Pediatric Palliative Care Consultant

Pocket Edition

Melissa O’Neill Hunt
Bridget McCrate Protus
Janine Penfield Winters
Diane C. Parker

Guidelines for Effective Management of Symptoms
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ABRIDGED POCKET EDITION

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DISCLAIMER: All clinical recommendations contained herein are intended to assist with determining the appropriate therapy for the patient. Responsibility for final decisions and actions related to care of specific patients shall remain the obligation of the institution, its staff, and the patients attending physicians. Nothing in this document shall be deemed to constitute the providing of medical care or the diagnosis of any medical condition. Use of product brand names are intended to assist the clinician in identifying products and does not connote endorsement or promotion of any kind. No financial support for the development of this book was provided by any product vendor or manufacturer.

Optum Hospice Pharmacy Services

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“Palliative care seeks to enhance quality of life and the child's ability to enjoy life in the face of an ultimately terminal condition. The goal is to add life to the child’s years, not simply years to the child’s life…”

American Academy of Pediatrics

Pediatric Palliative Care Consultant (PPCC) is intended to be a quick reference guide for palliative symptom management in pediatric patients. The authors and collaborators have systematically reviewed and collected the pertinent literature and resources related to pediatric palliative care and compiled the information into concise guidelines for effective management of symptoms. This abridged pocket guide includes chapters on some of the more common symptoms seen in pediatric palliative care. Each chapter focuses on pharmacological treatment options, comprehensive drug tables, and step-by-step algorithms that walk practitioners through patient specific symptom management. This pocket version is meant to provide easy access to information utilized on a regular basis while managing patients in the field. Additional information regarding these symptoms, as well as many other symptoms and disease states can be found in the full edition of the Pediatric Palliative Care Consultant.

This reference was designed to provide practical recommendations and improve symptom management in pediatric patients. It is the hope that this tool will aid all professionals who care for pediatric patients with chronic, life-limiting conditions, whether they have pediatric-specific training or rarely see a pediatric patient.
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GENERAL PEDIATRIC CONSIDERATIONS

**Age Definitions**
- Neonate: < 1 month old
- Pre-term: < 36 weeks gestation
- Term: ≥ 36 weeks gestation
- Infant: < 1 year old
- Child: 1 – 11 years
- Adolescent: 12 – 16 years

**Useful Conversions**
- 2.2 lb = 1 kg
- 1 inch = 2.54 cm
- 1 mL = 20 drops
- 1 teaspoon = 5 mL
- 1 tablespoon = 15 mL

**Useful Equations**

- **Body Surface Area (BSA)**
  \[ BSA (m^2) = \sqrt{\frac{Ht (cm) \times Wt (kg)}{3600}} \]

- **Ideal Body Weight (IBW)**
  \[ IBW (kg) = \frac{Ht (cm) \times 1.65}{1,000} \]

- **Créatinine Clearance**
  \[ CrCl = K \times \frac{Ht}{SCr} \]

- **Schwartz Equation**
  \[ CrCl = \frac{0.413 \times Ht}{SCr} \]

- **Bedside Schwartz**
  \[ CrCl = \frac{0.48 \times Ht}{SCr} \]

**Table 1. Calculation of Fluid Requirements**

<table>
<thead>
<tr>
<th>Body Weight</th>
<th>Fluid Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 10 kg (1-10 kg)</td>
<td>100 mL/kg/day</td>
</tr>
<tr>
<td>Second 10 kg (11-20 kg)</td>
<td>50 mL/kg/day</td>
</tr>
<tr>
<td>Each additional kg (&gt;20 kg)</td>
<td>20 mL/kg/day</td>
</tr>
</tbody>
</table>

**Normal Urine Output**
- Children: 1-2 mL/kg/hr
- Adults: 0.5-1 mL/kg/hr

*Estimate urine output by weighing diapers if needed

**Table 2. K Values for Schwartz CrCl Equation**

<table>
<thead>
<tr>
<th>Age</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low birth weight &lt;1 yoa</td>
<td>0.33</td>
</tr>
<tr>
<td>Full term &lt;1 yoa</td>
<td>0.45</td>
</tr>
<tr>
<td>1-12 yoa</td>
<td>0.55</td>
</tr>
<tr>
<td>13-21 yoa female</td>
<td>0.55</td>
</tr>
<tr>
<td>13-21 yoa male</td>
<td>0.7</td>
</tr>
</tbody>
</table>
Table 3. Mean Expected Pediatric Values

<table>
<thead>
<tr>
<th>Age Range</th>
<th>BP (mmHg)</th>
<th>HR (bpm)</th>
<th>RR (breaths/min)</th>
<th>TBW (%)</th>
<th>SCr (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Systolic</td>
<td>Diastolic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonate</td>
<td>85 – 100</td>
<td>51 – 65</td>
<td>145</td>
<td>30-60</td>
<td>74</td>
</tr>
<tr>
<td>Infant</td>
<td>87 – 105</td>
<td>53 – 66</td>
<td>115</td>
<td>25-50</td>
<td>60</td>
</tr>
<tr>
<td>Toddler</td>
<td>95 – 105</td>
<td>53 – 66</td>
<td>104</td>
<td>20-30</td>
<td>59</td>
</tr>
<tr>
<td>School Age</td>
<td>97 – 112</td>
<td>57 – 71</td>
<td>83</td>
<td>16-24</td>
<td>-</td>
</tr>
<tr>
<td>Adolescent</td>
<td>112 – 128</td>
<td>66 – 80</td>
<td>70</td>
<td>15-20</td>
<td>-</td>
</tr>
<tr>
<td>Adult</td>
<td>120</td>
<td>80</td>
<td>-</td>
<td>12-18</td>
<td>55</td>
</tr>
</tbody>
</table>

BP = blood pressure; HR = heart rate; RR = respiratory rate; TBW = total body water; SCr = serum creatinine

Table 4. Developmental Alterations in Intestinal Drug Absorption

<table>
<thead>
<tr>
<th>Functional Alteration</th>
<th>Neonates</th>
<th>Infants</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric acid secretion</td>
<td>Reduced (pH &gt;5)</td>
<td>Adult (pH 2-4)</td>
<td>Adult (pH 2-3)</td>
</tr>
<tr>
<td>Gastric emptying time</td>
<td>Variable</td>
<td>Prolonged</td>
<td>Prolonged slightly</td>
</tr>
<tr>
<td>Intestinal motility</td>
<td>Slower</td>
<td>Increased</td>
<td>Normal</td>
</tr>
<tr>
<td>Intestinal surface area</td>
<td>Reduced</td>
<td>Near adult</td>
<td>Adult pattern</td>
</tr>
<tr>
<td>Biliary function</td>
<td>Immature</td>
<td>Near adult</td>
<td>Adult pattern</td>
</tr>
<tr>
<td>Microbial colonization</td>
<td>Acquiring</td>
<td>Near adult</td>
<td>Adult pattern</td>
</tr>
</tbody>
</table>

Pharmacokinetics

- Each patient’s diagnosis will affect their pharmacokinetic characteristics. Monitor for signs of toxicity as patient’s organ function declines.
- Pharmacokinetic parameters are difficult to predict in premature infants. Dose cautiously and observe closely for response.

Absorption

- Generally slower absorption in infants; Reaches adult values at 6 months of age.
  - Neonates have less gastric acid production and less GI surface area
    - Reflux most common within 30-45 minutes of oral dose
    - Skin permeation for topical route may be variable

Distribution

- Fat, water, and muscle distribution may not be proportional to body weight
  - Hydration can vary significantly throughout the day and with illness
  - Body fat increases during gestation and infancy
  - Blood-brain barrier underdeveloped in infants which may allow for easier penetration
GENERAL PEDIATRIC CONSIDERATIONS

Metabolism
- May exceed adult values for some medications, especially early childhood
  - Dosing per body weight may seem high compared to adult dosing
  - Confirm maximum initial dosing in pediatric drug reference
  - Infants: Half-life increased, clearance decreased
  - Children: Half-life decreased, clearance increased

Elimination
- Glomerular filtration rate (GFR) increases with gestational age
  - Near adult values at 12-24 months

References
Oral or Sublingual Administration

- Consider concentration of liquid medications to ensure a measurable dose and appropriate volume for child’s age and swallowing ability.
  - 5 mL or less for children less than 5 years of age
  - 5-10 mL or less for children greater than 5 years of age
  - 1-2 mL or less for sublingual administration

Table 1. Oral Dosage Forms and Possible Manipulations

<table>
<thead>
<tr>
<th>Dosage Form</th>
<th>Possible Manipulations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple compressed tablets (sugar or film coated, immediate release)</td>
<td>Can be crushed and mixed with soft food or liquids</td>
</tr>
<tr>
<td>Simple powder filled capsules (immediate release)</td>
<td>Can be opened and mixed with soft food or liquids</td>
</tr>
<tr>
<td>Enteric coated tablets</td>
<td>Do not crush or chew</td>
</tr>
<tr>
<td>Extended, sustained, or delayed release tablets</td>
<td>Do not crush or chew</td>
</tr>
<tr>
<td>Extended, sustained, or delayed release capsules</td>
<td>Can be opened and mixed with specific food or liquids. Individual pellets should not be crushed or chewed</td>
</tr>
<tr>
<td>Gel capsules</td>
<td>Pierce with a needle and mix with soft food or liquids</td>
</tr>
<tr>
<td>Orally disintegrating tablets</td>
<td>Can often be dissolved in water</td>
</tr>
</tbody>
</table>

*Always consult a pharmacist prior to manipulating a medication formulation. Oral chemotherapy agents require special handling precautions.

- Dosing cups – for older children who can drink from a cup
  - Multiple sizes available from 5-30 mL. Recommend using only if cup contains a graduation for the dose being measured, usually 2.5-5 mL increments.
  - Rinse with water prior to use to prevent medication from adhering to cup.
  - Pacifier caps can also be used with dosing cups to allow administration to infants. Small volumes should not be measured in a dosing cup.

- Measuring spoons – for children able to sip or drink from a spoon
  - Use only calibrated measuring spoons. Never use household spoons.

- Oral syringes – for infants and younger children or for bad tasting medication
  - Multiple sizes available ranging from 0.3 mL to 60 mL. Ensure that syringe has graduations appropriate for the volume being measured. For example, a 0.3 mL syringe can be used to measure 0.1 mL of medication.
  - Gently administer medication alongside the child’s cheek.
  - May split larger doses and administer half in each cheek.
  - May help bypass the taste-buds for medications with poor palatability.
  - Medicine droppers for infants: small volumes available in from 1 mL to 5 mL
Table 2. Excipient Considerations

<table>
<thead>
<tr>
<th>Excipient</th>
<th>Side Effects</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| Benzyl alcohol             | Intraventricular hemorrhage, metabolic acidosis, seizures, gasping, and increased mortality | • Acceptable daily limit: 5 mg/kg/day  
• Toxicity threshold: 99 mg/kg/day  
• Present in oral solutions and elixirs of dexamethasone |
| Ethanol                    | CNS depression, altered mental status, synergistic CNS depression depending on active ingredient | • Often found in elixirs and tinctures  
• May cause a disulfiram-like effect (severe nausea/vomiting) in patients taking metronIDAZOLE  
• Present in oral solutions of hyoscyamine |
| Propylene glycol           | Lactic acidosis, seizures, hemolysis, CNS/respiratory depression, hyperosmolality, arrhythmias, hypotension, contact dermatitis | • Adult acceptable limit: 25 mg/kg/day  
• Adult toxicity: 3,000 mg/kg/day  
• Present in LORazepam oral solution and glycopyrrolole oral solution |
| Aspartame/phenylalanine    | Headache, seizures, anecdotal reports of panic attack, mood changes, hallucinations, dizziness | • Avoid in patients with phenylketonuria or pregnant women carry a fetus with phenylkenouria  
• Children safe threshold: 10 mg/kg/day |
| Benzalkonium chloride      | Bronchoconstriction, cough, burning sensation, facial flushing, pruritus        | • In albuterol nebulizer solutions  
• Bronchoconstriction is inhibited by concurrent administration with a beta-2-agonist |
| Lactose                    | Diarrhea, abdominal cramping, bloating, flatulence, bronchospasm                | • Symptoms occur in infants, children, and adults with lactase deficiency and infants with galactose intolerance  
• Commonly found in infant formulas, tablets, capsules, liquids and dry powder inhalers |
| Sulfites                   | Wheezing, dyspnea, chest tightness                                            | • Reactions most common in patients with asthma  
• Many anti-asthmatic medications containing sulfites have been reformulated |
| Sorbitol                   | Diarrhea, malabsorption                                                       | • Found as a sweetener in many liquid formulations |
| Saccharin                  | Cross-sensitivity with sulfonamides                                           | • Not included in drug labeling  
• Avoid in children with sulfa allergy |
| Coloring agents            | Abdominal pain, vomiting, indigestion, hives, photosensitivity, contact dermatitis | • Possible side-effects depend on the dyes present  
• Links to hyperactivity in children have not been confirmed |
Recommended Sublingual Administration Technique

1. Tablets can be wetted or crushed and mixed with 1-2 mL of water.
   - Avoid volumes >2 mL; liquid will likely leak out of the sublingual cavity.
2. Allow 5-10 minutes between SL doses or before eating or drinking to prolong drug exposure and promote absorption.
3. Do not crush enteric-coated or controlled-release tablets for SL administration. Only immediate release preparations should be utilized for SL administration.
4. Repeated instillations of alcoholic (elixirs) or glycol agents (parenteral drugs) can be irritating to the oral mucosa.

Table 3. Common Hospice Medications that can be given Sublingually

<table>
<thead>
<tr>
<th>Anticholinergics</th>
<th>Antiemetics</th>
<th>Antipsychotics</th>
<th>Benzodiazepines</th>
<th>Opioids</th>
</tr>
</thead>
<tbody>
<tr>
<td>atropine</td>
<td>promethazine</td>
<td>chlorproMAZINE</td>
<td>ALPRAZolam</td>
<td>HYDROMorphone</td>
</tr>
<tr>
<td>(Isopto Atropine®)</td>
<td>(Phenergan®)</td>
<td>(Thorazine®)</td>
<td>(Xanax®)</td>
<td>(Dilaudid®)</td>
</tr>
<tr>
<td>hyoscyamine</td>
<td>haloperidol</td>
<td>clonazePAM</td>
<td>methadone</td>
<td></td>
</tr>
<tr>
<td>(Levsin®)</td>
<td>(Haldol®)</td>
<td>(KlonopIN®)</td>
<td>(Dolophine®)</td>
<td></td>
</tr>
<tr>
<td>diazepam</td>
<td></td>
<td></td>
<td>morphine*</td>
<td></td>
</tr>
<tr>
<td>(Valium®)</td>
<td></td>
<td></td>
<td>(Roxanol®)</td>
<td></td>
</tr>
<tr>
<td>LORazepam</td>
<td></td>
<td></td>
<td>oxyCODONE</td>
<td></td>
</tr>
<tr>
<td>(Ativan®)</td>
<td></td>
<td></td>
<td>(Roxicodone®)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>fentaNYL</td>
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</tr>
</tbody>
</table>

*While morphine (Roxanol®) is administered sublingually, sublingual absorption is <20% with most of the drug in liquid form trickling down the esophagus for oral absorption.

- Commercially-available liquids, compounded liquids, or solid dosage forms that are crushed can be flavored. Choose flavors that help mask bitterness and are most acceptable to the patient. Many pharmacies provide flavoring of liquid medications at no charge or minimal cost.
  - From birth to teenage years, children have a greater preference for salty, sour, and especially sweet tastes compared to adults. Infants may be more sensitive to bitter tastes.
- Liquid medications or crushed solid medications can be added to a food or drink.
  - Always check with a pharmacist to ensure that mixing with food or drink will not decrease effectiveness.
  - Do not add medication to a substance that the child relies on for basic nutrition (milk, formula, etc.); the child may refuse as a result of altered taste.
  - Add medication to small amounts of liquid or food to ensure the child receives the entire dose.
- Use a taste-masking spray. These are water-based lubricants flavored to mask medicine taste and sprayed in the mouth just prior to taking medications.
• Give an ice cube or Popsicle® to numb taste buds prior. Give lollipop or Popsicle® to mask taste after.
• Chill medications to mask flavor. Many liquid antibiotics require refrigeration after reconstitution for stability purposes; in addition to palatability. Consult a pharmacist to ensure that temperature changes or administration with food will not affect the effectiveness of the medication.
• Mix medication in ice cream or cold pudding.
• Pinch nose while taking medications to prevent odor influence on taste.
• Administer medication to cheek with an oral syringe to bypass the taste buds.
• Have older children drink medication through a straw.

Gastrostomy Tube Administration
• Consider multiple factors prior to administering a medication through a gastrostomy tube including:
  o Length of the patient’s functional bowel: decreased length of functional bowel can decrease drug absorption.
  o Tube composition: silicone tubes clog more often than polyurethane tubes.
  o Tube internal diameter and distal tip diameter: tube diameters are measured in French units (1 French unit = 0.33 mm) and are designated as small-bore (5-12 French) or large-bore (≥ 14 French). Most feeding tubes are small-bore and likely to clog with drugs or thick formulas.
  o Location of the distal end of the feeding tube relative to site of drug absorption
    ▪ Stomach is the most tolerant of medications and enteral formulas.
    ▪ Duodenum or jejunum preferred in patients with pancreatitis, gastroparesis, severe reflux, high gastric residual volumes, or aspiration.
  o Drug formulation and excipients
  o Routine flushing regimen
    ▪ To prevent tube clogging and ensure medication delivery, flush tubes after starting and stopping enteral nutrition, and between each medication administration.
    ▪ Routine flushes every 4 hours are only recommended for nasojejunal tubes in children (1-3 mL for neonates and 3-5 mL for infants/children).
  o Drug interactions with enteral nutrition formula
    ▪ Consult a pharmacist to determine medications that should be separated from enteral nutrition to prevent decreased absorption or that may interact with enteral nutrition.
  o Size of the oral or enteric syringe needed for accurate dosing and safe intraluminal pressures
    ▪ Ensure the syringe used has an appropriate volume and graduations for accurate measurement of the prescribed dose.
    ▪ Excessive intraluminal pressure can cause the feeding tube to rupture and break. Use caution especially when attempting to unclog a clogged tube.
Do not add medications directly to enteral nutrition products for administration. Hold enteral feedings before and after medication administration.

Crushing multiple solid medications or mixing multiple liquid medications increases risk of drug interactions and changes drug mixture compatibility and stability.

Medications that should not be administered through feeding tubes include:

- Enteric-coated, film-coated tablets: may clump in water and clog tubes
- Extended-release, delayed-release, or sustained-release: destroys the delivery mechanism and may cause overdose
- Buccal or sublingual preparations: not designed for absorption in the GI tract
- Carcinogenic, teratogenic, or cytotoxic medications: aerosolized particles may harm caregiver
- Injectable medications: formulated for specific physiology of the blood

Liquid medication considerations:

- Elixirs or suspensions are preferred over syrups which are more likely to cause clumping when exposed to enteral nutrition.
- Dilute hyperosmolar or hypertonic liquids to prevent osmotic diarrhea, bloating, nausea, or cramping.

### Recommended Gastrostomy Tube Administration Technique

1. Stop continuous tube feedings 15 minutes prior to medication administration and restart feedings 15 minutes after administration.
   - Hold feedings for more than 30 minutes only if the medication requires longer separation to avoid drug-nutrition interactions (e.g., phenytoin).
   - If using bolus gastric feedings, then administer medications between feedings.
2. Flush the tube with an appropriate volume of sterile water after feedings are stopped, between each medication, and before feedings are restarted.
   - Flushing volume (1-15 mL) dependent on patient’s age, fluid status, and tube size.
3. Crush solid medications into a fine powder using a mortar and pestle and dilute in 15-30 mL of sterile water before delivery into the tube.
4. Dilute liquid medications, especially highly concentrated or viscous liquids, with 10-30 mL of sterile water before delivery into the tube.
   - Dilution volume should be at least a 50:50 dilution.

### Rectal Administration

- Rectal medication administration should be avoided in premature infants, immunocompromised patients (e.g. oncology), patients with active rectal bleeding or thrombocytopenia, rectal trauma, acute exacerbations of inflammatory bowel disease, diarrhea, paralytic ileus, colonic obstruction, recent gastrointestinal or gynecological surgery, and in situations where abuse is suspected.
- Cut suppositories in half length-wise if necessary.
Recommended Rectal Administration Technique

1. Lubricate medications or devices with water-based lubricant prior to insertion.
2. Position child on his/her side with knees bent and drawn up toward the abdomen.
3. Insert medication as recommended per manufacturer directions, if known.
   - Insert ½-1 inch past the rectal sphincter for infants.
   - Insert 1 inch past the rectal sphincter for adults.\(^\text{17}\)

### Tablets/Capsules
- Administer oral dosage forms rectally as whole tablets, or crush and mix in water. Do not crush enteric-coated or controlled-release tablets.
- Ensure that the fluid volume is appropriate for the child’s age and size.
  - Younger children—Instill 1- 5 mL of warm water
  - Older children/adults—Instill 5 - 10 mL of warm water
- Ensure that insertion depth is appropriate for child’s age and size.
  - Infants—Insert ½ - 1 inch past the rectal sphincter
  - Adults—Insert 1 inch past the rectal sphincter

### Liquids
- Administer oral liquids rectally if dose can be given in an appropriate volume.
- Limit liquid drug volumes based on patient size. Max volume 60-80 mL to prevent spontaneous expulsion; Enema volumes for children:
  - 2 - 6 years: 180 mL (6 oz)
  - 6 - 12 years: 360 mL (12 oz)
  - Adolescents/adults: 480 mL (16 oz)

### Table 4. Common Hospice Medications that can be given Rectally\(^\text{19-21}\)

<table>
<thead>
<tr>
<th>Analgesics</th>
<th>Anticonvulsants</th>
<th>Antiemetics</th>
<th>Antipsychotics</th>
<th>Benzodiazepines</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetaminophen</td>
<td>carBAMazepine</td>
<td>metoclopramide</td>
<td>chlorproMAZINE</td>
<td>ALPRAZolam clonazePAM</td>
</tr>
<tr>
<td>HYDROMorphone</td>
<td>PHENobarbital</td>
<td>prochlorperazine</td>
<td>haloperidol</td>
<td>diazepam LORazepam</td>
</tr>
<tr>
<td>ibuprofen</td>
<td>valproic acid</td>
<td>promethazine</td>
<td></td>
<td>midazolam</td>
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<tr>
<td>methadone</td>
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<tr>
<td>morphine</td>
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<tr>
<td>naproxen</td>
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<tr>
<td>oxyCODONE</td>
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</tbody>
</table>

### Inhaled Medication Administration\(^\text{23}\)
- **Mouthpieces** – Preferred interface for use with nebulizers or MDIs. Seal mouth around mouthpiece.
- **Masks** – Preferred interface if a mouthpiece cannot be used.
  - Use child-sized mask to ensure minimal leakage and prevent aerosol from reaching the eyes. Avoid use with inhaled steroids due to face and contact.
- **Hoods** – Preferred in infants who have significant distress with use of a mask or if an adequate mask-to-face seal cannot be achieved due to squirming or crying.\(^\text{24}\)
• Spacers – Decreases the velocity of medication droplets and creates droplets of a smaller size that travel more easily and deeper into the lungs.
• Valved holding chamber – Interface for MDI or poor hand-breath coordination.
  o Use with masks for children who cannot form a seal around the mouthpiece.
  o Similar to a spacer, however a one-way valve prevents patient from breathing out into the chamber and disturbing the held medication.
• Administer bronchodilators first to open airways, allowing better lung penetration.

Table 5. Age Guidelines for Use of Aerosol Delivery Device Types

<table>
<thead>
<tr>
<th>Aerosol Device and Interface</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-volume nebulizer with mask or hood</td>
<td>0-1 yoa</td>
</tr>
<tr>
<td>Small-volume nebulizer with mask</td>
<td>≤ 3 yoa</td>
</tr>
<tr>
<td>Small-volume nebulizer with mouthpiece</td>
<td>≥ 3 yoa</td>
</tr>
<tr>
<td>Pressurized MDI with valved holding chamber/spacer and mask</td>
<td>&lt; 4 yoa</td>
</tr>
<tr>
<td>Pressurized MDI with valved holding chamber/spacer</td>
<td>≥ 4 yoa</td>
</tr>
<tr>
<td>Dry powder inhaler</td>
<td>≥ 4 yoa</td>
</tr>
<tr>
<td>Breath-actuated MDI</td>
<td>≥ 5 yoa</td>
</tr>
<tr>
<td>Breath-actuated nebulizer</td>
<td>≥ 5 yoa</td>
</tr>
</tbody>
</table>

Nasal Medication Administration
• The nasal cavity can only hold a small volume of approximately 0.1 mL per nare, therefore a concentrated solution may be needed to achieve an adequate dose. Divide dose and deliver half in each nare.
• Atomizing medications provides a thin layer of medication to the nasal mucosa preventing medication drainage to the oropharynx and therefore allows for better absorption than nasal drops.
• Irritation of the nasal mucosa may occur if the solution is more basic or acidic than typical nasal secretions, pH 5 to 7, or if the solution is not isotonic.
• Prior to administering any medication nasally, clear mucus or blood from nostrils that may reduce medication contact with mucosal surface.
• After nasal administration, avoid blowing nose to reduce medication loss.

Recommended Nasal Administration Technique: Bulb Syringe Use
1. Position child on back; consider swaddling to assist with holding the child still.
2. Before inserting the bulb syringe into the nostril, depress the bulb to expel air.
3. Place the tip of the bulb syringe into the nostril until sealed. Occlude other nostril.
4. Slowly release bulb to provide suction of mucus from the nose.
5. Remove bulb syringe from nostril and squeeze mucus into a tissue.
6. Repeat suctioning of opposite nostril if necessary.
Recommended Nasal Administration Technique: Spray bottles, Multi-Dose Counting Bottles, and Unit-Dose Devices

1. Prime or shake medication as directed.
2. Keep head and bottle in the upright position (some unit-dose devices may not need to remain upright and allow for alternative head positioning).
3. Insert applicator tip into the nostril and close off opposite nostril.
4. While breathing in through nose, activate medication spray.
5. Repeat in opposite nostril if necessary.

Recommended Nasal Administration Technique: Medicine Dropper and Standard Syringe with Nasal Atomizer

1. Prepare appropriate dose of medication in the dropper or syringe.
2. Position patient in one of the following positions (if using an atomizer or drops for seizure, administer medication regardless of positioning)
   - Lying head back – Lying in supine position with head just off the bed in hyperextension.
   - Lateral head low – Lying on the side with side of the head resting on the bed. Administer medication in the lower nostril.
   - Head down and forward – Kneeling down with top of the head on the ground with the forehead close to the knees and nostrils facing up.
3. Insert applicator tip into the nostril and administer medication.
4. Repeat in opposite nostril if necessary.

Topical Medication Administration

- Absorption of topically applied medications depends on several factors including
  - Site of application: areas of thicker skin, decreased blood circulation, or decreased subcutaneous fat may decrease drug absorption.
  - Thickness and integrity of the skin: skin thickness varies with age, typically thinner in children, increasing absorption, as well as risk of toxicity.
  - Blood flow to the skin and body temperature: varies with age and is often increased in children which may increase absorption and risk of toxicity. At the end of life, blood flow may decrease.
  - Drug characteristics: low molecular weight or if lipophilic, increases absorption
- Instruct caregivers to wear gloves when applying creams, ointments, or gels.
- Do not apply creams, ointments, or gels to broken skin or cover with diapers.
- Do not cut patches or manipulate in any way unless directed by physician.
- Avoid contact with heat sources near area where patches are applied.
- Ensure proper disposal of patches. Fold fentaNYL patches with adhesive together and flush in toilet.
References


3. Arvedson JC. Swallowing and feeding in infants and young children. GI Motility online 2006; doi:10.1038/gimo17.


13. Lexicomp Online [Internet]. Hudson, OH: Lexi-Comp, Inc. [cited 2013 September 5].


PediGEMS
Guidelines for Effective Management of Symptoms

- Constipation
- Dyspnea
- Nausea & Vomiting
- Pain
  - Somatic Pain
  - Visceral Pain
  - Bone Pain
  - Neuropathic Pain
  - Methadone
- Secretions
- Seizures
- Spasticity
Non-Pharmacological Treatment

- The establishment of a regular bowel routine should be supported by providing access to a toilet with privacy, especially after meals.
- Encourage increased activity when appropriate. This can be facilitated with physical therapy or a child life specialist.
- Increase fluid intake of the child’s favorite drinks. (Children less than six months of age should not be given free water or fruit juices.)
- Increase dietary fiber from sources such as:
  - Whole-grain cereals
  - Fruits: apples, dates, figs, peaches, pears, plums, prunes, or raisins
  - Vegetables: beans, broccoli, cabbage, carrots, cauliflower, celery
  - Fruit juices: apple, pear, or prune juice
  - Power pudding: blend 1 cup prune juice, 1 cup bran cereal, and 1 cup applesauce; administer 1-2 tablespoons daily and titrate as needed; refrigerate up to one week.\textsuperscript{14}
  - Fruit paste: Boil 1 lb prunes, 1 lb raisins, 1 lb figs, and 16 oz brewed senna tea for 5 minutes, then add 1 cup brown sugar and 1 cup lemon juice and mix to form paste; freeze and serve 1-3 teaspoons daily and titrate as needed.\textsuperscript{12}
- Consider abdominal massage in a clockwise fashion. Warm hands placed on the stomach tend to increase abdominal relaxation.
- Self-hypnosis, biofeedback, and cognitive-behavioral therapy may be effective in children with neurogenic bowel.
- In infants, rectal stimulation may be successful. Dietary changes, such as a small amount of fruit juice, may be adequate.

Pharmacotherapy

- The goal of pharmacotherapy should be focused on preventing constipation, where possible, and treating patients who have already become constipated to avoid impact on quality of life.
- Stool softeners and/or stimulant laxatives should be initiated to prevent constipation when patients are started on opioids.
- Daily maintenance therapy for pediatric patients should be initiated with an osmotic laxative, such as polyethylene glycol (PEG, Miralax). Ensure adequate fluid intake for maximum benefit and safety. PEG is considered the first-line osmotic therapy, as it has been reported superior to other osmotic agents in palatability and acceptance by children, but requires administration with 4-8 ounces of liquid.\textsuperscript{15-23}
- Second-line osmotic agents, magnesium hydroxide, lactulose, and sorbitol, seem to be equally efficacious; therefore, choice is based on safety, cost, the
child’s preference, ease of administration, and the practitioner’s experience. Although, if PEG is ineffective, a stimulant is often used, rather than trying another osmotic agent.

- Osmotic laxatives may not be beneficial in patients with neuromuscular conditions or opioids-induced constipation. In these cases stimulant laxatives may be necessary. Senna would be considered first-line stimulant due to the risk of cramping with bisacodyl.
- In the patient with chronic illness, stimulant laxatives may be necessary intermittently. However, prolonged use of these agents may lead to dependency, fluid and electrolyte imbalances, or vitamin and mineral deficiencies. In the hospice patient, senna (+/- docusate) is the preferred agent for opioid-induced constipation.
- Stimulants and enemas should be avoided in infants. Glycerin suppositories and dietary changes should be first line in infants.
- Suppositories and enemas should be used with caution in neutropenic or thrombocytopenic patients.
- Certain enemas may be toxic to children. Phosphate enemas may lead to hyperphosphatemia. Soapsuds enemas can lead to perforation and bowel necrosis. Tap water enemas can cause hyponatremia.
- Fecal disimpaction may be necessary before initiating maintenance therapy for constipation.
  - Rectal stimulation may be adequate to stimulate disimpaction, especially in infants or patients with neurologic deficit.
  - Glycerin suppositories in infants and bisacodyl suppositories in older children have shown efficacy for rectal disimpaction.
  - Suppositories help to soften and lubricate the fecal mass and allow for easier evacuation.
  - If suppositories are inadequate, rectal disimpaction may be performed with phosphate soda enemas, saline enemas, or mineral oil enemas followed by a phosphate enema.
  - PEG has been successful for oral disimpaction. Oral mineral oil should be avoided due to risk of aspiration.
  - High-dose magnesium hydroxide, magnesium citrate, lactulose, sorbitol, senna, and bisacodyl have also shown success in oral disimpaction.

Clinical Pearls
- Patients receiving more than one opioid dose per day should have corresponding orders for medications to prevent opioid-induced constipation.
  - An osmotic laxative or stool softener should be scheduled and, if ineffective, a stimulant should be added. While osmotic laxatives
may be adequate in healthy children, hospice patients often require a stimulant laxative initially.
  - Stool softeners provide the “mush,” but without the “push” of a stimulant the “mush” may not leave the colon.
  - For high impactions, give 2-3 “Vaseline Balls” orally instead of mineral oil.
    - “Vaseline Balls” – pea sized frozen balls of white petrolatum rolled in powder sugar or powered hot chocolate mix.
  - In infants, sweet syrup can be made using 2 tablespoons of brown sugar in 4 oz warm water. Dry brown sugar is less likely to contain organisms that might be found in a concentrated sugar liquid.
  - While PEG has a multitude of safety and efficacy data in children, it can be difficult to find the appropriate dose. Patients may complain of a “seesaw” effect, where the dose is either supratherapeutic or subtherapeutic and then the opposite after dosage adjustment. It’s availability over the counter may allow easy accessibility, but limit coverage by third party payers.
  - The gastrointestinal (GI) tract is a neurologic organ. Therefore, bowel motility issues are common in patients with neurologic disease.
  - Laxatives are contraindicated in patients with complete bowel obstruction (see Bowel Obstruction PediGEMS). Softening the stool may be acceptable in cases of partial obstruction.

Table 1. Pharmacological Management of Constipation

<table>
<thead>
<tr>
<th>Medication &amp; Age Guide*</th>
<th>Typical Starting Dose**</th>
<th>Routes</th>
<th>Pediatric Formulation Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stool Softeners</strong></td>
<td></td>
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<tr>
<td>docusate (Colace)</td>
<td>PO: 5 mg/kg/day div q6h-QD</td>
<td></td>
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<tr>
<td></td>
<td>&lt;3 yoa: 10-40 mg/day div q6h-QD</td>
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<td>3-6 yoa: 20-60 mg/day div q6h-QD</td>
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<tr>
<td></td>
<td>6-12 yoa: 40-150 mg/day div q6-QD</td>
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<tr>
<td></td>
<td>&gt;12 yoa: 50-400 mg/day div q6-QD</td>
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<tr>
<td></td>
<td>PR: &gt;12 yoa: add 50-100 mg of docusate liquid to NS or water</td>
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<tr>
<td></td>
<td>PO PR</td>
<td>Liquid: 50 mg/5 mL</td>
<td>Caps: 50, 100, 240, 250 mg</td>
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<td></td>
<td></td>
<td>Soln, enema: 283 mg/5 mL</td>
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<tr>
<td></td>
<td></td>
<td>• Enemeez Plus contains benzocaine</td>
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<td></td>
<td></td>
<td>• Administer liquid with milk, fruit juice, or infant formula to mask taste</td>
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</tbody>
</table>

- Option for patients who should avoid straining during defecation
- Must be used with adequate fluid intake to maximize benefit and safety
- Avoid using with mineral oil
- SE: abdominal cramping, nausea, diarrhea, intestinal obstruction

Continued
## PediGEMS

### CONSTIPATION

<table>
<thead>
<tr>
<th>Medication &amp; Age Guide*</th>
<th>Typical Starting Dose**</th>
<th>Routes</th>
<th>Pediatric Formulation Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>glycerin</strong></td>
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</table>
| <6 yoa: 1 infant suppository BID prn OR 2-5 mL of rectal solution as an enema | **PR** | Supp: 1, 1.5, 2 g, 82.5% Soln, PR: 2.3 g/2.3 mL, 5.6 g/5.5 mL | • Suppository tip or chip can be used  
  • Retain in rectum for 15 minutes |
| >6 yoa: 1 adult suppository BID prn OR 5-15 mL of rectal solution as an enema | | | |
| **Stimulant Laxatives** |                         |        |                                       |
| **bisacodyl**  
  (Dulcolax) | PO:  
  3-12 yoa: 5-10 mg  
  or 0.3 mg/kg q24h  
  >12 yoa: 5-15 mg/day; Max: 30 mg  
  PR:  
  <2 yoa: 5 mg/day  
  2-11 yoa: 5-10 mg/day  
  >12 yoa: 10 mg/day | **PO**  
  PR | Tab: 5, 10 mg  
  Tab, EC, DR: 5 mg  
  Supp: 10 mg  
  Soln, enema: 10 mg/30 mL |
| | | | • Do not crush or chew EC tablets |
| **docusate and senna**  
  (Senokot-S) | 2-6 yoa: ¾ tab qHS, Max: 1 tab BID  
  6-12 yoa: 1 tab qHS, Max: 2 tabs BID  
  >12 yoa: 2 tabs qHS, Max: 4 tabs BID | **PO** | Tab: 50 mg docusate sodium and 8.6 mg sennosides |

- Penetrates and softens stools  
- Promotes bilirubin excretion by reducing enterohepatic circulation in newborns  
- Can stimulate passage of meconium  
- SE: abdominal pain, rectal irritation  

**Continued**
## Constipation

### PediGEMS Medication 

<table>
<thead>
<tr>
<th>Medication &amp; Age Guide*</th>
<th>Typical Starting Dose**</th>
<th>Routes</th>
<th>Pediatric Formulation Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>senna</strong> (Senokot)</td>
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</tbody>
</table>
| Tablet ≥ 2 yoa         | **1 mon-2 yoa**: 2.2-4.4 mg sennosides (1.25-2.5 mL) QHS, **Max**: 5 mL/day  
|                        | **2-6 yoa**: 4.4-6.6 mg sennosides (2.5-3.75 mL, ¼ tab) QHS, **Max**: 3.75 mL or 1 tab BID  
|                        | **6-11 yoa**: 8.8-13.2 mg sennosides (5-7.5 mL, 1 tab) QHS, **Max**: 7.5 mL or 2 tabs BID  
|                        | ≥12 yoa: 17.6-26.4 mg sennosides (10-15 mL, 2 tabs) QHS, **Max**: 15 mL or 4 tabs BID | PO     | Syrup: 8.8 mg/5 mL  
|                        |                         | PR     | Liquid, conc: 33.3 mg/mL  
|                        |                         |        | Drops: 8.8 mg/mL  
|                        |                         |        | Strips, ODT: 8.6 mg  
|                        |                         |        | Tab, chewable: 10, 15 mg  
|                        |                         |        | Tab: 8.6, 15, 25 mg  
|                        |                         |        | • Liquid products may contain propylene glycol or sodium benzoate  
|                        |                         |        | • Preferred for opioid-induced constipation  
|                        |                         |        | • Drink plenty of fluids; Syrup can be taken with juice, milk, or mixed with ice cream to mask taste  
|                        |                         |        | • SE (mild): abdominal pain, nausea, vomiting, diarrhea, may discolor urine (red/brown) or feces  

### Osmotic Laxatives

| lactulose (Generlac)  | <18 yoa: 0.7-2 g/kg/day (1-3 mL/kg/day) in divided doses  
|                       | Adult: 10-20 g (15-30 mL) QD  
|                       | **Max**: 40 g/day (60 mL/day) | PO     | Soln, PO, PR: 10 g/15 mL  
|                       | Crystals for soln, PO: 10 g/packet, 20 g/packet  
|                       | • As retention enema: mix with H₂O or NS & use a rectal balloon catheter – retain for 30-60 min |        | • Contraindicated if on galactose-restricted diet  
|                       | • Infants may develop hyponatremia and dehydration  
|                       | • SE: abdominal pain, bloating, nausea, diarrhea  

| magnesium citrate (Citroma) | <6 yoa: 2-4 mL/kg  
|                            | 6-12 yoa: 100-150 mL  
|                            | >12 yoa: 150-300 mL  
|                            | • Dosed daily or in divided doses | PO     | Solution: 290 mg/5 mL  
|                            | • Monitor magnesium levels in patients with a CrCl <25 mL/min  
|                            | • SE: abdominal cramps, diarrhea, gas, hypermagnesemia, hypotension, or respiratory depression  

*Continued*
<table>
<thead>
<tr>
<th>Medication &amp; Age Guide*</th>
<th>Typical Starting Dose**</th>
<th>Routes</th>
<th>Pediatric Formulation Considerations</th>
</tr>
</thead>
</table>
| magnesium hydroxide (Milk of Magnesia) | <2 yoa: 0.5 mL/kg/dose  
2-5 yoa: 311-622 mg (5-15 mL)  
6-11 yoa: 933-1244 mg (15-30 mL)  
>12 yoa: 1866-2488 mg (30-60 mL)  
• Dosed QHS or in divided doses  
• Based on 400 mg/5 mL conc | PO | Susp: 400 mg/5 mL  
Susp, conc: 800 mg/5 mL  
Tab, chewable: 311, 400 mg  
• Mix solution with glass of H₂O and administer on an empty stomach  
• Administer tablet with a glass of H₂O |
| polyethylene glycol 3350 (MiraLAX) | >6 mon: 0.5-1.5 g/kg/day, NTE 17 g/day  
Adult: 17 g (1 heaping tbsp) QD  
• Difficult to establish patient dose | PO | Powder for soln: 17 g/dose, 17 g/packet  
• Dose can be measured using bottle cap & added to 4-8 ounces of liquid  
• For ease of measuring: 1 tsp=5.5 g |
| sodium phosphates (Fleet Enema) | PO: 5-9 yoa: 7.5 mL QD  
10-11 yoa: 15 mL QD  
>12 yoa: 15-45 mL QD  
PR: 2-4 yoa: 1/2 of a 2.25 oz pediatric enema QD  
5-11 yoa: 2.25 oz enema QD  
>12 yoa: 4.5 oz enema QD | PO PR | Soln: sodium phosphate monohydrate 2.4 g, heptahydrate 0.9 g/5 mL  
Soln, enema: sodium phosphate monohydrate 19 g, heptahydrate 7 g/118 mL  
• Dilute oral solution in 8 ounces of cool water, follow with 8 more ounces of water  
• Avoid retention of enema solution |

• Repeated use may be appropriate  
• Monitor magnesium levels in patients with a CrCl <25 mL/min  
• Not used often in very ill children because of strong purgative action  
• SE: abdominal pain, diarrhea, nausea, vomiting, ↑ magnesium, hypotension, respiratory depression

• SE (mild): abdominal bloating, cramping, nausea, diarrhea, flatulence

• Short-term treatment of constipation  
• Maintain adequate fluid intake  
• Avoid oxalate (berry, nut, chocolate, bean, tomato) or phytate-containing foods (bran, wheat)  
• SE: abdominal discomfort, nausea, vomiting, diarrhea, mucosal bleeding, hypernatremia, hyperphosphatemia, dizziness, headache

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<table>
<thead>
<tr>
<th>Medication &amp; Age Guide*</th>
<th>Typical Starting Dose**</th>
<th>Routes</th>
<th>Pediatric Formulation Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>sorbitol</td>
<td><strong>PO: 2-11 yoa: 2 mL/kg</strong>&lt;br&gt;<strong>&gt;12 yoa: 30-150 mL</strong>&lt;br&gt;<strong>PR: 2-11 yoa: 30-60 mL (25-30%)</strong>&lt;br&gt;<strong>&gt;12 yoa: 120 mL (25-30%)</strong></td>
<td>PO PR</td>
<td><strong>Soln, PO, PR: 70%</strong>&lt;br&gt;Use 25%-30% solution for PR: Dilute 1 part solution with 2.3 parts water</td>
</tr>
<tr>
<td></td>
<td><strong>Single dose at infrequent intervals; Rarely used</strong>&lt;br&gt;<strong>Contraindication: anuria</strong>&lt;br&gt;<strong>SE: abdominal pain, nausea, vomiting, diarrhea, dry mouth (xerostomia)</strong></td>
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<tr>
<td>Prokinetic Agents</td>
<td></td>
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<tr>
<td>Erythromycin (E-Mycin)</td>
<td><strong>2.5 mg/kg Q6H</strong>&lt;br&gt;<strong>Adult: 125-250 mg</strong>&lt;br&gt;<strong>Administer before meals and qhs</strong></td>
<td>PO</td>
<td><strong>Susp: 200 mg/5 mL</strong>&lt;br&gt;<strong>Caps, Tab: 250 mg</strong>&lt;br&gt;<strong>Chewable tablets should not be swallowed whole</strong>&lt;br&gt;<strong>Do not break or chew delayed release and enteric coated tablets</strong>&lt;br&gt;<strong>Avoid IV administration, associated with fatal complications</strong>&lt;br&gt;<strong>Rarely used for constipation, unless underlying motility disorder</strong>&lt;br&gt;<strong>Consider if patient cannot tolerate metoclopramide (due to EPS)</strong></td>
</tr>
<tr>
<td>metoclopramide (Reglan)</td>
<td><strong>0.1-0.2 mg/kg Q6H</strong>&lt;br&gt;<strong>Adult: 10 mg</strong>&lt;br&gt;<strong>May dose up to 1 mg/kg for dopamine antagonism or chemotherapy induced nausea/vomiting</strong>&lt;br&gt;<strong>Administer 30 min before meals and at bedtime</strong></td>
<td>PO PR IM IV</td>
<td><strong>Soln: 5 mg/5 mL</strong>&lt;br&gt;<strong>Tab: 5, 10 mg</strong>&lt;br&gt;<strong>Tab, ODT: 5, 10 mg</strong>&lt;br&gt;<strong>Inj: 5 mg/mL</strong>&lt;br&gt;<strong>Some products contain sodium benzoate</strong>&lt;br&gt;<strong>Rarely used for constipation, unless underlying motility disorder</strong>&lt;br&gt;<strong>Extrapyramidal symptoms (EPS) occur more frequently in children. May administer diphenhydramine for EPS prevention. Concurrent administration with anticholinergic agents (e.g. diphenhydramine) will decrease prokinetic effect, but not anti-emetic effect.</strong>&lt;br&gt;<strong>Black box warning: irreversible tardive dyskinesia</strong>&lt;br&gt;<strong>Contraindication: complete bowel obstruction</strong>&lt;br&gt;<strong>SE: sedation, confusion</strong></td>
</tr>
</tbody>
</table>

*Use cautiously in patients outside of FDA & manufacturer recommended age parameters.

**Do not exceed usual maximum adult starting doses. Not intended for use in neonatal population.
**Avoid stimulant laxatives in patients <2 yoa. Glycerin suppository first line in infants.**

†Avoid rectal exam, suppositories, & enemas in neutropenic patients.
References
