

PREGLED LITERATURE – REVIEW ARTICLE

**Postoperative nausea and vomiting – risk factors and prevention**

Postoperativna mučnina i povraćanje – faktori rizika i prevencija

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**Summary** Postoperative nausea and vomiting (PONV) often occur in children and require prophylactic and therapeutic measures. PONV can be reduced by avoiding the use of inhalation anesthetics and by reducing postoperatively given opioids. Dexamethasone and 5-HT<sub>3</sub> antagonists are considered basic prophylactic drugs. Surgical intervention that lasts for a long time, a type of surgical procedure (eg strabismus and certain otorhinolaryngological procedures) and PONV history are also considered risk factors that increase the incidence of PONV, while short procedures and ambulatory surgery are considered a low risk factor. Based on the assessment of low, medium or high risk, a single, double or triple (two drugs and total intravenous anesthesia) prophylaxis is determined. Droperidol and metoclopramide can only be recommended as supplemental therapy.

**Keywords:** anesthesia, nausea, vomiting, risk, prevention, child

**Sažetak** Postoperativna mučnina i povraćanje (PONV) često se javljaju kod dece i zahtevaju profilaktičke i terapijske mere. PONV se može smanjiti izbegavanjem primene inhalacionih anestetika i smanjenjem postoperativno datih opioida. Deksametazon i 5-HT<sub>3</sub> antagonisti smatraju se osnovnim profilaktičkim lekovima. Hirurška intervencija koja duže traje, vrsta hirurškog zahvata (npr. strabizam i određeni otorinolaringološki zahvati) i PONV u anamnezi takođe se smatraju faktorima rizika koji povećavaju incidencu PONV, dok se kratke procedure i ambulantna hirurgija smatraju faktorom niskog rizika. Na osnovu procene niskog, srednjeg ili visokog rizika određuje se jednostruka, dvostruka ili trostruka (dva leka i totalna intravenska anestezija) profilaksa. Droperidol i metoklopramid mogu se preporučiti jedino kao dopunska terapija.

**Cljučne reči:** anestezija, mučnina, povraćanje, rizik, prevencija, dete

## Introduction

During the last decades, life-threatening complications associated with anesthesia have become very rare. This safety record has encouraged anesthesiologists to focus attention on minor morbidity. Of these, postoperative nausea and vomiting (PONV) is one of the “big little problems” after general anesthesia. Although anesthesiologists are aware of postoperative nausea and vomiting (PONV/POV) as a common complication in pediatric anesthesia, its incidence in daily routine is still too high. During the last decade, different guidelines tried to standardize clinical practice, but failed to provide clear algorithms (1). PONV may decrease parental satisfaction, increase the use of resources, including medical and nursing care, IV fluids, drugs, and other supplies. Furthermore, in the ambulatory setting, PONV is a major cause of unanticipated admission. For these reasons, tools

to predict an increased risk for developing nausea and vomiting are certainly useful in clinical practice. Several scores have been developed for adults. However, their use in pediatric patients is limited, because several of the proven risk scores for adults are difficult to assess or not applicable to children (2).

## Incidence of postoperative nausea and vomiting

The average incidence of PONV in childhood of between 33.2 and 82% can be twice as high compared with adults. This high incidence warrants the use of antiemetic prophylaxis instead of therapy (1).

### **Risk factors for postoperative nausea and vomiting**

Eberhart et al. identified four risk factors for PONV or POV in pediatric anesthesia: previous PONV or a positive family history, duration of anesthesia (>30 min), age ( $\geq 3$  years), and strabismus surgery. The risk of POV was predicted as 9, 10, 30, 55, and 70%, respectively, depending on the presence of 0, 1, 2, 3, and 4 risk factors. Furthermore, excluding strabismus, the incidence of POV is 11.6% in the presence of only one risk factor, 28.2% POV with two risk factors, and up to 42.3% in the presence of three risk factors (3). Others possible risk factors include history of migraine, history of PONV or motion sickness in a child's parent or sibling, better ASA physical status, intense preoperative anxiety, certain ethnicities or surgery types (strabismus and ear–nose–throat surgery like tonsillectomy or adenoidectomy are associated with PONV incidences as high as 54 and 82%, respectively), decreased perioperative fluids, crystalloid versus colloid administration, increasing duration of anesthesia, general versus regional anesthesia or sedation, balanced versus total IV anesthesia, and use of longer-acting versus shorter-acting opioids. Early-phase menstruation, obesity and lack of supplemental oxygen are disproved risk factors (4). On the other hand, anesthesia times and operative times are significantly longer for obese patients undergoing most types of pediatric surgical procedures (5), so increased incidence of obesity (6,7) and relating complications could contribute to anesthesia risks and complications (8).

A variety of anaesthetic-related factors have been implicated in producing increased POV in children. However, few of these factors are included in any of the POV risk scoring systems in the published literature for paediatric patients. Although modern volatile agents are less emetogenic than older agents (e.g. ether), there is evidence that volatile agents may significantly contribute to early POV particularly in high-risk patients. There is also a strong dose-response relationship between POV and duration of exposure to volatile agents. Antagonism of neuromuscular blockade has been associated with increased risk of POV.

But, Efuno et al. (9) find out that there was no association with age, gender, airway management, nitrous oxide use, amount of intravenous fluids, duration of anesthesia, intraoperative antiemetic administration or dosage, length of time from recovery room discharge to first oral intake, or length of ride home from the hospital. In their study, multivariate generalized linear regression analysis confirmed intraoperative and postdischarge opioids to be independent risk factors for postdischarge nausea and vomiting.

### **Prevention of postoperative nausea and vomiting**

#### **Antiemetic strategies during anesthesia**

Anesthetists are able to reduce the so-called baseline risk factors and can decrease the incidence of PONV with simple strategies (10):

- (1) avoidance of volatile anesthetics and preferential use of total intravenous anesthesia (TIVA) with propofol;
- (2) preferential use of regional anesthesia or combined general and regional anesthesia to reduce postoperative opioids;
- (3) multimodal postoperative pain therapy to reduce postoperative opioids;
- (4) avoidance of nitrous oxide; and
- (5) adequate hydration.

One part of a multimodal postoperative pain therapy to reduce opioid requirements is the use of nonsteroidal anti-inflammatory drugs (NSAIDs). However, there is still an ongoing debate about the potentially increased postoperative bleeding risk, especially after tonsillectomy (1).

#### **Antiemetic drugs**

Dexamethasone as glucocorticoid is one of the PONV prophylactic drugs. A study by Hermans et al. showed that 0.15 mg/kg dexamethasone was as effective as 0.5 mg/kg in reducing PONV incidence from 49% in placebo to 21 and 22%, although dosage of 0.1 mg/kg proved to be prophylactic in pediatric everyday practice. One of the most severe complications of low-dose dexamethasone is the tumor lysis syndrome with consecutive hyperuricemia, hyperkalemia, hyper-phosphatemia, and hypocalcemia. A second major concern is a potential increase in the bleeding incidences in children undergoing tonsillectomy (11). The effect of dexamethasone on glucose metabolism and tolerance is another important issue.

Ondansetron as one agent of the 5-HT<sub>3</sub> antagonist group is widely used for PONV prophylaxis and therapy (9). Ondansetron may have a dose-dependent effect, but reduces PONV effectively with doses as low as 0.1–0.15 mg/kg intravenously (maximum 4 mg). In general, the 5-HT<sub>3</sub> receptor antagonists have a favorable side-effect profile and are considered equally well tolerated except palonosetron.

Dimenhydrinate is an antihistamine drug with antiemetic effects. However, dimenhydrinate-treated patients tend to be more sedated and require significantly longer observation in the postanesthesia care unit (PACU).

Droperidol has an antiemetic effect via dopaminergic receptors. As a result of its possible extrapyramidal symptoms, sedation, and QT prolongation leading to a FDA 'black box warning', the drug is currently recommended as rescue medication in therapy-refractory PONV only.

Metoclopramide is a dopaminergic antagonist with antiemetic properties. Metoclopramide should not routinely be used as a prophylactic drug.

### Conclusion

Baseline risk reduction of PONV with avoidance of nitrous oxide and volatile anesthetics and preferential use of propofol instead, reduction of postoperative opioids with regional anesthesia and multimodal pain therapy, and adequate hydration are absolutely necessary in every pediatric anesthesia. The high incidence of PONV, existing not only in strabismus or ear–nose–throat surgery but also in general pediatric surgery, makes pharmacologic prophylaxis more than reasonable. The following antiemetic interventions are feasible with a sensible risk–benefit ratio: TIVA, dexamethasone, and 5-HT3 antagonist.

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