Postoperative Nausea and Vomiting Management

Postoperative recovery is complicated by nausea and vomiting in up to 30% of patients.[1,8] Postoperative nausea and vomiting (PONV) can lead to dehydration, wound dehiscence, or delay hospital discharge.[1] Pharmacologic and non-pharmacologic options can be used to prevent and/or treat PONV. This chart reviews antiemetic dosing, administration timing, and other considerations for managing **adults** with PONV.

Drugs listed in alphabetical order; NOT order of preference. ***Many doses are from consensus statements and may differ from product labeling.***

Drug/Drug Class/ Cost[a]	Adult PONV Dosing Regimens	Other Considerations
Amisulpride *Barhemsys* Dopamine antagonist Injection: $45 (5 mg/2 mL vial)	**Prevention**: 5 mg IV x 1, at anesthesia induction[8,13] **Treatment**: 5 or 10 mg IV x 1[8,13]	• Consider using a 10 mg dose instead of 5 mg for **treatment of established PONV** in patients who failed prevention with antiemetic meds with other mechanisms of action, as 5 mg may not be effective in these patients.[8] • Studies using antiemetic doses have not reported sedation, EPS, or QTc prolongation.[8] • May be associated with injection site pain and a slight increase in prolactin levels.[8,13]
Aprepitant *Emend*, generic (PO) *Aponvie* emulsion (IV) Neurokinin-1 antagonist Capsule: ~$88 (40 mg capsule) Injection: ~$58 (32 mg/4.4 mL vial)	**Prevention**: 40 mg PO x 1, at anesthesia induction[8] 32 mg IV x 1, at anesthesia induction[28] **Treatment**: No data for use to treat established PONV.[8]	• Aprepitant 40 mg PO more effective than ondansetron for prevention of PONV, especially 24 to 48 hours postoperatively, which may be due to its half-life of nine to 13 hours.[8,13] • Headache and dizziness are common side effects.[13] • Aprepitant can reduce the efficacy of hormonal contraceptives. Patients should be advised to use a back-up contraceptive for **one month** following the last dose of aprepitant.[28,29] • CYP3A4 substrate, inhibitor, and inducer; CYP2C9 inducer.[13] • Aprepitant 40 mg PO plus dexamethasone seems more effective than ondansetron plus dexamethasone at preventing vomiting in neurosurgery patients.[8] • FDA approval of IV emulsion was based on efficacy data from PO formulation.[28]
Dexamethasone Corticosteroid Injection: ~$1.20 (4 mg/1 mL vial) *Continued…*	**Prevention**: 4 to 8 mg IV x 1, at or shortly after anesthesia induction[8,23] **Treatment**: NOT effective alone as rescue	• As effective as ondansetron and granisetron for **PONV prevention**.[8,12] Considered a first-line option for prevention. • Possible additional benefit may be dexamethasone's opioid-sparing effects.[8] • Doses used for PONV: o may increase blood glucose levels by up to ~36 mg/dL in patients with diabetes.[27] Risk increases with dose.[8] Some centers avoid in patients with diabetes.[23] o do not seem to increase infection risk or anastomotic leaks.[11,27]

Drug/Drug Class/ Cost[a]	Adult PONV Dosing Regimens	Other Considerations
Dexamethasone, continued	therapy for established PONV.[1]	• Dexamethasone 8 mg IV x 1 added to standard therapy (preop ondansetron and/or cyclizine) seems more effective than standard therapy alone at preventing PONV for the first 24 hours after gastrointestinal surgery [Evidence Level A-1] and may reduce the need for rescue antiemetics for up to 72 hours after surgery.[11]
Droperidol *Inapsine*, generics Butyrophenone Injection: ~$4.50 (5 mg/2 mL vial)	**Prevention**: 0.625 mg IV x 1, at the end of surgery[8,23] **Treatment**: 0.625 mg IV x 1[1,13]	• Evidence for PONV prevention is not as strong as for aprepitant, 5-HT3 antagonists, or dexamethasone.[20] Combo with ondansetron seems more effective than either med alone.[22] • Side effects include sedation, dizziness, hallucinations, and EPS.[1,13] • "Black box" warning added due to reports of QTc prolongation, arrhythmias, and sudden cardiac death. However, for doses <2.5 mg IV/IM, electrocardiogram (ECG) monitoring is not recommended and the boxed warning about QTc prolongation/torsades risk does not apply.[8,13,21] When QTc monitoring is performed, avoid droperidol if QTc >440 ms (men) or >450 ms (women).[21,23]
Granisetron 5-HT3 antagonist Tablet: ~$8 (1 mg) Injection: ~$10 (1 mg/1 mL vial)	**Prevention**: 0.35 to 3 mg IV x 1, given at the end of surgery (1 mg is commonly used)[1,8,13] 1 mg PO x 1, given 1 hour before surgery[1] **Treatment**: 0.1 mg IV x 1[8,13]	• Appears equally effective as ondansetron for PONV prevention and treatment.[1,8] • Side effects include headaches, constipation (especially if given to a patient receiving opioids), and QTc prolongation.[1,8] • Granisetron 0.1 mg IV is a recommended option to treat established PONV in patients who did NOT receive any meds for prevention. Doses between 0.1 mg and 3 mg have been studied, without evidence of dose responsiveness, thus lower doses are recommended.[8,13] • May be the preferred 5-HT3 antagonist option (instead of ondansetron) for patients with a history of delayed PONV due to its longer half-life.[13,23] • CYP3A4 substrate.[13]
Haloperidol Butyrophenone Tablet: ~$0.50 (1 mg) Injection: ~$2.80 (5 mg/1 mL vial)	**Prevention**: 0.5 to <2 mg IM or IV x 1, given at induction or at the end of surgery[8] **Treatment**: 1 mg IV x 1[1]	• Has been given as an alternative to droperidol, and is similarly effective for PONV prevention.[8] • Noninferior to ondansetron for PONV treatment, but is more sedating when given IV.[1,8,14] • Side effects include headache, sedation, dizziness, dry mouth, and EPS. EPS appears to be less common with IV than other routes of administration.[13] • Appears to have a similar risk for QTc prolongation as the 5-HT3 antagonists.[9] QTc prolongation is more likely to occur with IV administration, but is rare at doses lower than 2 mg.[17]

Drug/Drug Class/ Cost[a]	Adult PONV Dosing Regimens	Other Considerations
Metoclopramide Dopamine antagonist Disintegrating tablet: ~$7.50 (5 mg) Injection: ~$1 (10 mg/2 mL vial)	**Prevention**: 10 mg IM or 10 to 25 mg IV x 1, given 15 to 30 minutes before the end of surgery[1,13] 10 to 20 mg IM x 1, given before the end of surgery[13] **Treatment**: 10 mg IV x 1[1]	• Not considered as effective as other PONV options.[8] • Combinations using metoclopramide are not usually more effective than monotherapy.[1] • Weakly effective for PONV prevention at usual doses.[8] A 25 to 50 mg dose is needed to provide similar efficacy to ondansetron.[8] • Side effects include sedation, hypotension (with fast injection), and EPS (more likely with higher doses).[1,10,13] • Dose may need to be adjusted based on renal function.[13] • IV doses should be given over 1 to 2 minutes to prevent feelings of restlessness and anxiety.[10] For IV doses >10 mg, dilute and infuse over at least 15 minutes.[13]
Naloxone, low-dose Opioid receptor antagonist Injection: ~$9.50 (0.4 mg/1 mL vial)	**Prevention**: 0.2 to 0.25 mcg/kg/hr by continuous infusion postoperatively[8,15] 0.001 to 0.061 mcg/kg/hr delivered via patient-controlled analgesia (PCA)[15]	• Continuous infusion route of administration more effective for PONV prevention than when given via PCA.[8,15] • Reduced postoperative nausea and the need for rescue medications, but did not reduce postop vomiting [Evidence Level A-2].[8,15]
Ondansetron 5-HT3 antagonist Tablet: <$1 (4 mg, 8 mg) Disintegrating tablet: <$1 (8 mg) Injection: <$1 (4 mg/2 mL vial)	**Prevention**: 4 mg IV x 1, given at the end of surgery[8] 8 mg disintegrating tablet PO x 1, given 30 minutes before surgery[3] **Treatment**: 4 mg IV x 1[13]	• "Gold standard" antiemetic for prevention and treatment of PONV.[8] • Combo with droperidol seems more effective than either med alone.[22] • Ondansetron 4 mg IV is considered a first-line option to treat established PONV in patients who did NOT receive meds for prevention.[8] • Side effects include headache, diarrhea, and constipation.[13] • Higher doses are more likely to cause QTc prolongation; single doses should not exceed 16 mg.[13] • CYP3A4, CYP2D6, and CYP1A2 substrate.[13]

Drug/Drug Class/ Cost[a]	Adult PONV Dosing Regimens	Other Considerations
Palonosetron 5-HT3 antagonist Injection: ~$15 (0.25 mg/5 mL)	**Prevention**: 0.075 mg IV x 1, given right before induction[8,13]	• More effective than ondansetron or granisetron for PONV prevention and similar effectiveness as aprepitant.[8] • Especially helpful for prolonged PONV prevention (up to 72 hours), due to its long half-life (40 hours).[10] • Low risk for drug interactions, and does not prolong the QTc.[13]
Promethazine Phenothiazine Injection: <$2 (25 mg/mL vial)	**Prevention**: 6.25 mg to 12.5 mg IM (preferred) or IV x 1 (at start of surgery)[8,13] **Treatment**: 6.25 mg to 12.5 mg IM (preferred) or IV x 1[1,8] 12.5 mg to 25 mg IM (preferred) or IV q 4 to 6 hours PRN[10,13]	• Limited evidence for efficacy for prevention of PONV.[8] However, consider for treatment of established PONV, only when other safer alternatives can't be used.[2,8] • Deep IM injection is the preferred route of administration.[10] Subcutaneous administration is contraindicated, and IV injection should be avoided, if possible.[13] If given IV, avoid concentrations >25 mg/mL and avoid administration rates >25 mg/minute.[13] • "Black box" warning about tissue damage, including thrombophlebitis, gangrene, and amputation.[13] • Side effects include sedation and EPS.[13] Anticholinergic.[13] Beers List drug.[13] • CYP2D6 substrate and inhibitor; CYP2B6 substrate.[10,13]
Rolapitant *Varubi* Neurokinin-1 antagonist Tablet: ~$330 (90 mg)	**Prevention**: 90 to 180 mg PO given at induction (doses used in studies: 70 to 200 mg)[8]	• Similar efficacy to ondansetron during the first 24 hours postoperatively, and more effective for PONV prevention during postoperative days two and three.[8] • Half-life of 180 hours.[8,18] • CYP2D6 inhibitor; contraindicated with thioridazine or pimozide.[18] • Rolapitant currently only FDA-approved for prevention of chemo-induced nausea/vomiting.[13]
Scopolamine *Transderm Scop*, generics Anticholinergic Transdermal patch: ~$15 (1 mg/72 hours)	**Prevention**: 1 patch, applied behind the ear two hours before induction or as early as the night before surgery[8,13]	• As effective as ondansetron or droperidol for PONV prevention.[1] • Onset of action is as early as two to four hours after application, and effects last up to 72 hours.[8,13] • Not effective alone as rescue therapy for established PONV.[1] • Sedating.[13] Anticholinergic. Beers List drug. • Remove patch 24 hours after surgery.[13] If not removed prior to discharge, ensure patient counseling for proper removal and disposal.[23]

--Continue to the next section for Non-Pharmacologic Management of PONV—

Non-Pharmacologic Management of PONV

Options listed in alphabetical order; NOT order of preference. Evidence is limited.

Intervention	Adult PONV Dosing Regimens	Therapeutic Considerations
IV hydration Lactated Ringer's (LR), Dextrose 5% in water (D5W)/LR, Normal saline (NS) Crystalloids	**Prevention**: 10 to 30 mL/kg IV infusion[7,8]	• Reduces both early and late PONV.[7,8] • May reduce the need for rescue antiemetics.[7,8] • May be more effective for late onset PONV prevention, than for PONV in first 24 hours following surgery.[19]
Transdermal stimulation *ReliefBand*, etc Transcutaneous electrical acupoint stimulation Cost:[6] ~$100 (*ReliefBand* 50 Hours)	**Prevention**: • Follow product labeling for specific instructions. • Uses conductivity gel.[6] • Usually applied to acupoint P6.[25] • Stimulation level is adjusted per patient tolerability.[25]	• May be covered by insurance.[24] • Reduces risk and severity of PONV and need for rescue antiemetics.[25,26] • Most studies have been done in China, as part of a multimodal antiemetic strategy in patients receiving general anesthesia[25,26] • Side effects may include redness, itching, and swelling at the application site.[26]
70% isopropyl alcohol *Kendall Webcol* prep pad, etc Aromatherapy	**Treatment**: 3 deep inhalations q 5 to 15 minutes PRN, repeated up to 3 times.[4,5] Fold prep pad in half and hold 0.5 inches below patient nares.[4]	• Is thought to act at multiple sites within the chemoreceptor trigger zone.[4] • Fast onset (~10 to 15 minutes), but short-lived.[4.5] • May reduce the use of rescue antiemetics [Evidence Level B-2].[16]

a. Pricing based on wholesale acquisition cost (WAC), for generic when available. Medication pricing by Elsevier, accessed March 2023.

Abbreviations: EPS = extrapyramidal symptoms; IV = intravenous; PO = oral; PONV = postoperative nausea and vomiting; PRN = as needed; QTc = corrected QT-interval.

Users of this resource are cautioned to use their own professional judgment and consult any other necessary or appropriate sources prior to making clinical judgments based on the content of this document. Our editors have researched the information with input from experts, government agencies, and national organizations. Information and internet links in this article were current as of the date of publication.

Levels of Evidence

In accordance with our goal of providing Evidence-Based information, we are citing the **LEVEL OF EVIDENCE** for the clinical recommendations we publish.

Level	Definition	Study Quality
A	Good-quality patient-oriented evidence.*	1. High-quality randomized controlled trial (RCT) 2. Systematic review (SR)/Meta-analysis of RCTs with consistent findings 3. All-or-none study
B	Inconsistent or limited-quality patient-oriented evidence.*	1. Lower-quality RCT 2. SR/Meta-analysis with low-quality clinical trials or of studies with inconsistent findings 3. Cohort study 4. Case control study
C	Consensus; usual practice; expert opinion; disease-oriented evidence (e.g., physiologic or surrogate endpoints); case series for studies of diagnosis, treatment, prevention, or screening.	

***Outcomes that matter to patients** (e.g., morbidity, mortality, symptom improvement, quality of life).

[Adapted from Ebell MH, Siwek J, Weiss BD, et al. Strength of recommendation taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. Am Fam Physician. 2004 Feb 1;69(3):548-56. https://www.aafp.org/pubs/afp/issues/2004/0201/p548.html.]

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