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## 32.1 PONV

The incidence of nausea and vomiting in the postoperative period is estimated to be 30% in the general surgical population and can rise to 80% in high-risk cohorts [1]. Postoperative nausea and vomiting (PONV) is also associated with a significantly longer stay in the post-anaesthesia care unit, unanticipated hospital admission and increased health care costs [2, 3]. One of the goals of the current guidelines is to understand how effective the treatment is in the cases of PONV and postdischarge nausea and vomiting with or without prophylaxis, that is, emergency scenarios [4].

In an evidence-based analysis, the authors claim that there are patient-specific risk factors for PONV in adults: female sex, a history of PONV and/or motion sickness, non-smoking status and younger age. Moreover, in a randomized trial, Leslie et al. point out that laparoscopic surgery (in particular, bariatric surgery, gynaecological surgery and general surgery, such as cholecystectomy), duration of anaesthesia with volatile anaesthetics and postoperative opioids, may be associated with an increased risk of PONV [5, 6]. The effect of volatile anaesthetics

on PONV was shown to be dose-dependent, particularly 2–6 h after surgery. The use of opioids in the postoperative period increases the risk for PONV in a dose-dependent fashion, and the effect lasts as long as the drugs are taken in the postoperative period. The incidence of PONV is lower for opioid-free anaesthesia and total intravenous anaesthesia. With the choice of multimodal pain management, with opioid-free regional anaesthesia, perioperative administration of  $\alpha_2$  agonist and beta-blockers helps to reduce the incidence of PONV [7–9]. The administration of nitrous oxide analgesia can increase the risk of PONV if the duration of exposure is more than 1 h [10]. In contrast to planned surgery, in emergency situations, there is less time to prepare patients preoperatively; however, it is helpful to apply a risk score to reduce the rate of PONV at an institutional level and can be important to draw up protocols and standardize behaviours.

The Apfel-simplified risk score is based on four predictors [11], and the Koivuranta score includes the four Apfel risk predictors as well as length of surgery >60' [12]. Age is not an independent risk factor for PONV, and there is a 10% decreasing risk for every decade of age in adults, starting at age 30. This could be related to a decreasing dose of anaesthetic agents administered as a result of decreased lean body mass, reduction in cardiac output and metabolism and reduction of brain neurons, all lead to

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an altered pharmacokinetic and pharmacodynamic response [13].

In an emergency setting, when there is not sufficient time to prepare the elderly and frail patient for surgery, another goal is to reduce baseline risk for PONV. Select multimodal systemic analgesia to minimize the use of perioperative opioids, use regional anaesthesia when possible, choose propofol infusions as the primary anaesthetic, avoid volatile anaesthetics and ensure proper preoperative and intraoperative hydration. In addition, during laparoscopic surgery, it is necessary to administer a neuromuscular blockade and a reversal at the end of surgery to avoid postoperative residual curarization, and different meta-analyses show that the choice of sugammadex instead of neostigmine is supported by evidence [14–18].

To apply multimodal prophylaxis, we have different classes of drugs: 5-HT<sub>3</sub> receptor antagonists (ondansetron, dolasetron, granisetron, tropisetron, ramosetron, palonosetron), NK1 receptor antagonists (aprepitant, casopitant, rolapitant, vestipitant), corticosteroids (dexamethasone, methylprednisolone), antidopaminergics (amisulpride, droperidol, haloperidol, metoclopramide, perphenazine), antihistamines (dimenhydrinate, promethazine) and anticholinergics (scopolamine transdermal patch) [19–38]. Some drugs have significant side effects and do not have an food and drug administration (FDA) indication for PONV, so it is difficult to define the best timing of administration or indication based only on the type of surgery (i.e. orthopaedic surgery).

Metoclopramide should not be used in elderly and Parkinson's patients due to significant central nervous system (CNS) side effects such as dyskinesia, drowsiness and agitation. Scopolamine is highly associated with delirium and should be avoided in elderly patients. Prophylactic antiemetics should be used based on a risk score; thus, they are not recommended in elderly patients [39]. Gabapentin, when given preoperatively in patients undergoing abdominal surgery, reduces PONV [40] but was associated with respiratory depression in patients undergoing laparoscopic surgery [41]. When they are part of a multimodal

analgesic approach, intraoperative use should be reduced, especially in elderly patients [42].

PONV prophylaxis can be obtained even with a nonpharmacologic approach: many trials confirm that stimulation of the pericardium 6 acupuncture point (PC6) significantly reduces the risk of nausea and vomiting and the need for rescue therapies [43].

The evidence supports the use of two or more antiemetics, but there is insufficient evidence to allow the clinician to select the most effective individual antiemetic, with the exception of choosing agents from a different pharmacologic class [44]. Nausea and vomiting may be driven by a variety of central and peripheral mechanisms, so the right combination of choice of drug, dose and timing has not yet been identified [45, 46].

In emergency laparoscopic surgery, if the patient did not receive PONV prophylaxis, 5-HT<sub>3</sub> receptor antagonists are the first choice for treating PONV: ondansetron 4 mg per os or iv and ramosetron 0.3 mg iv [47]. A combination of multiple antiemetics may be more effective in treating established PONV [48].

Unfortunately, adherence to PONV prophylaxis guidelines is still poor, with less than half of medium- to high-risk patients receiving the appropriate prophylaxis [49].

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## 32.2 Pain Management

Frequently, the problem of PONV is related to pain management; elderly patients may be receiving chronic treatment with opioids (e.g. for arthrosis), and the intra-postoperative administration of more opioids can worsen the situation. Perioperative pain management should be tailored to the needs of the individual patient, taking into account the patient's age, medical and physical condition, level of fear/anxiety, whether the surgery is elective or emergency, and the type of surgical procedure. Inadequate treatment of postoperative acute pain leads to increased sympathetic activity, which brings tachycardia and hypertension; in elderly patients with coronary artery disease, the risk of myocardial infarction is

increased. Regional blood flow can be depressed and may increase the risk of postoperative infection; moreover, fear and anxiety due to inadequate pain control can impair sleep and rehabilitation in the immediate postoperative period. Generally, patients with pain have shallow breathing that in the postoperative period can lead to hypoxemia, atelectasis and pneumonia [50]. Moreover, postoperative pain increases the risk of postoperative delirium, and only high levels of rest pain are associated with postoperative delirium. About opioids, there is insufficient evidence to assert which do not cause this symptom, except meperidine, which has an influence on brain cholinergic activity [51]. However, inadequate postsurgical acute pain management could facilitate the development of a chronic pain syndrome that can, especially in the elderly population, affect the quality of life [52]. Regional anaesthesia, including neuraxial techniques (spinal and epidural anaesthesia) and peripheral nerve blocks, can prevent chronic pain and is the best choice for pain control during and/or after surgery, improving pain relief and functional outcomes, and reducing the hospital stay for selected patients. Epidural analgesia can be employed postoperatively to obtain better pain control from large abdominal and thoracic incisions; the advantages over systemic narcotics include less sedation and improved respiratory mechanics. Absolute contraindications to neuraxial anaesthesia/analgesia, even more so in emergency cases, are anticoagulation and antiplatelet medication; other situations include sepsis, bacteraemia and hypovolemia.

In the CNS of elderly patients, dementia, memory loss and degenerative diseases are present at higher frequencies. Alterations in neurotransmitter levels and neuronal circuits cause pharmacodynamic changes that can result in increased sensitivity to some classes of drugs, for example midazolam and some opioids [53]. Therefore, modifications in pain perception result from age-related changes in the peripheral nervous system (PNS). Generally, elderly patients have increased pain thresholds, which contribute to delayed presentation in the emergency room (ER) in cases of painful conditions (i.e. peritonitis).

With regard to laparoscopic surgery, the significant advantages in elderly patients are more rapid recovery, less pain in the postoperative period and reduced fluid requirements [54]. For opioids, age-related increased sensitivity seems more tied to changes in the pharmacodynamics and sensitivity of the receptors as opposed to an alteration in the distribution or clearance of the medications [55]. In general, all initial opioid doses should be reduced in older patients [56], but in the case of morphine, the initial postoperative requirement is the same as in a younger patient, changing the maintenance doses that should be reduced [57]. However, patients who requested parenteral morphine for pain had four times the risk of myocardial ischaemia and tachyarrhythmias than those whose pain was well controlled with epidural analgesia [58]. Thoracic epidural analgesia significantly reduced the incidence of myocardial injury and ameliorated pain compared with parenteral analgesia after major abdominal surgery [59].

When a multimodal opioid-sparing pain approach is chosen, acetaminophen is frequently overlooked intra- and postoperatively but should be used with caution in older patients with liver dysfunction and matched with low doses of non steroidal anti inflammatory drugs (NSAID) [60], as this drug category has ceiling dose effects above which no further analgesia is obtained. In general, elderly patients are most appropriately treated with agents with short half-lives (ibuprofen); for patients with a history of dyspepsia, ulcer disease or bleeding diatheses, acetyl salicylic acid (ASA) and choline magnesium trisalicylate should be used if a traditional NSAID is indicated [61]. Many physicians in the ER are reluctant to prescribe any analgesia when a patient arrives with acute abdominal pain, due to the risk of impairment of diagnostic accuracy, but it is possible to affirm that opioids can also be used safely [62].

The attention to certain measures in laparoscopic surgical techniques can reduce postoperative pain and improve its management. Low pressure, saline lavage followed by suction, aspiration of pneumoperitoneum gas, mini-port technique and port site local anaesthetic infiltration preferably with long-acting agents and prior to incision are recommended [63, 64].

Good practice for acute perioperative pain management is a multimodal therapy to minimize the need for opioids, and it is suitable to select regional anaesthesia and administer NSAIDs and to choose acetaminophen before the induction of general anaesthesia when possible. In the case of locoregional analgesia, transversus abdominis plane blocks or other interfascial plane blocks are indicated, and local anaesthetic wound infiltration and postoperative patient-controlled analgesia using iv opioids are suggested [65, 66]. It is known that patients receiving emergency surgery have significantly higher pain severity than those hospitalized in the scheduled mode. These patients have a high likelihood of developing postoperative wound complications, such as superficial or deep wound infections that affect pain severity and can require wound drains [39, 67]. For frail elderly patients and those with cognitive impairment undergoing major complex abdominal surgery, epidural anaesthesia/analgesia is probably the best choice for pain management for good reporting of efficacy/side effects [68]. Importantly, one of the causes of acute confusion in surgical patients is stress resulting from pain, and improved pain management can prevent postoperative delirium [39, 69].

Elderly patients should receive tailored pain therapy, and a multimodal analgesic plan should be developed. Potentially inappropriate medications such as barbiturates, benzodiazepines, non-benzodiazepine hypnotics, pentazocine and meperidine should be avoided. Opioid-sparing techniques should be used [70].

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