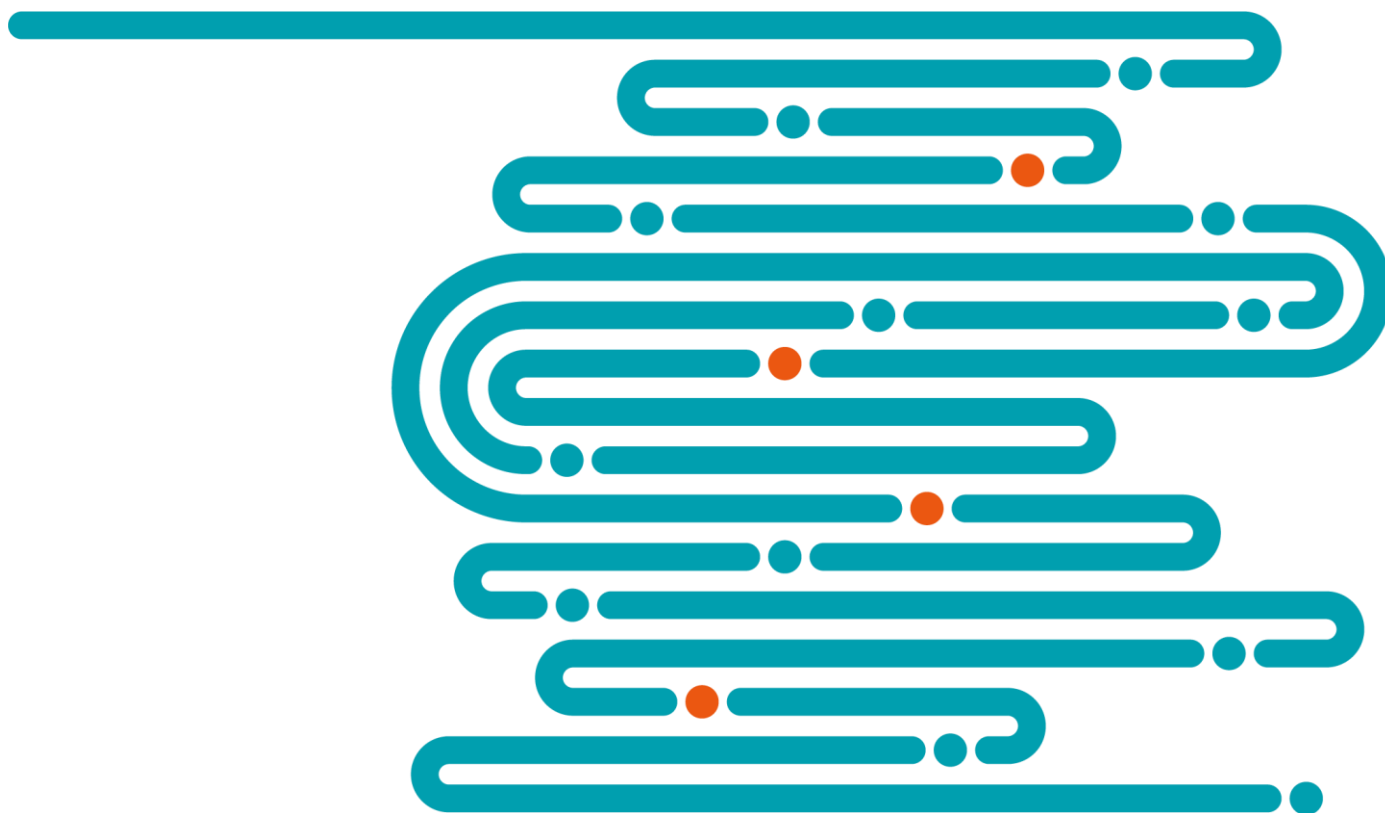


Adult and pediatric IV push medication reference

June 2023



Purpose

The purpose of this document is 2-fold:

- 1) to provide a list of medications commonly administered as intravenous (IV) push or slow IV injection
- 2) to provide a list of medications that can be administered as IV push or slow IV injection to supplement drug shortage mitigation strategies in the setting of bulk IV fluid shortages.

The list of medications provided is not all-inclusive. Clinical judgment and assessment of appropriateness is recommended at the institutional level and may differ based on the clinical scenario (eg, code situations).

Methodology

To provide the 2022 update to this reference, Vizient subject matter experts met to identify medications that are commonly administered via IV push or have recently experienced a drug shortage. From this initial list of 34 medications, IV push or slow IV injection information was obtained and verified with multiple tertiary resources. Once the medication information was collected, Vizient subject matter experts met again to reach consensus on which medications had appropriate literature support for addition to the list. In total, 25 additional medications met criteria to be added the reference list. In 2023, pediatric information was added for medications with available guidance. The list is not inclusive of neonatal administration information. Please refer to the appropriate clinical resources for neonatal information.

Mitigation strategies to conserve IV fluids

This document provides guidance on how members can take advantage of administering medications via IV push or slow IV injection; we have also noted where alternate routes—such as oral (PO) or intramuscular (IM) administration—are an option.

There are several additional strategies that members may wish to implement to conserve IV fluids, including:

- transitioning patients to an oral equivalent when clinically appropriate
- administration of a more concentrated (smaller volume) product wherever possible
- increasing “hang” time of IV fluids
- a summary of [mitigation strategies](#) was published by the American Society of Health-System Pharmacy (ASHP)
- discontinuing “to keep open (TKO)” practice and using intermittent line flushing for maintaining patency
- a full list of Vizient mitigation strategies can be accessed on the Vizient website at [Drug shortage mitigation strategies](#)

Safety considerations

Surveys [conducted by the Institute for Safe Medication Practices](#) (ISMP) have highlighted a number of unsafe practices associated with administering medications IV push, including improper dilution and use of prefilled normal saline flush syringes to dilute medications (often without syringe relabeling).

In recognizing a lack of available guidance and standardized safe practices associated with IV push administration, the ISMP released the [ISMP Safe Practice Guidelines for Adult IV Push Medications](#) and also published [updated guidance](#) following their survey conducted in 2018. ISMP has a [Gap Analysis Tool for Safe IV Push Medication Practices](#) available.

These resources developed by ISMP provide guidance around identifying and targeting the risks associated with current practices that may exist at member institutions, as well as establishing safe and best practices and providing education to healthcare providers.

Medications with literature support for IV push or slow IV injection^a

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
Acid suppressants				
Esomeprazole (Nexium)	40 mg vial: reconstitute powder with 5 mL NS, LR, or D5W	No additional dilution is necessary	Adult: Administer over at least 3 min Pediatric: No data	<ul style="list-style-type: none"> Flush line prior to and after administration with NS, LR, or D5W. IV push administration is approved for treatment of GERD. The manufacturer recommends that pediatric patients receive IV esomeprazole by intermittent IV infusion only.
Famotidine (Pepcid)	20 mg vial: supplied as solution for injection	May administer undiluted or dilute 20 mg (2 mL) vial with NS or another compatible diluent to a total volume of 5 to 10 mL	Adult: Administer over at least 2 min and no faster than 10 mg/min Pediatric^b: 2 mg/mL over at least 2 min and no faster than 10 mg/min	None of note

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
Pantoprazole (Protonix)	40 mg vial: reconstitute with 10 mL NS	No additional dilution is necessary	Adult: Administer over at least 2 min Pediatric^b: 4 mg/mL over at least 2 min	Flush IV line before and after administration with D5W, NS, or LR.
Analgesics				
Fentanyl (Sublimaze)	Supplied as ampules, vials, prefilled syringes, and cartridges supplied as solution for injection	May administer undiluted	Adult: Administer over 1 to 2 min Pediatric^b: 10 to 50 mcg/mL over at least 3 to 5 min; larger doses over 5 to 10 minutes	Rapid administration may result in skeletal muscle and chest wall rigidity, impaired ventilation, or respiratory distress/arrest. Additional monitoring required.
Hydromorphone (Dilaudid)	Extreme caution should be used to avoid confusion of the highly concentrated injectable product with the less concentrated injectable product	<ul style="list-style-type: none"> For the less concentrated formulation - no additional dilution is necessary For high-potency formulation, reconstitute with 25 mL of SWFI to a concentration of 10 mg/mL 	Adult: Administer over 2 to 3 min Pediatric^b: Same as adult	Rapid administration been associated with an increase in adverse events, especially respiratory depression and hypotension. Additional monitoring required.
Ketorolac (Toradol)	15 mg and 30 mg vials: supplied as solution for injection; 60 mg/2 mL vials for IM injection only	No dilution is necessary	Adult: Administer over 15 s; may also be administered as a slow IV injection distributed evenly over 1 to 2 min. Pediatric^b: administer over 1 to 5 min	Monitor for signs and symptoms of gastrointestinal upset or bleeding.
Morphine	Supplied as prefilled syringes and cartridges supplied as solution for injection	May dilute to a final concentration of 0.5 to 5 mg/mL	Adult: Administer over 4 to 5 min Pediatric^b: 0.5 to 5 mg/mL over 4 to 5 min	Products are designed for administration by specific routes. Rapid administration may result in skeletal muscle and chest wall rigidity, impaired ventilation, or respiratory distress/arrest. Additional monitoring required.

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
Anesthetics / Sedatives				
Diazepam (Valium)	Supplied as vials, prefilled syringes, and cartridges supplied as solution for injection	Do not dilute	Adult: Administer no faster than 5 mg/min Pediatric^b: Administer over at least 3 min; rate should not exceed 2 mg/min	Avoid smaller veins to reduce incidence of venous thrombosis, phlebitis, or local irritation.
Etomidate (Amidate)	Supplied as vials, ampuls, and syringes as solution for injection	Do not dilute	Adult: Administer over 30 to 60 s Pediatric^b: Same as adult	For general anesthesia induction or procedural sedation. Should be administered by or under the direct supervision of persons trained in administration and management of complications with general anesthesia.
Lorazepam (Ativan)	Supplied as vials, and syringe cartridges as solution for injection	Dilute with SWFI, NS, or D5W. Dilute with an equal volume of compatible solution immediately prior to use.	Adult: Administer over at least 2 min; should not exceed 2 mg/min or 0.05 mg/kg Pediatric^b: Same as adult	Avoid smaller veins to reduce incidence of venous thrombosis, phlebitis, or local irritation.
Midazolam (Versed)	Supplied as vials as solution for injection	For procedural / sedation / anxiolysis use a 1 mg/mL concentration or a dilution of the 1 or 5 mg/mL concentrations.	Adult: For procedural sedation / anxiolysis / amnesia administer over at least 2 min For induction of anesthesia administer over 5 to 15 s Pediatric^b: 1 or 5 mg/mL given over 20 to 30 s for anesthesia induction; should not be administered faster than 2 min in neonates	For general anesthesia induction or procedural sedation should be administered by or under the direct supervision of persons trained in administration and management of complications with general anesthesia.
Antibiotics				
Ampicillin	125, 250, and 500 mg vials: reconstitute with 5 mL SWFI or BWFI	No additional dilution necessary	Adult: Administer doses ≤ 500 mg over 3 to 5 min Administer doses > 500 mg over 10 to 15 min Pediatric^b: Same as adult	<ul style="list-style-type: none"> Solutions must be used within 1 h of reconstitution Administering ampicillin more rapidly than recommended may result in seizures

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
	1 g and 2 g vials: reconstitute with 7.4 mL or 14.8 mL SWFI or BWFI, respectively			
Aztreonam (Azactam)	1 g and 2 g vials: reconstitute with 6 to 10 mL SWFI; immediately shake vigorously	No additional dilution necessary	Adult: Administer over 3 to 5 min Pediatric^b: Same as adult	None of note
Cefazolin	500 mg vial: reconstitute with 2 mL SWFI. Shake well. <i>Final conc. = 225 mg/mL</i> 1 g vial: reconstitute with 2.5 mL SWFI. Shake well. <i>Final conc. = 330 mg/mL</i>	Further dilute reconstituted solution with 5 mL SWFI	Adult: Administer over 3 to 5 min Pediatric^b: Same as adult and further dilute to a maximum concentration of 100 mg/mL	None of note
Cefotaxime (Claforan)	500 mg, 1 g, and 2 g vials: reconstitute with 10 mL SWFI <i>Final conc. = 50, 95, and 180 mg/mL, respectively</i>	No additional dilution necessary	Adult: Administer over 3 to 5 min Pediatric^b: 180 to 200 mg/mL over 3 to 5 min	Avoid rapid injection (< 1 min) due to association with arrhythmias
Cefotetan (Cefotan)	1 g vial: reconstitute with 10 mL SWFI <i>Final conc. = 95 mg/mL</i> 2 g vial: reconstitute with 10 to 20 mL SWFI <i>Final conc. = 182 or 95 mg/mL, respectively</i>	No additional dilution necessary	Adult: Administer over 3 to 5 min Pediatric^b: ≤ 182 mg/mL over 3 to 5 min	None of note
Cefoxitin	1 g vial: reconstitute with 10 mL SWFI, BWFI, NS, or D5W <i>Final conc. = 95 mg/mL</i> 2 g vial: reconstitute with 10 or 20 mL SWFI, BWFI, NS, or D5W <i>Final conc. = 180 or 95 mg/mL, respectively</i>	No additional dilution necessary	Adult: Administer over 3 to 5 min Pediatric^b: 180 mg/mL over 3 to 5 min	None of note

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
Ceftazidime (Fortaz, Tazicef)	<p>500 mg vial: reconstitute with 5.3 mL SWFI</p> <p><i>Fortaz final conc. = 100 mg/mL</i></p> <p>1 g and 2 g vials: reconstitute with 10 mL SWFI</p> <p><i>Fortaz or generic final conc. = 100 and 170 mg/mL, respectively</i></p> <p><i>Tazicef final conc. = 95 and 180 mg/mL, respectively</i></p>	No additional dilution necessary	<p>Adult: Administer over 3 to 5 min</p> <p>Pediatric^b: 100 to 170 mg/mL over 3 to 5 min</p>	None of note
Cefuroxime	<p>750 mg vial: reconstitute with 8.3 mL SWFI</p> <p>1.5 g vial: reconstitute with 16 mL SWFI</p> <p><i>Final conc. = 90 mg/mL</i></p>	No additional dilution necessary	<p>Adult: Administer over 3 to 5 min</p> <p>Pediatric^b: 90 mg/mL over 3 to 5 min</p>	None of note
Chloramphenicol	<p>1 g vial: reconstitute with 10 mL SWFI or D5W</p> <p><i>Final conc. = 100 mg/mL</i></p>	No additional dilution necessary	<p>Adult: Administer over at least 1 min</p> <p>Pediatric^b: 100 mg/mL over at least 1 min</p>	None of note
Colistimethate sodium	<p>150 mg vial: reconstitute with 2 mL SWFI; swirl gently to avoid frothing</p> <p><i>Final conc. = 75 mg/mL colistin base activity</i></p>	No additional dilution necessary	<p>Adult: Administer over 3 to 5 min</p> <p>Pediatric^b: Same as adult</p>	The 2019 International Consensus Guidelines for the Optimal Use of the Polymixins advise administration over 0.5 to 1 h
Daptomycin (Cubicin, Cubicin RF)	<p>Generic 350 mg vial: reconstitute with 7 mL NS. Allow to stand for 10 min, then gently swirl to obtain completely reconstituted solution. Do not shake or agitate vial vigorously.</p> <p>Cubicin and generic 500 mg vials: reconstitute with 10 mL NS. Allow to stand for 10 min, then gently swirl to obtain completely reconstituted</p>	No additional dilution is necessary	<p>Adult: Administer over at least 2 min</p> <p>Pediatric: No data</p>	Use of saline-based diluents to reconstitute Cubicin RF results in hyperosmotic solution that may cause infusion site reactions when administered IV push

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
	<p>solution. Do not shake or agitate vial vigorously.</p> <p>Cubicin RF 500 mg vials: reconstitute with 10 mL SWFI or BWFI (do NOT use NS). Rotate or swirl vial for a few minutes, as needed, to reconstitute.</p> <p><i>Final conc., all products. = 50 mg/mL</i></p>			
Meropenem (Merrem)	<p>500 mg vial: reconstitute with 10 mL SWFI</p> <p>1 g vial: reconstitute with 20 mL SWFI</p>	No additional dilution is necessary	<p>Adult: Administer over 3 to 5 min</p> <p>Pediatric^b: 50 mg/mL over 3 to 5 min</p>	None of note
Nafcillin	<p>1 g vial: reconstitute with 3.4 mL SWFI, BWFI, or NS</p> <p>2 g vial: reconstitute with 6.6 mL SWFI, BWFI or NS</p> <p><i>Final conc., both vial sizes= 250 mg/mL</i></p>	Further dilute with 15 to 30 mL SWFI or NS prior to administration (applies to both vial sizes)	<p>Adult: Administer over 5 to 10 min</p> <p>Pediatric^b: Administer appropriate dose in 15 to 30 mL of diluent over 5 to 10 min</p>	<p>Vesicant. Caution extravasation.</p> <p>Caution phlebitis.</p>
Oxacillin	<p>1 g vial: reconstitute with 10 mL of SWFI or NS; shake well</p> <p>2 g vial: Add 20 mL of SWFI or NS; shake well</p>	No additional dilution is necessary	<p>Adult: Administer over at least 10 min</p> <p>Pediatric^b: Same as adult</p>	Caution phlebitis.
Antiemetics				
Metoclopramide (Reglan)	Supplied as vials and prefilled syringes as solution for injection	Doses ≤ 10 mg may be given undiluted	<p>Adult: Administer doses ≤ 10 mg undiluted as an IV push over at least 2 min</p> <p>Pediatric^b: Same as adult</p>	Doses > 10 mg should be diluted in 50 mL compatible solution (preferably NS) and administered via IV piggyback over at least 15 min

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
Ondansetron (Zofran)	Supplied as vials as solution for injection	Administer undiluted	Adult: Administer over at least 30 s, but preferably over 2 to 5 min Pediatric^b: In children < 40 kg receiving 0.1 mg/kg administer over at least 30 s, but 2 to 5 min is preferred	IV push is given for PONV only (single doses)
Cardiovascular agents				
Diltiazem (Cardizem)	Supplied as vials as solution for injection. ADD-Vantage powder vials should be reconstituted with 100 mL D5W or NS.	Administer undiluted	Adult: Administer over 2 min Pediatric^b: 5 mg/mL over 2 to 5 min	Continuous ECG and blood pressure monitoring required
Enalaprilat (Vasotec)	Supplied as vials as solution for injection	May be administered undiluted	Adult: Administer evenly distributed over 5 min Pediatric^b: Same as adult	Monitor for precipitous blood pressure drop with first dose
Hydralazine	Supplied as vials as solution for injection	Administer undiluted	Adult: Administer over 1 min Pediatric^b: Administer over 1 to 2 min and no faster than 5 mg/min	Monitor blood pressure every 5 min until at desired level. Check every 15 min thereafter throughout crisis.
Labetalol	Supplied as vials, cartridges, and premixed bags as solution for injection	May administer undiluted	Adult: Administer over at least 2 min and no faster than 10 mg/min Pediatric^b: 5 mg/mL over 2 to 3 min and no faster than 2 mg/min	Although initial bolus dose is often followed by a continuous infusion, providers may instead attempt intermittent IV push dosing before converting to a drip or to another agent.
Metoprolol tartrate (Lopressor)	Supplied as ampuls, vials, and syringe cartridges as solution for injection	May administer undiluted	Adult: Administer over 1 min Pediatric: No data	Continuous ECG and blood pressure monitoring required
Corticosteroids				
Dexamethasone (Decadron)	Supplied as vials as solution for injection	May administer 4 mg/mL or 10 mg/mL concentration undiluted	Adult: Administer over at least 1 min Pediatric^b: Administer over 1 to several minutes	Rapid administration may be associated with perineal burning or tingling. Can dilute to 0.5 mg/mL in NS and administer up to a 10 mg dose

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
				over 30 s to eliminate the incidence of perineal pruritus.
Hydrocortisone (Solu-Cortef)	Reconstitute 100 mg vial with 2 mL of BWFI or bacteriostatic NS. Act-O-vials reconstituted by pressing down on the plastic activator.	No additional dilution is necessary	Adult: Administer over at least 30 s For doses \geq 500 mg, administer over 10 min Pediatric^b: Same as adult	Reconstitute per prescribing information as differences exist between manufacturers.
Methylprednisolone sodium succinate (Solu-Medrol)	Reconstitute with accompanying diluent or bacteriostatic water for injection with benzyl alcohol	No additional dilution is necessary	Adult: Administration rate is variable, several minutes for doses 10 to 40 mg to at least 5 min for doses \leq 250 mg Pediatric^b: Doses \leq 1.8 mg/kg or \leq 125 mg over 1 to several min; for large doses (\geq 500 mg) administer over 10 min	Administer high-dose therapy (30 mg/kg) by IV administration over at least 30 min. Rapid administration of high doses may precipitate cardiac arrhythmia and sudden death.
Diuretics				
Acetazolamide (Diamox)	Reconstitute each 500 mg vial with at least 5 mL SWFI	No additional dilution is necessary	Adult: Administer over at least 3 min Pediatric^b: 100 mg/mL at a rate no faster than 500 mg/min	IM administration not recommended
Bumetanide	Supplied as vials as solution for injection	May administer undiluted	Adult: Administer over 1 to 2 min Pediatric^b: 0.25 mg/mL over 1 to 2 min	Oral bioavailability is very good (~80-100%)
Chlorothiazide (Diuril)	Reconstitute each 500 mg with at least 18 mL of SWFI	No additional dilution is necessary	Adult: Administer over 3 to 5 min (maximum of 500 mg) Pediatric^b: Administer slowly over 3 to 5 min as a direct injection	None of note

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
Furosemide	Supplied as vials and prefilled syringes as solution for injection	May administer undiluted	Adult: Administer over 1 to 2 min and no faster than 20 to 40 mg/min Pediatric^b: Administer over 1 to 2 min and no faster than 0.5 mg/kg/min not to exceed 4 mg/min	Administration faster than 4 mg/min in adults and 0.5 mg/kg/min in pediatrics increases the rate of ototoxicity
Rescue agents				
Atropine	Supplied as vials and prefilled syringes as solution for injection	Administer undiluted	Adult: Administer as a rapid IV push Pediatric^b: Same as adult	Slow administration may cause paradoxical bradycardia. Additional monitoring of vital signs and / or ECG based on the clinical scenario is required.
Flumazenil (Romazicon)	Supplied as vials as solution for injection	May be administered undiluted. Dilution not required, but may be mixed with D5W, LR, or NS.	Adult: Administer over 15 to 30 s Pediatric^b: 0.1 mg/mL over 15 s to 30 s; do not exceed 0.2 mg/min	Administer through a freely running IV infusion into a large vein (to minimize pain at injection site) as a series of small injections.
Mesna (Mesnex)	Supplied as vials as solution for injection	Dilute with D5W, NS, LR, D5-0.2% NS, D5-0.33% NS, or D5-0.45% NS. <i>Final conc. of 20 mg/mL</i>	Adult: Administer over at least 1 min Pediatric^b: Administer as IV bolus per manufacturer; however, current guidelines recommend administration by short IV infusion over 15 to 30 min or by continuous IV infusion	Refer to specific protocol for administration rate and details.
Naloxone (Narcan)	Supplied as vials, ampuls, cartridges, and prefilled syringes as solution for injection	Can administer undiluted or diluted. For lower doses (0.02 to 0.04 mg), may dilute 1 mL of naloxone 0.4 mg/mL formulation with 9 mL of NS or SWFI for a total volume of 10 mL <i>Final conc. of 0.04 mg/mL</i>	Adult: Administer undiluted as an IV push over 30 s Administer diluted as a slow IV push Pediatric^b: 0.4 or 1 mg/mL undiluted over 30 s	Duration of narcotic action may exceed that of naloxone.

Medication	Instructions for reconstitution	Dilution instructions for IVP/slow IV inj.	Administration time for IVP/slow IV inj.	Remarks
Miscellaneous				
Cosyntropin (Cortosyn)	Reconstitute 0.25 mg lyophilized powder with 1 mL of NS	Dilute with 2 to 5 mL of NS	Adult: Administer over 2 min Pediatric^b: Same as adult	Note administration differences between the lyophilized powder and solution
Diphenhydramine (Benadryl)	Supplied as vials, ampuls, and prefilled syringes as solution for injection	May be given undiluted	Adult: Administer no faster than 25 mg/min Pediatric^b: Same as adult	Monitor for relief of symptoms and mental alertness
Levothyroxine	100 mcg, 200 mcg and 500 mcg vials: reconstitute with 5 mL NS. Shake well.	No additional dilution is necessary	Adult: Administer at a maximum rate of 100 mcg/min Pediatric^b: Administer as concentration of 40 to 100 mcg/mL in NS over 2 to 3 minutes	None of note

^aThis list is not inclusive of neonatal administration information. Please refer to the appropriate clinical resources for neonatal information.

^bPediatric administration rates provided only; dilution and monitoring information may vary from adults and should be verified with the appropriate clinical resources

Abbreviations: BWF1 = bacteriostatic water for injection; D5W = dextrose 5% in water; ECG = electrocardiogram; GERD = gastrointestinal esophageal reflux disease; h = hour; IM = intramuscular; IN = intranasal; IV = intravenous; LR = lactated Ringer solution; min = minute; NA = not applicable; NS = normal saline; PO = by mouth; PONV = postoperative nausea and vomiting; s = second; SC = subcutaneous; SWFI = sterile water for injection

Appendix 1. Antimicrobials that should not be administered as IV push / slow IV injection

Antibiotic	Reason
Amikacin	Not recommended based on manufacturer recommendations and/or limited data
Azithromycin (Zithromax)	Not for IM or IV bolus administration
Ceftaroline (Teflaro)	Not recommended based on manufacturer recommendations and/or limited data
Ceftazidime / avibactam (Avycaz)	Not recommended based on manufacturer recommendations and/or limited data
Ceftolozane / tazobactam (Zerbaxa)	Not recommended based on manufacturer recommendations and/or limited data
Ciprofloxacin (Cipro)	Not recommended based on manufacturer recommendations and/or limited data
Clindamycin (Cleocin)	Cardiopulmonary arrest and hypotension have been reported following too rapid intravenous administration
Dalbavancin (Dalvance)	Not recommended based on manufacturer recommendations and/or limited data
Doxycycline (Doxy 100)	Not recommended based on manufacturer recommendations and/or limited data
Eravacycline (Xerava)	Not recommended based on manufacturer recommendations and/or limited data
Erythromycin (Erythrocin)	Do not administer IV push or bolus
Imipenem/cilastatin (Primaxin)	Do not administer IV push
Lefamulin (Xenleta)	Not recommended based on manufacturer recommendations and/or limited data
Levofloxacin	Avoid rapid or bolus IV infusion due to risk of hypotension
Linezolid (Zyvox)	Not recommended based on manufacturer recommendations and/or limited data
Meropenem/vaborbactam (Vabomere)	Not recommended based on manufacturer recommendations and/or limited data
Metronidazole (Flagyl)	Not recommended based on manufacturer recommendations and/or limited data
Minocycline (Minocin)	Infuse over 60 min; avoid rapid administration. Injectable route should only be used if oral route not feasible; caution of thrombophlebitis
Moxifloxacin (Avelox)	Infuse over 60 min; do not infuse by rapid or bolus IV infusion
Oritavancin (Orbactiv)	Not recommended based on manufacturer recommendations and/or limited data
Penicillin G (Pfizerpen)	Not recommended based on manufacturer recommendations and/or limited data
Piperacillin / tazobactam (Zosyn)	Not recommended based on manufacturer recommendations and/or limited data
Polymyxin B	Administration of polymyxin B over a period < 30 min is not recommended, and rapid IV injections should be avoided due to the potential for nephro- or neurotoxicity.
Quinupristin / dalfopristin (Synercid)	Infusion should be completed over 60 min; toxicity may be increased with shorter infusion
Rifampin (Rifadin)	Not recommended based on manufacturer recommendations and/or limited data
Tedizolid (Sivextro)	Do not administer as an IV push or bolus
Telavancin (Vibativ)	Not recommended based on manufacturer recommendations and/or limited data
Tigecycline (Tygacil)	Not recommended based on manufacturer recommendations and/or limited data
Trimethoprim-sulfamethoxazole (Bactrim)	Not recommended based on manufacturer recommendations and/or limited data
Vancomycin	Recommended adult infusion rate is a minimum of 30 min for every 500 mg administered

Appendix 2. Antimicrobials that may be administered as IV push / slow IV injection in adults

As highlighted in *Hospital Pharmacy* and validated with current package inserts, there are several antibiotics that have primary literature in adults to support IV push administration but for which **IV push administration is not FDA approved**. These medications include **cefepime (Maxipime)**, **ceftriaxone**, **ertapenem (Invanz)**, **gentamicin**, and **tobramycin**.

While administration via IV push / slow IV injection is not prohibited for the following products, each has **associated requirements and/or recommendations that may minimize the benefit(s) generally associated with a push strategy**:

- **Ampicillin-sulbactam (Unasyn)** may be administered via slow injection over 10 to 15 minutes; however, the minimum required product dilution (ie, 33.3 mL for a 1.5 g vial) creates a limitation from a small volume / fluid conservation standpoint.
- The maximum concentration for **fosphenytoin (Cerebyx)** (25 mg PE/mL; ie, 40 mL minimum total volume for a 1000 mg PE dose) also creates a limitation from a small volume/fluid conservation standpoint. Moreover, although fosphenytoin may be administered at a rate of 150 mg PE/min, severe and fatal cardiovascular events (ie, hypotension and cardiac arrhythmias) may occur with rapid administration. Slower administration reduces the incidence of cardiovascular events as well as severity of paresthesias and pruritis.
- **Phenytoin** has a maximum infusion rate of 50 mg/min (ie, 20-minute infusion for 1 g dose). If rapid IV administration is necessary, fosphenytoin is generally preferred.

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