



**GA-Related Risk Factors for Postoperative Nausea and Vomiting: Meta-Analysis Review**

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**Abstract**

**Introduction:** Postoperative nausea and vomiting (PONV) are common side effects that must be addressed effectively after general anaesthesia to ensure a patient's full recovery. This review will highlight the significant risk factors associated with PONV and provide the most effective strategies for reducing its incidence.

**Methods:** This study is based upon the collected data from various articles published in PubMed, Medline, and Scholars, which helped us draw conclusions and make recommendations.

**Results:** In this period, this review has employed PONV as Prophylaxis and Risk factors as Keywords. Various determinants are linked with PONV, including patient-related factors, surgery-related factors, and anaesthesia-related factors. Logistic regression analyses show that age younger than 50, female gender, history of PONV, use of volatile anaesthetics, nonsmoking status, use of opioid analgesics, and gynecologic and obstetric surgeries increase the likelihood of PONV.

**Conclusion:** An Anaesthesia Procedure and anaesthetics used play key factors in the Incidence of nausea and vomiting, just as modern anaesthesia methods use Pharmacological & Non-Pharmacological Prophylaxis as a multimodal strategy, the use of combined antiemetics Should be adapted which is more effective in avoiding PONV, Propofol as an induction agent, and the administration of combined neostigmine and atropine as reversal agents. Along with the intervention it decreases the baseline risks in patients with higher chances of PONV.

**Keywords:** General Anaesthesia, PONV, Risk Factors, analgesia; antiemetics

**Abbreviations:** PONV, post-operative nausea and vomiting; NV, Nausea and vomiting; RCT, Randomized control trial.

**Introduction**

Nausea and vomiting are frequently observed complications following general anaesthesia. These side effects can lead to discomfort and distress for patients

during the postoperative period. Nausea is characterized by the unpleasant sensation of an urge to vomit, while vomiting involves the forceful expulsion of stomach contents through the mouth. It is important for patients to be aware of these potential complications and to discuss preventative measures with their healthcare provider. By taking steps to prevent nausea and vomiting, patients can have a smoother and more comfortable recovery after surgery. It is considered one of the most common causes of morbidity, and it has major effects on patient satisfaction. [1] PONV is now recognized as one of the most distressing, yet common adverse events experienced by patients after surgery and has been targeted as a major patient-center outcome within perioperative care. PONV has several effects on patient's good health and a massive financial interference on patient care. This has led to a growing body of literature supporting the study of PONV over recent years. Data generated by the Apfel Consensus Guidelines on PONV have determined that four independent predictors contribute to PONV and can be used as a simplified approach to measuring the probability of PONV in individual patients. The predictors of PONV include female gender, non-smoking, history of PONV or motion sickness, and use of postoperative opioids. PONV can result from various perioperative conditions, including the use of opioids, volatile anaesthetics, and anxiety. Management of PONV is important to prevent complications such as dehydration, electrolyte imbalances, and pulmonary aspiration syndrome,[2] which can prolong hospital stay and increase healthcare expenses. By addressing the underlying causes of PONV, such as the use of opioids, volatile anaesthetics, and anxiety, healthcare providers can improve patient outcomes and satisfaction in perioperative care. Such simplified predictions help identify patients at high risk of PONV, and in doing so,

patients can be targeted with prophylactic therapy in the hope of preventing PONV. It can moderately disappear on its own yet cause uneasiness and discomfort and sometimes lead to Severe complications that can lead to dissatisfaction and may also result in medical and psychological issues. These complications can hinder the effectiveness of therapy and slow down the rate of recovery.[3] Today, paying attention to the postoperative period is just as crucial as the intraoperative period. After surgery, PONV has an unpleasant and most frequently occurred adverse effect after pain post surgeries performed under GA. Several different kinds of drugs are used to carry out General Anaesthesia procedures, such as hypnotics, analgesics, and muscle relaxants. As Multiple agents are used, they have adverse effects on patients, Nausea and Vomiting are the most frequently occurring events in the next 24 hours post-GA. Nausea and vomiting can have serious consequences. During the administration of general anaesthesia, there are potential complications that may have serious consequences for the patient's health. One of these complications is aspiration, where gastric contents enter the lungs and cause respiratory distress, such as asphyxia, hypoxia, and hypercapnia. Research by Cook et al (2011) indicates that the risk of death due to general anaesthesia is relatively low, with a 1 in 100,000 occurrence. Additionally, postoperative nausea and vomiting (PONV) is a common complication that can arise following surgery and anaesthesia. While PONV may seem like a minor inconvenience, it can lead to complications such as dehydration, electrolyte imbalances, wound reopening, pulmonary aspiration, and delayed hospital discharge. As such, healthcare providers should take steps to closely interpret patients who have undergone general anaesthesia to prevent and manage these potential complications. The regulation of nausea and vomiting is

primarily governed by the vomiting centre, which is situated in the medulla oblongata. <sup>[4]</sup> The emetic response is regulated by the vomiting centre, which can be activated directly by irritants or indirectly through input from four key areas: the gastrointestinal tract, cerebral cortex and thalamus, vestibular region, and chemoreceptor trigger zone (CRTZ).<sup>[5,6,7]</sup> Nausea and Vomiting may occur due to several causes & Involvement of complex Physiological and biological mechanisms, it can be an early sign of Illness, Poisoning, or complication of surgery and General anaesthesia. There are many potential risk factors correlated with GA, Individuals with a medical history of abdominal pathology, diabetes mellitus, hypothyroidism, pregnancy, increased intracranial pressure, and a history of swallowing blood, along with those who have a full stomach, are at an elevated risk of experiencing PONV. <sup>[8]</sup> The occurrence of either Nausea or Vomiting in the postoperative period after surgery is strongly related to the type of surgery performed and its duration. The longer the Duration, the Higher the risk of PONV. There are great chances of PONV in Cholecystectomy, Gynaecology & Laparoscopic surgery & relatively lower in Orthopedic Surgeries. However, the precise cause of PONV remains elusive. Identification of patients at high risk and events associated with the development of PONV can be seen as a positive step towards reducing the overall incidence of PONV. This can only be achieved by understanding the nature of PONV and the first place to look for events that are associated with the development of PONV is in PACU as these are usually events that occur in the immediate post-operative period. After extensive analysis, several publications have reported varying results. However, the issue persists in analysis, several publications have reported varying results. However, the issue persists. The incidence rate is 10% for patients who

don't have any risk factors. For patients with 1, 2, 3, or 4 risk factors, the incidence rates are 21%, 39%, 59%, and 78%, respectively. <sup>[9]</sup> PONV can be the result of many perioperative conditions such as the use of opioids, volatile anaesthetic, and anxiety. The capillaries in the endothelium lack tight junctions. <sup>[2]</sup> Despite advances in surgical techniques and anaesthetic pharmacology, the incidence of PONV has changed very little in the past three decades and remains high. This may be due to the general trend for day case surgery, an increase in elderly patients, or perhaps because more surgery is performed as an outpatient where patients are less closely supervised during the crucial time post-surgery. Patients have been constantly reported to be delayed discharge and in severe cases, present back to the hospital. Issues resolved around a society of day surgery patients increase the wastage of often limited healthcare resources. Considering the rising cases of outpatient surgery, Multimodal approaches should be practiced before and after GA. The aims are to determine the prevalence of PONV after General anaesthesia, identify the risk factors, and determine the best strategy to control PONV.

## Discussion

### 1. Physiology of Nausea and Vomiting

The pathophysiology underlying nausea and vomiting (NV) is intricate and may present challenges in comprehension. The central regulation of these symptoms originates from the vomiting centre situated in the medulla oblongata, consisting of the reticular formation and the NTS. Activation of this centre initiates the motor pathways responsible for inducing vomiting. <sup>[10]</sup> The emetic centre can be directly activated by irritants from four areas: the gastrointestinal tract, cerebral cortex and thalamus, vestibular region, and CRTZ. Unlike other brain centres, the vomiting centre lacks the protection of the blood-brain barrier, and the endothelial capillaries

exhibit a lack of tight junctions. This means that it is easily affected by irritants, regardless of their lipid solubility or molecular size.<sup>[11]</sup>

## 2. Patients Assessment

All patients must undergo an assessment to determine their baseline risk of postoperative nausea and vomiting (PONV). Following a 2-hour evaluation in the post-anesthesia care unit (PACU), patients should be classified as either low or high risk for PONV. These data were collected before surgery: Age, Gender, BMI, History of PONV, smoking status & concerning the duration of anaesthesia, postoperative opioid use, and blood loss. prevention and management must be dealt with according to its risk factors. Based on research studies <sup>[5-6]</sup>, the probability of postoperative nausea and vomiting (PONV) is 10%, 21%, 39%, 59%, and 78% for patients with 0, 1, 2, 3, and 4 risk factors, respectively. It is important to note that patients with more than one risk factor are considered to have a high risk of experiencing PONV, while those with one or fewer risk factors have a low risk. This information is critical for assessing and managing the risk of PONV in patients undergoing surgery. <sup>[11]</sup> Group age group <55y & Gender Females are more likely to experience PONV than men. Patients with abdominal issues, diabetes, hypothyroidism, pregnancy, increased intracranial tension, a history of swallowing blood, or a full stomach are at a higher risk for postoperative nausea and vomiting (PONV).<sup>[8]</sup>

## 3. Surgical Factors

The event of either nausea or vomiting in the postoperative period after surgery is strongly related to the type of surgery that was performed and its duration. The longer the duration of the surgery, the higher the risk of postoperative nausea and vomiting (PONV). The probability of experiencing PONV are greater in surgeries such as cholecystectomy, gynecology, and

laparoscopic surgery, while the risk is relatively lower in orthopedic surgeries. Postoperative period after surgery is strongly related to the type of surgery performed and its duration. Longer the Duration, Higher the risk of PONV. There are great chances of PONV in Cholecystectomy, Gynaecology & Laparoscopic surgery & relatively lower in Orthopedic Surgeries.

## 4. General Anaesthesia factors

- The utilization of Nitrous Oxide has been shown to heighten the likelihood of a PONV (Postoperative Nausea and Vomiting) event.
- The administration of volatile anaesthetics is associated with a twofold increase in the likelihood of postoperative nausea and vomiting (PONV). This risk escalates in a dose-dependent manner, and there is no significant disparity in its occurrence across various volatile anaesthetics. Furthermore, the utilization of volatile anaesthetics stands as the primary determinant for predicting vomiting within the initial two postoperative hours.<sup>[6]</sup>
- Using Propofol for IV anaesthetic induction instead of volatile anaesthetic can reduce the likelihood of PONV. There is a suggestion that Propofol possesses antiemetic properties; however, there is limited evidence to substantiate this assertion.<sup>[6]</sup>
- The use of opioids during the intra and post-operative period significantly increases the chances of experiencing postoperative nausea and vomiting (PONV). This is due to opioids reducing muscle tone and peristaltic movement, leading to delayed gastric emptying, causing distension and activating vomiting reflexes. It is crucial to consider alternative pain management methods to minimize the risk of PONV events in patients undergoing surgery.<sup>[12]</sup>
- The duration of anaesthesia refers to the period in which the patient is subject to substances capable of

inducing vomiting, such as volatile anaesthetics and intraoperative opioids.<sup>[6]</sup>

**5. Risk Scoring System:** To accurately evaluate a patient's baseline risk for PONV, it is essential to employ a validated score that is based on independent predictors.<sup>[13]</sup> The Apfel score and the Koivu Ranta score are the two most often used risk scores for patients undergoing Balanced Anaesthesia.

The Apfel simplified risk score is derived from four key predictors, including gender (female), history of PONV and motion sickness, nonsmoking status, and use of postoperative opioids. The incidence of PONV varies depending on the number of risk factors present. Patients with 0, 1, 2, 3, or 4 risk factors have an incidence of 10%, 20%, 40%, 60%, and 80%, respectively.<sup>[14]</sup> Patients are categorised as low, medium, or high risk. Patients presenting with 0-1 risk factors are classified as low risk, those with 2-3 risk factors are categorised as medium risk, and individuals with more than 3 risk factors are deemed to be at high risk.<sup>[13]</sup>

### Conclusion

It is concluded that PONV is one of the most dissatisfying situations for a patient, which keeps happening even after PACU discharge too. Incidence of Postoperative Nausea and Vomiting is linked with a longer stay in PACU with significant resource utilisation and costs. All-inclusive Reduced incidence of PONV was reported patient factors such as age, sex, smoking status, previous history of motion sickness, anaesthesia factors like type and durations, and surgery factors were potential risk factors for PONV. Maintenance of anaesthesia by using propofol is more beneficial in reducing the occurrence of PONV, thus shorter hospital stays, even so, it is more expensive but more helpful in lowering PONV over volatile anaesthetic (sevoflurane or desflurane) in patients undergoing daycare surgery.

**Preoperative Hydration:** Administration of IV fluids in preoperative duration is a productive way to reduce the incidence of PONV as it has a major effect in avoiding adverse effects of antiemetics drugs and associated complications of GA. Currently, various RCT results confirmed that Administering 1000 ml of crystalloid fluid before the commencement of surgery or providing preoperative hydration is imperative for mitigating the incidence of PONV and its associated complications.<sup>[15,16,17]</sup>

**Antiemetics drugs:** Antiemetics drugs are considered Antagonists at receptor sites of Vomiting centres and associated sites it works by blocking acetylcholine and histamine. Administration of combined Antiemetics such as Dexamethasone and ramosetron in the preoperative period has a great impact on reducing the chances or severity of PONV.<sup>[18]</sup> To prevent postoperative nausea and vomiting (PONV), it's important to address perioperative anxiety, hypotension, hypoxia, and pain.<sup>[6,19,11,17]</sup> As per the PONV risk score, baseline risk factors can be decreased by eliminating the use of mitogenic agents like opioids, and anaesthetic inhalation agents instead use of locoregional anaesthesia or propofol based on TIVA is way better, It has been observed that the administration of inhalational agents for general anaesthesia during surgical procedures may elevate the risk of postoperative nausea and vomiting (PONV). To mitigate the heightened incidence of PONV in patients with high susceptibility, it is advisable to administer a low dose (0.5mg/kg) of propofol intravenously following the surgical procedure. This methodology has demonstrated efficacy in significantly reducing the occurrence of PONV within two hours postoperatively. In instances where propofol infusers are not readily accessible, this approach can be regarded as a feasible alternative.<sup>[20]</sup>

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