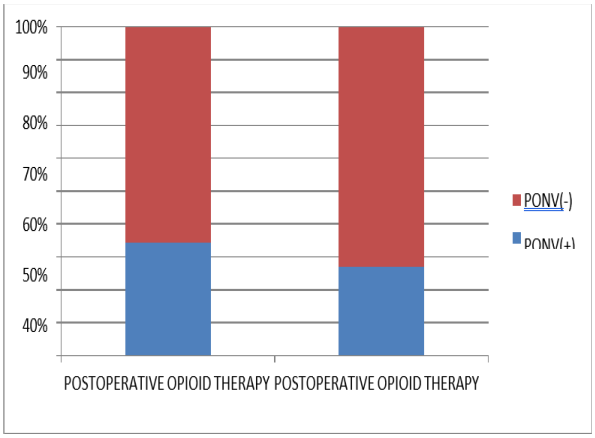
Graph 3. Comparison Of Incidence Of PONV Based On Gender



Graph 4. Comparison Of Incidence Of PONV Based On Smoking Status

It is observed in the study that none of the smokers experienced PONV whereas PONV was present in 34% of the non-smokers (Graph 4). There was statistically significant relation between non-smoking status and PONV. (p = 0.002)

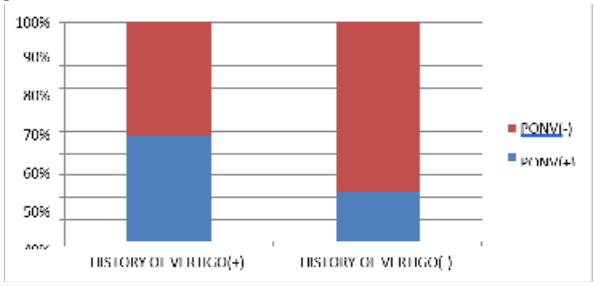
In the study population, 79 patients had a previous history of motion sickness or PONV, out of which 30 (38%) suffered from PONV. PONV was also present in patients without a past history of motion sickness or PONV, but only 22.9% of these patients experienced PONV. From the statistical analysis of this data, it is found that history of motion sickness and PONV is a significant risk factor for PONV.(p=0.036)



Graph 5. Comparison of incidence of PONV based on whether postoperative opioid therapy is planned or not.

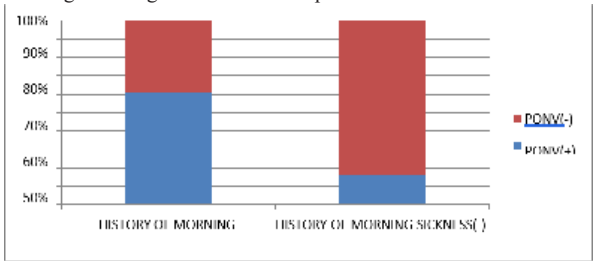
In the study, postoperative opioid therapy was planned in 73 patients and not planned in 89 patients. But the incidence of PONV was almost similar in the two groups: 34.2% in whom opioid therapy was planned and 27% in whom it was not planned.(Graph 5) The minor difference in incidence did not have any statistical significance. (p=0.315)

The secondary objective of the study was to identify other possible factors contributing to postoperative nausea and vomiting in the study population. The following graphs and tables depict the association between PONV and the following perioperative factors: history of vertigo, history of morning sickness, history of migraine, duration of preoperative fasting, type of surgery, duration of surgery, intraoperative use of opioids / volatile anaesthetic / carrier gas, postoperative use of opioids and duration of postoperative nil per oral period.



Graph 6. Comparison Of Incidence Of PONV Based On History Of Vertigo

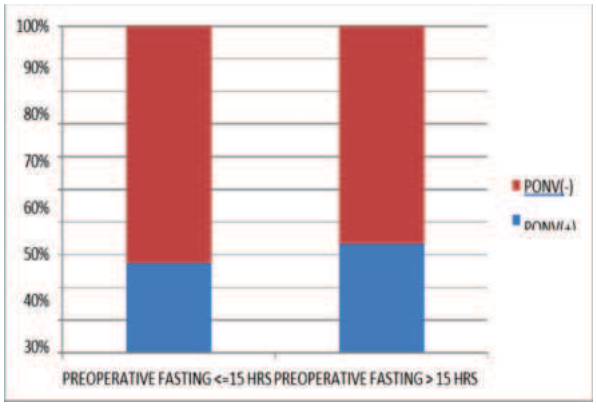
Out of the 162 study subjects, 48 had a history of vertigo, among whom 23 (47.9%) experienced PONV. And out of the remaining 114 patients, who did not have a history of vertigo, only 26 (22.8%) experienced PONV. (Graph 6)This difference in incidence of PONV was statistically significant (p=0.001) and hence, it concludes that history of vertigo has a significant relationship with PONV.



Graph 7. Comparison Of Incidence Of PONV Based On History Of Morning Sickness.

Comparison of incidence of PONV and history of morning sickness was done among the 115 females in the study population. Of the 115 females, 64 patients had a history of morning sickness out of which 39 (60.9%) had PONV. Out of the 51 females who did not have a history of morning sickness, only 9 (17.6%) experienced PONV.(Graph 7) There was statistically significant association between history of morning sickness in females and incidence of PONV in them. (p<0.0001)

Comparison of incidence of PONV and history of migraine showed statistical significance. (p=0.0001). Among the 35 study subjects who had a history of migraine, 23 (65.7%) patients suffered from PONV and PONV occurred in only 20.5% patients who did not have a history of migraine.

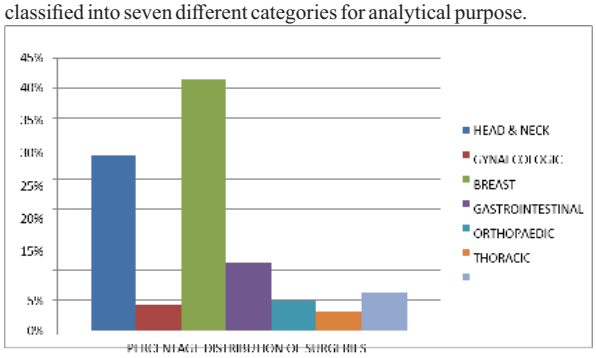


Graph 8. Comparison Of Incidence Of PONV Based On Duration Of Preoperative Fasting

Mean duration of preoperative fasting was 15.6 hrs. For statistical

analysis, study subjects were divided into two groups with duration of preoperative fasting <= 15 hours and >15 hours, which consisted of 87 and 75 study subjects respectively.(Graph 8) The incidence of PONV was then compared in the two groups. Duration of preoperative fasting had no significant association with PONV. (p=0.427). Incidence of PONV in the group with duration of preoperative fasting <=15 hours was 27.6% and it was 33.3% in the other group.

The study included various types of oncosurgeries and they were classified into seven different categories for analytical purpose.



Graph 9. Percentage Distribution Of Different Surgeries Included In The Study

Majority of surgeries included in the study were breast surgeries (41.4%) followed by head and neck surgeries (29%) and the least number of surgeries were thoracic surgeries (3.1%).(Graph 9)Incidence of PONV was maximum in gynaecologic surgeries (71.4%) followed by laparoscopic surgeries (40%). PONV did not occur in any patients who underwent thoracic surgeries. Statistical analysis showed that there was no significant association between type of surgery and PONV. p=0.113).Mean duration of surgery in patients who had PONV is 2.96 + 1.14 hours and in patients who did not experience PONV, it is 3.12 + 1.40 hrs. This difference in duration of surgery did not have any statistical significance. (p=0.469). Intraoperative use of opioids and incidence of PONV had no significant association. (p=0.507) Opioids were used intraoperatively in 151 patients, out of which 47 (31.1%) patients suffered from PONV and 2 (18.2%) of the 11 patients in whom opioids were not used intraoperatively experienced PONV.

Out of the 119 patients in whom volatile anaesthetic was used, 45 (37.8%) experienced PONV and of the 43 patients in whom no volatile anaesthetic was used, only 4 (9.3%) suffered from PONV. There was significant statistical association between use of volatile anaesthetic and occurrence of PONV (p=0.0001)

There was significant association between use of nitrous oxide and occurrence of PONV(p=0.006) . While 30 (41.1%) out of the 73 patients in whom nitrous oxide was used had PONV, only 19 (21.3%) out of the 89 patients in whom nitrous oxide was not used, experienced PONV.

For statistical analysis, study subjects are divided into 4 categories based on the duration for which patients are not allowed oral feed post op : <6 hrs, >6 but <12 hours, >12 but <24 hours, >24 hrs. No significant relationship was found between duration of post operative fasting and incidence of PONV.(p=0.157).Post operatively, opioids were used in 76 patients and among them, 27 (35.5%) had PONV and 22 (25.6%) patients out of the 86 patients in whom opioids were not used postoperatively experienced PONV. There was no significant association(p = 0.169).Hence, it is concluded that significant risk factors for PONV in the study population are : Female gender, non-smoking status, history of motion sicknesss / PONV / vertigo / morning sickness / migraine and use of volatile anaesthetic or nitrous oxide.

The data records were randomly split into an evaluation set and a validation set. In the evaluation set, the risk attributed to individual factors was estimated using univariate logistic regression analysis. Further, multivariate logistic regression analysis using forward likelihood ratio method was also done to identify independent predictors for PONV and their combined risk. A multivariate logistic regression model was fitted with occurrence of PONV as the response variable. p value less than0.05 was considered significant.

Table 2. Multivariate Logistic Regression Analysis

Variable	Beta	S.E	P value	Odds ratio	95% CI	
					Lower	Upper
Gender	3.171	1.249	0.011	23.831	2.062	275.493
History of morning sickness	1.594	0.557	0.004	4.925	1.654	14.664
History of migraine	1.672	0.571	0.003	5.324	1.740	16.293
Use of volatile anaesthetic	2.234	0.751	0.003	9.336	2.144	40.650
Constant	-6.383	1.418	0.000	0.002		

From the Table 2, it is concluded that risk of PONV in the study population is : 23 times more in females; approximately 5 times more in those with history of morning sickness and migraine ; and 9 times more if volatile anaesthetic is used.

DISCUSSION

This prospective observational study aimed at validating Apfel score in the study population and identifying the risk factors for PONV in the study population.The study was conducted in 162 patients who underwent elective oncosurgeries under general anaesthesia. Primary objective of the study was the validation of Apfel score in the study population. For this, the study subjects were divided into two equal groups based on their Apfel score as described in the methodology. The two groups were comparable with respect to age and gender distribution. Variables other than gender could not be uniformly distributed between the groups, as the predicted group with Apfel score > 2, will obviously have study subjects with more number of risk factors.

Primary objective of the study was validation of Apfel score in our patient population. Incidence of PONV in the study population was 30.2% which is close to that quoted in various studies.[1,20,21]. But it was lesser than that predicted by Apfel, Koivuranta et al, for all values of Apfel score.[22] Moreover, the incidence of PONV did not show a linear relationship with Apfel score. The study also shows that there is no significant difference in the incidence of PONV in the two groups - with Apfel score <=2 and >2. This could be due to the following reasons:1.risk of PONV is attributed not merely to the number of risk factors;2.all Apfel score variables do not contribute uniformly to the probability of PONV - each factor carries a unique risk.3.some or all Apfel score variables had weak significance in the population4. probable presence of more strong risk factors compared to Apfel score variables.

Due to all these facts, there is need for analysis of the significance of individual risk factors – those included in the Apfel score as well as other risk factors.

Among the Apfel score variables, female gender, non-smoking status and history of motion sickness or PONV proved to be statistically significant risk factors for PONV. Female gender and non-smoking status showed strong statistical significance, whereas, history of motion sickness or PONV had only borderline significance. Due to the high prevalence of breast malignancies in the population studied, the study sample included more number of patients who underwent breast oncosurgeries. Since incidence of breast cancer is more in females, there were more number of females in the study. Due to local, social and cultural reasons, smoking is less prevalent among females. Hence there were more number of non-smokers in the study. These factors might have affected the statistical results. But female gender and non-smoking status are widely accepted and proven risk factors for PONV. So this study did not result in any contradictory conclusions.

Preoperatively planned postoperative opioid therapy failed to show any significant association with PONV. These observations were in accordance with various studies done before[57] in figure. There are several hypotheses explaining the questionable significance of postoperative opioid therapy. In the study setting, postoperative opioid therapy for sedation or analgesia is usually started after patient reaches postoperative ICU or ward from PACU. It is known to cause delayed PONV. But in the study population, incidence of PONV is maximum during the immediate postoperative period, ie., at PACU. So we conclude that the administration of opioids for analgesia or sedation in the postoperative period may aggravate the already initiated PONV; and unlikely to initiate PONV as thought. Opioid induced PONV is also dose related. Strict adherence to the allowable dose limits and use of short acting opioids are other reasons for the negligible effect of opioids on PONV. The ability to predict a patient's postoperative

opioid requirement is likely to be poor, and this may continue to hamper accurate prediction of PONV. [12,43,67,68] The risk of PONV due to the initiation of postoperative opioid therapy could not be separately analysed as many patients received opioids intraoperatively also.

Secondary objective of the study was to identify other possible risk factors in the study population, apart from those included in the Apfel score. The study showed that significant risk factors for PONV in the study population are:

- history of vertigo
- history of morning sickness
- history of migraine
- use of volatile anaesthetic
- use of nitrous oxide.

When vestibular system receptors or receptors involved in mediating emesis are sensitized, it leads to development of a well developed reflex arc for emesis, leading to higher incidence of PONV in patients with history of vertigo, morning sickness and migraine. The emetic effect of volatile anaesthetics and nitrous oxide is through its absorption into the bloodstream and resultant stimulation of CTZ. Use of TIVA in a subset of patients led to decreased incidence of PONV despite use of intraoperative opioids, showing that use of volatile anaesthetics and nitrous oxide were stronger predictors of PONV than opioids. Incidence of PONV was maximum during the immediate post operative period and it decreased with time. This suggested that intraoperative anaesthetic drugs/gases used had significant impact on incidence of PONV in the immediate postoperative period and the incidence decreased with time as the drugs/gases got washed off the body.Duration of preoperative fasting failed to show any significant relationship with PONV. Preoperative fasting can lead to PONV, only if it resulted in significant dehydration and perioperative hemodynamic changes.Type of surgery is also a widely accepted risk factor for PONV. In this study, maximum incidence of PONV occurred in gynaecological followed by laparoscopic surgeries. The reason for increased incidence of PONV in these surgeries was already discussed in previous sections.[23,24] In this study, statistical significance of type of surgery as risk factor was poor due to the heterogenous sample with varying number of surgeries in each category. A larger study including more number of surgeries in each category is needed for significant inference.

Duration of surgery, a probable risk factor for PONV, failed to show any significance in the study. This could be due to the fact that short duration surgeries that lasted for one to two hours were not present in the study, as all the cases included in the study were major oncosurgeries of prolonged duration (>2 hours).Postoperative NPO period also failed to show any significance. There is conflicting opinion about the effect of postoperative fasting and PONV. Early initiation of postoperative feeding without adequate prokinetic therapy may lead to intestinal bloating and PONV, whereas prolonged postoperative fasting without adequate intravenous hydration may result in hypotension and increased incidence of PONV. As the study included various types of surgeries, initiation of feeding occurred at different time intervals post operatively. NPO period even extended to >24 hours postop in case of some gastrointestinal surgeries. The postoperative monitoring in this study was done only upto 24 hours. So validation of this factor was less reliable.In one subset of the study population, multivariate logistic regression analysis using forward likelihood ratio method identified the independent predictors out of the significant risk factors - female gender, morning sickness, migraine and use of volatile anaesthetic. These independent predictors were used to set up a new score for predicting the probability of PONV. The score is a measure of the combined risk due to these independent predictors. The score was then validated in the other subset of the study population by plotting the ROC curve and calculating the area under the ROC curve. The AUC-ROC was 0.698 with a p value of 0.000 which showed significance. This value was also comparable to the AUC-ROC of various scores proposed previously.[11,12,13]

LIMITATIONS AND FUTURE SCOPE

1. Sample size of the present study was inadequate to include sufficient number of all risk factors. A larger study over a longer duration of time, will ensure satisfactory number of all risk factors resulting in more reliable results.
2. All cases included in this study were oncosurgical cases which could not be completed in a short duration. So, duration of surgery as a risk factor for PONV could not be studied accurately. Studies including surgeries of short as well as long duration can be done to find the association between PONV and duration of surgeries.
3. There was no quantification of opioids in this study. As opioid induced PONV is dose dependent, estimation of quantity of opioid consumption may result in better understanding of effect of opioids in inducing PONV.
4. Postoperative monitoring of patients was done only upto 24 hrs. Delayed onset PONV might have been missed in the study. Postoperative monitoring period may be extended in future studies.
5. The study was done in only adult population. Pediatric population have different risk scores which also requires population specific validation.
6. The increased prevalence of breast malignancies resulted in inclusion of more number of females in the study. This also resulted in fewer smokers getting included in the study, as smoking is less frequent among females in our society.

CONCLUSION

- The incidence of PONV in the study population was 30.2%.
- Apfel score was not able to predict PONV in the study population.
- Incidence of PONV in the predicted group and non-predicted group was 37% and 23.5% respectively. There was no significant difference in incidence of PONV between the two groups.
- Actual incidence of PONV was less than that predicted by Apfel score at all values of Apfel score.
- The incidence of PONV did not show a linear relationship with the Apfel score.
- Significant risk factors for PONV in the study population were : Female gender, non-smoking status, history of motion sicknesss / PONV / vertigo / morning sickness / migraine and use of volatile anaesthetic or nitrous oxide.
- Independent predictors of PONV in the study population were: Female gender, history of morning sickness or migraine and use of volatile anaesthetic.
- The risk score for PONV in the study population is calculated as follows:
- Log odds(emesis) = -6.383 + 3.171 * (Gender) + 1.594 * (History of morning sickness) + 1.672 * (History of migraine) + 2.234 * (Use of volatile anaesthetic)
- Accuracy of the risk score was confirmed by calculating the area under the ROC , which was0.698.

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