Saskatchewan Health Authority

EMS

Provincial

Interfacility Transfer

Medications

Often EMR's and paramedics are called upon to transport patients from the rural area to urban centers or in urban centers between facilities with interfacility medications and IV infusions. The Paramedic Clinical Practice Guidelines and Scope of Practice provides for paramedics to attend on inter-facility transfers of patients receiving oral medications as well as number of IV drip medications. Any medication a paramedic can administer via IV can be monitored on an inter-facility transfer in addition to those listed below. ***These medications are to be used in association with the SCoP Paramedic Clinical Practice Protocols.*** *Please note – these contain general information regarding commonly transported medication, the list is not limited to these medication, practitioners are to collaborate with the sending facility regarding dosages and IV rates. All medications will be reviewed biannually and/or updated when changes are required.

Version 4: June 2025

Table of Contents

Version Control, Disclaimer, References and Resources

Version Control

The version number and most current date of release are listed on the Drug Reference Cards at the front of the SHA EMS Provincial Ambulance Medications Drug Reference Cards (DRC).

Disclaimer

We encourage all EMS providers to ensure they have downloaded the most up to date version of the Drug Reference Cards and review all updates and associated education. It is up to the individual utilizing this resource to ensure they successfully complete the appropriate training and possess the necessary knowledge and skills to be competent before administering any medication in the DRC's.

The SHA EMS Provincial Ambulance Medications Drug Reference Guide (DRC) undergoes constant review. Changes are made based on the best practice from medical evidence-based research. These medications are intended to support decision-making processes using sound clinical judgment and provide consistent equitable care to all people of Saskatchewan.

The medications within the approved drug classification have been assessed and evaluated based on medical evidence in EMS approved resources, listed below. All medications and dosages have been endorsed by the SHA Medical Oversight Team in collaboration with the SHA Pharmacy.

The DRC's are based on best practice. Best Practice represents quality care which is deemed optimal. Best practices are health practices, methods, interventions, procedures or techniques based on high-quality evidence in order to obtain improved patient and health outcomes.

References and Resources

- SHA EMS Medical Director & Advisors
- Advanced Cardiovascular Life Support (ACLS) Provider Manual 2020
- Advanced Cardiovascular Life Support for Experienced Provider Manual 2017
- Heart and Stroke 2020 Handbook of Emergency Cardiovascular Care for Healthcare Providers
- Pediatric Advanced Life Support (PALS) Provider Manual 2020
- SaskKids Pediatric Parental Manual
- Neonatal Resuscitation Program (NRP) 2021 8th Edition
- Pedi STAT
- AB and BC EMS protocols (for peds MDI)
- Palliative Program (2021)
- Paramedic Clinical Practice Protocols Version 7.0 (2024)
- https://online.lexi.com/lco/action/login
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Pages/Monographs.aspx
- https://web.p.ebscohost.com/nup/detail/detail?vid=10&sid=9eae3cac-5d73-4548-9e94-e9ab86b7f319%40redis&bdata=JnNpdGU9bnVwLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=2009958716&db=nup

Background

The need for standardization of medications for ground EMS was driven by a number of underlying requirements:

- SHA EMS Accreditation: A high priority Required Organizational Practice for EMS accreditation through Accreditation Canada is to have a consistent medication management for ground EMS including the standardized ordering of high alert medications. This new process and resulting work standard will address the standard ordering of all medications that fall within the Saskatchewan Paramedic Clinical Practice Protocols.
- The ask from paramedics and ambulance services for greater standardization for both contracted and SHA EMS services
- The request from SHA Pharmacy to have a standard drug inventory or standard list of medications for EMS
- To support frontline EMS with a resource that is kept up to date while aligning with best practice based on medical evidence research

The Drug Reference Cards (DRC) for ground EMS were built directly from the SHA formulary. Information on the DRC's came directly from the SHA Parenteral Manual and when required, adjusted dosages for prehospital medicine based on best practice and medical evidence research. All medications within the approved drug classifications were assessed and evaluated by the SHA Medical Oversight Team that include our provincial EMS Clinical Care EMS Medical Director and EMS Medical Advisors. Through this process, there has been consistent collaboration with both SHA Pharmacy and the Saskatchewan College of Paramedics. The standardized order forms for medications were developed based on patient safety/cost saving and the provision of the best dating on the medication with SHA Pharmacy.

We would like to reiterate that this document is a living document, therefore changes will occur. The intent is to ensure it will be updated when required for scope of practice changes and to have biannual reviews to assess and address any changes required, such as a change in best practice, or a change in supplies to medications.

A provincial ground EMS medication list ensures all EMS services, based on service level, have the same medications available ensuring continuity of patient care and support among services and meets the Accreditation Canada required organizational practice for standardized ordering of high alert medications. All medications and their associated supply and concentrations have been approved by the EMS Medical Oversight Team. This team consists of the EMS Provincial Medical Director and each zone (north, central and south) Medical Advisor.

Medications available to EMS through the SHA will align with SHA Formulary including policies and procedures that could include, but are not limited to, restrictions, high alert, storage, TALLman labelling.

SHA Pharmacy is the owner of the SHA EMS Medications Order Form. Any changes to the form or medications, including supply and concentrations require approval.

Instructions - How to utilize the IFT Drug Reference Cards

1. The IFT Drug Reference Cards (DRC) are resources that are to be used in association with the Saskatchewan College of Paramedics, "Paramedic Clinical Practice Protocols". It is the expectation that every practitioner understands and practices within their scope of practice.

2. This document can be saved and downloaded for both iPhone and android. Within the **"Table of Contents"**, you can go directly to the medication by selecting that line and it will bring you directly to that medication.

3. Within the **"Indications"** section of the IFT DRC, the **"EMS Indications"** have the SCoP approved scope of practice indications listed. Each licensure level will still need to understand and know what falls under their scope. Within this section, we have also included other Health Canada Approved and Non Health Canada approved uses of each medication as a reference and source of additional information. These are in place to ensure practitioners understand the full use of the medication, as there may be circumstances where it would be beneficial to know, such as an IFT that may be using it for other approved usages. These are for your information only and not to be used to exceed your approved scope of practice.

4. If any medication has an alert associated with it (ex: ELDER ALERT), it has been added to the IFT DRC. These alerts are noted in the **"Cautions"** sections of the DRC.

5. Dosages and IV rates for prehospital IFT meds are to be determined by the sending hospital. Under the **"Dosing"** section, common approved dose and rates, along with supply and concentration are listed. Within the section, the **"Provider/Route"** identifies all approved routes for each license level.

6. Compatibility/Stability with IV solutions – all medication are considered stable in D5W or NS for at least 24 hours at room temperature ; Compatible with dextrose, saline, dextrose-saline combinations, Ringer's and lactated Ringer's solutions unless otherwise stated on the DRC.

Updates and Highlights – June 2025

Acetylcysteine IFT Infusion:

- Addition: Monitoring information as per SHA parenteral manual and Lexidrug

Alteplase IFT Infusion:

- Addition: Mechanism of Action
- Addition: Pharmacokinetics

DiazePAM IFT

- Addition: under provider/route to ICP: IV monitor only for alcohol withdrawal as per MOT and SCoP protocol
- Addition: under dosing:

  ALCOHOL WITHDRAWAL

  Adult 17 years or older:

  - BAWS Score of 3 to 7: 10 mg IV/PO every 1 hour PRN
  - BAWS Score of 8 or greater: 10 mg IV/PO every 30 minutes PRN

    *Discontinue when 2 consecutive BAWS scores are less than 3

    *Brief Alcohol Withdrawal Scale (BAWS): https://www.saskhealthauthority.ca/system/files/2023-09/SHA-0327-Alcohol-Withdrawal-Assessment-Flowsheet.pdf

    ****Note: Diazepam is preferred benzodiazepine due to quicker onset of action and longer half-life. LORazepam is preferred for frail patients and those with severe liver disease (prolonged sedation can be harmful in hepatic encephalopathy).**

Pantoprazole IFT Infusion:

- Addition: under Drug Interactions: information about clopidogrel as per Lexidrug

EMS Provincial Inter-facility Transfer Medications

Acetylcysteine/Mucomyst HIGH ALERT

Classification

- Antidote for acetaminophen poisoning

Indications

EMS INDICATIONS

- Monitor Infusion only

*Special note for EMS:

BLS Response: PCP's / ICP – please be advised that the Loading dose **AND,** if required, the Maintenance dose infusion **must** be initiated in the facility prior to transporting. PCP's/ICP's are *NOT* to make infusion rate adjustments or to start the Maintenance Infusion enroute. All adjustments or changes will need to be started prior to transport in the sending facility. Transports will have to wait until the end of the loading dose (one hour).

ALS Response: ACP's – can adjust the rate from loading dose (high concentration) to maintenance dose (low concentration). This is one bag in which the infusion is adjusted, most people will only need one bag for the 20 hour infusion, therefore they can leave for transport with the Loading dose running and then start the Maintenance dose (that has previously been premixed and double checked by the sending facility).

HEALTH CANADA APPROVED

- *As an antidote to prevent or reduce hepatic injury due to acetaminophen overdose*

NON HEALTH CANADA APPROVED INDICATIONS BUT SUBSTANTIATIED IN THE LITERATURE

- *In patients at high risk of radiographic contrast agent induced reduction in renal function, when oral route is not available*
- *Treatment of early stage non-acetaminophen acute liver failure*

Mechanism of Action

- Acetylcysteine acts as a hepatoprotective agent by restoring hepatic glutathione, serving as a glutathione substitute, and enhancing the nontoxic sulfate conjugation of acetaminophen.
- Exerts mucolytic action through its free sulfhydryl group which opens up the disulfide bonds in the mucoproteins thus lowering mucous viscosity.

Pharmacokinetics

- **Onset:** 5 to 10 minutes
- **Metabolism:** Undergoes extensive first pass metabolism to form cysteine and disulfides (N, N-diacetylcysteine and N-acetylcysteine); cysteine is further metabolized to form glutathione and other metabolites.
- **Half-life elimination :** 2 hours
- **Duration:** less than 1 hour
- **Excreted** in urine

Contraindications

- No contraindications when used to treat acetaminophen overdose

Cautions

- **HIGH ALERT**
- May cause cerebral edema resulting in encephalopathy
- Asthma, or sensitivity to acetylcysteine; administer loading dose slowly and be prepared to treat anaphylactoid reactions
- Patients requiring blood glucose monitoring should have it done by central laboratory. Glucose testing by the Inform II meter should not be resumed until 24 hours after administration
- May interfere with point-of-care glucose meter devices that use glucose dehydrogenase (GDH). Therapeutic concentrations of IV acetylcysteine may be associated with falsely elevated blood glucose levels when GDH-linked glucose meter devices are used to measure blood glucose. Alternate blood glucose analysis is recommended.

PREGNANCY

- Contact pharmacy or specialized online resources for most up to date information
- Acetylcysteine is not teratogenic or embryotoxic in animals and, although the data are limited, do not appear to represent a risk to the human fetus when IV doses are used as an antidote for acute acetaminophen overdose. After IV administration, the drug crosses the placenta to achieve protective serum levels in the fetus. A 1999 report concluded that acetaminophen overdose in pregnant women should be managed the same way as in nonpregnant patients and that acetylcysteine therapy was protective to both the mother and the fetus. There is no reported human pregnancy experience after use of acetylcysteine as a mucolytic agent.

BREAST FEEDING

- Contact pharmacy or specialized online resources for most up to date information
- No reports describing the use of acetylcysteine during lactation have been located. Although the molecular weight of the drug (about 163) is low enough for excretion into breast milk, the various conditions in which acetylcysteine is used suggest that the drug will rarely be prescribed during breastfeeding. Moreover, IV acetylcysteine has been administered directly to preterm neonates for therapeutic indications, without causing toxicity, at doses far above those that would be obtained from milk.

MONITORING REQUIREMENTS

- Electronic IV infusion device
- When blood glucose monitoring is required, it MUST be done by a lab draw. Result form the Inform II beside monitor will not be accurate and should not be used for 24 hours after the infusion has been stopped.
- Ensure STEP 1 is only infused for one hour and the start time and the end time for that step has been documented.

  At the completion of 21 hours, IV acetylcysteine therapy can be terminated in patients who meet all of the following criteria:
  - Serum acetaminophen concentration is undetectable (i.e. below the lower limit of quantification measured by the local laboratory)
  - Aminotansferases (ALT +/- AST) normal or declining on at least one measurement INR less than 2
  - Serum creatinine normal or declining
  - Patient clinically well (no evidence of encephalopathy)

  If the criteria in the above required monitoring are not met at the end of 21 hours:
  - IV acetylcysteine must be continued indefinitely at the rate of 15 mg/kg/hour (57.5 mL/hour if over 100 kg) (preparing a new bag of IV acetylcysteine may be required) and terminated when all of the criteria above are met

- Repeat laboratory tests should be performed approximately every 12 hours during ongoing IV acetylcysteine therapy

PEDIATRICS

- Blood glucose monitoring every 4 to 6 hours as clinically indicated (**MUST be done by a lab draw**)

MONITORING RECOMMENDED

- Observe for/be prepared to treat nausea, vomiting (common) and hypersensitivity-like reactions, particularly during and shortly after IV loading dose
- Advise patients to report burning/stinging/pain at IV site promptly
- Prevention of nephrotoxic effects of radio contrast agents: serum creatinine
- Physician should contact Poison & Drug Information Service (PADIS) for Saskatchewan (1-866-454-1212) for most recent information

The following tests are recommended as part of the initial investigation of the acetaminophen poisioned patient:

- Serum acetaminophen concentration
- Aminotransferases (ALT +/- AST)
- INR
- Serum creatinine

*****Near the end of the 21-hour infusion, repeat the acetaminophen bloodwork as above*****

Adverse Effects

GASTROINTESTINAL

- Nausea /vomiting; may be profuse with loading dose, typically improves with maintenance infusion

HYPERSENSITIVITY

- Anaphylactoid reactions due to a dose related histamine release, rather than a true allergic response
- Rash, hives, flushing and pruritus; occur during or shortly after IV loading dose, particularly if infused over less than 60 minutes. Responds to IV diphenhydrAMINE and a decreased rate of infusion
- EPINEPHrine and corticosteroids may be given if required
- Hypotension, bronchospasm (rare)

Dosing

INFORMATIONAL Resource only; see "Special Note for EMS" in the Indications Section

ACETAMINOPHEN OVERDOSE – **LOADING DOSE (acetylcysteine step 1)**

Loading dose for patient **UNDER 100 KG LOAD 1 HOUR**

- 150 mg/kg (**Maximum**: 15 grams) **over 1 hour**
- Infusion times less than 1 hour may increase incidence of adverse effects

Loading dose for **100 KG AND OVER LOAD 1 HOUR**

- 575 mL (15 grams**) over 1 hour**
- Infusion times less than 1 hour may increase incidence of adverse effects

ACETAMINOPHEN OVERDOSE – **MAINTENANCE DOSE (acetylcysteine step 2)**

Maintenance dose for patient **UNDER 100 KG**

- 15 mg/kg/hour for a minimum of 20 hours

Maintenance dose for patient **100 KG AND OVER**

- 57.5 mL/hour for a minimum of 20 hours (maximum dosing weight of 100 kg = 15 mg/kg/hour)
- If patient is fluid restricted no change is required

- **Massive ingestions** of acetaminophen or in patients with persistently high serum acetaminophen levels; consider extending continuous infusion as ordered by physician/MRP
- Physician should contact Poison & Drug Information Service (PADIS) for Saskatchewan (1-866-454-1212) for most recent information
- **Doubling or tripling the acetylcysteine infusion rate during dialysis** (either intermittent hemodialysis or CRRT) **is not recommended** as the 15 mg/kg/hour infusion rate provides enough acetylcysteine to cover what is removed by dialysis

HIGH ALERT MEDICATION PLEASE READ AND FOLLOW DIRECTIONS CAREFULLY

NOTE: This is a 2 STEP Programing Process in the Plum 360. Ensure BOTH steps are programmed correctly

*This is a weight based infusion, ensure you obtain an **accurate weight** on the patient prior to infusion

Preparation Method

Single Concentration for: Loading dose (STEP 1) and maintenance dose (STEP 2):

- 30 grams of acetylcysteine added to 1000 ml bag of D5W
  (30 grams = 150 ml of acetylcysteine 200 mg/ml)

Prepared Infusion bag:
30 grams/1150 ml
OR
26 mg/ml

NOTE: acetylcysteine **is an exception to the 10% rule**

NOTE: A 2nd bag prep will be required in patients over 66 kg

STEP 1 – Loading Dose RUNS OVER 60 MINUTES

- Up to 100 kg: 150 mg/kg (maximum 15 grams) over **1 hour x 1 dose only**
- Over 100 kg: 575ml (15 grams) over **1 hour x 1 dose only**

Infusion times less than 1 hour may increase incidence of adverse effects

Large Volume will remain in bag – Proceed to Step 2

STEP 2 – Maintenance dose

- Under 100 kg : 15 mg/kg/hour for a minimum of 20 hours
- 100 kg and over: 57.5 ml/hour for a minimum of 20 hours

NOTE: No adaptations for fluid restricted patients

ADDITIONAL INFORMATION - acetylcysteine

- As for all IV medications ensure that you refer to the SK SMART Parenteral Manual, online version
- If you have questions about the drug monograph and/or infusion consult the pharmacy department or your Most Responsible Practitioner
- It is recommended for acetaminophen overdoses that the Practitioner should contact Poison and Drug Information Service (PADIS) for Saskatchewan at 1-866-454-1212
- Clearly document and communicate the start time and the time the infusion will reach 21 hours between ALL care providers
- The infusion must be continued past 21 hours if the patient does not meet all of the required criteria to terminate the infusion, which includes blood work and the patient's condition
- Refer to the drug monograph; contact Practitioner for further orders in regards to continuing or discontinuing the acetylcysteine infusion

COMPATIBILITY/STABILITY

- Stable in D5W, 0.45% NaCl or NS for at least 24 hours at room temperature and in refrigerator

Provider:

- **EMR:** Not in Scope
- **PCP/ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/acetylcysteine.pdf
- https://online-lexi-com.shal.idm.oclc.org/lco/action/doc/retrieve/docid/patch_f/6281?cesid=8yLJL69talC&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dacetylcysteine%26t%3Dname%26acs%3Dtrue%26acq%3Dacet
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711016
- The Hospital for Sick Children Electronic Formulary

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

rTPA Cathflo/Activase/Alteplase HIGH ALERT

Classification

- Thrombolytic

Indications

EMS INDICATIONS

- Monitor infusion only

HEALTH CANADA APPROVED

- *Thrombolsis in: acute MI or acute ischemic stroke, restoration of function to central venous access devices*

NON HEALTH CANADA APPROVED INCIATIONS BUT SUBSTANTIATED IN THE LITERATURE

- *Thrombolysis in acute massive pulmonary embolism treatment of mechanical prosthetic valve thrombosis, lysis of hemodialysis catheter-associated fibrin sheaths, catheter-directed thrombolysis after angiographic placement of catheter tip*

Mechanism of Action

- Initiates local fibrinolysis by binding to fibrin in a thrombus (clot) and converts entrapped plasminogen to plasmin

Pharmacokinetics

- **Duration:** fibrinolytic activity persists for up to 1 hour after infusion terminated
- **Excretion:** 80% cleared within 10 minutes of infusion being terminated

Contraindications

ABSOLUTE

- Hypersensitivity to alteplase or any component of the formulation
- Active internal bleeding
- Established cerebrovascular event (including TIAs within last 2 months)
- Active bleeding diathesis
- Recent gastrointestinal bleeding (within last 10 days)
- Within last 3 months: Neurosurgery (intracranial, spinal), intracranial trauma

RELATIVE

- Relative contraindications may vary depending on indication. Use specific protocols to determine eligibility criteria – the
- following apply to systemic therapy and is not an all-inclusive list
- At any time – cerebral hemorrhage, known intracerebral vascular disease (malignancy, AV malformation)
- Puncture of non-compressible vessel
- Intracranial tumour, recent eye surgery
- Hepatic failure (particularly those with coagulopathy), bacterial endocarditis, pregnancy, diabetic hemorrhagic

- retinopathy
- Within past 2 to 3 months: intracranial/intraspinal surgery or serious head trauma
- Within past 10 to 21 days: GI or GU hemorrhage, within past 10 days: cardiopulmonary resuscitation, major surgery,
- organ biopsy, major trauma
- Severe uncontrolled hypertension (systolic BP greater than 185 and/or diastolic BP greater than 110 mmHg), diabetic
- proliferative retinopathy, bleeding diathesis, hepatic dysfunction, acute pericarditis

Cautions

- **HIGH ALERT**
- Elderly: may have pre-existing conditions that may increase risk of intracranial bleeding
- Avoid conditions in which bleeding constitutes a substantial hazard or would be difficult to control because of its location
- Avoid any excessive or rough handling of patient; avoid invasive procedures (e.g. arterial puncture, venipuncture, IM injection). If these procedures are absolutely necessary, use extreme precautionary methods (use radial artery instead of femoral; avoid handling catheter sites and use extended pressure application of up to 30 minutes)
- Internal bleeding (intracranial, retroperitoneal, gastrointestinal, genitourinary, respiratory) or external bleeding, especially at arterial and venous puncture, sites may occur (may be fatal). The total dose should not exceed 90 mg for acute ischemic stroke or 100 mg for acute myocardial infarction or pulmonary embolism. Doses greater than or equal to 150 mg associated with significantly increased risk of intracranial hemorrhage compared to doses less than or equal to 100 mg. Bleeding risk is low. Monitor all potential bleeding sites; if serious bleeding occurs, the infusion of alteplase and any other concurrent anticoagulants (eg, heparin) should be stopped and the patient should be treated appropriately.
- Has been reported rarely in patients treated with thrombolytic agents; may present with livedo reticularis, “purple toe” syndrome, acute renal failure, gangrenous digits, hypertension, pancreatitis, myocardial infarction, cerebral infarction, spinal cord infarction, retinal artery occlusion, bowel infarction, or rhabdomyolysis and can be fatal.
- Hypersensitivity reactions (eg, anaphylaxis, urticaria, angioedema) have been reported; fatal outcome has been reported (rare). Although typically mild and transient, orolingual angioedema has occurred during and up to 2 hours after alteplase infusion in patients treated for acute ischemic stroke and acute myocardial infarction; the use of concomitant ACE inhibitors, female sex and strokes involving the insular and frontal cortex have been associated with an increased risk. Monitor closely for hypersensitivity reactions during infusion and for several hours after; if signs of hypersensitivity occur or angioedema develops, discontinue the infusion and promptly institute appropriate therapy.
- Use may increase risk of thromboembolic events in patients with high probability of left heart thrombus (eg, patients with mitral stenosis or atrial fibrillation).

DRUG INTERACTIONS

- Oral anticoagulant or heparin may increase risk of hemorrhage
- Drugs that affect platelet function, such as ASA, clopidogrel, NSAID’s, may increase risk of hemorrhage
- Heparin or low molecular weight heparin

PREGNANCY

- The limited use of alteplase during pregnancy does not suggest a significant fetal risk. Although only one of the reported human exposures occurred during organogenesis, the high molecular weight probably precludes the transfer of alteplase to the embryo. Moreover, teratogenicity was not observed in animals. Hemorrhage is a risk of therapy at any time during gestation, but careful monitoring of the mother can prevent this from becoming a significant risk to the fetus. Therefore, it appears that alteplase may be used during gestation if the mother's condition requires this therapy.

BREASTFEEDING

- Alteplase is identical to the glycoprotein enzyme found in the body and is a normal component of human colostrum and breast milk. The endogenous milk levels decrease rapidly during the first week and then slowly over time. It has a molecular weight of about 59,000. It is most likely destroyed in the infant's gut during breastfeeding. Because of the nature of the indications for this agent and its very short initial half-life (less than 5 minutes), the opportunities for its use during lactation are minimal.

REQUIREMENTS

- Electronic infusion device
- Vented administration set if infusing directly from original glass bottle

MONITORING REQUIRED

Intermittent Infusion of Doses 10 mg or greater (e.g. ischemic stroke, pulmonary embolism, MI, prosthetic valve thrombosis)

- Visual assessment for signs and symptoms of bleeding every 30 minutes during infusion, then every 1 hour x 6, then every 4 hours x 48 hours
- Baseline BP, HR and neuro-vital signs then every 1 hour during infusion then every 1 hour x 6 hours, then if stable every 4 hours x 48 hours
- Assess for frank or occult blood in stool, emesis, sputum and urine for at least 72 hours after initiation of therapy

Acute MI only

- In addition to above: Continuous ECG monitoring during infusion and for at least 6 hour post infusion Intermittent Infusion of doses less than 10 mg (e.g. lysis of hemodialysis catheter-associated fibrin sheaths)
- Visual assessment for signs and symptoms of bleeding (e.g. puncture site(s) assessment, bleeding gums, bruises, petechiae, nosebleeds, tarry stools) every 1 hour during infusion

Catheter-Directed Thrombolysis

- Arterial line management skills and standards
- Visual assessment for signs and symptoms of bleeding including neurological changes (e.g. headache, visual changes) every 30 minutes during infusion, then every hour x 6. If on concomitant heparin continue every 2 hours x 3 then stop i.e. monitor for 12 hours after infusion stops if on concomitant heparin
- Baseline BP, HR and neuro-vital signs, then every 60 minutes during infusion and for 6 hours after. If on concomitant heparin continue every 2 hours x 3 then stop
- Assess for frank or occult blood in stool, emesis, sputum and urine for at least 72 hours after initiation of therapy

Continuous Infusion

- Visual assessment for signs and symptoms of bleeding including neurological changes (e.g. headache, visual changes) every 30 minutes during infusion, then every 1 hour x 6. If on concomitant heparin continue every 2 hours x 3 then stop i.e. monitor for 12 hours after infusion stops if on concomitant heparin
- Baseline BP, HR and neuro-vital signs, then every 1 hour during infusion and for 6 hours after. If on concomitant heparin continue every 2 hours x 3 then stop
- Assess for frank or occult blood in stool, emesis, sputum and urine for at least 72 hours after initiation of therapy

MONITORING RECOMMENDED

- Baseline INR, PTT, hematology profile, fibrinogen, hematocrit, thrombin time and repeat daily during infusion

EXTRAVASATION

- Alteplase may be an irritant; avoid extravasation. Extravasation may result in inflammation or ecchymosis. If extravasation occurs, discontinue infusion at that IV site.

Adverse Effects

CARDIOVASCULAR

- Reperfusion arrhythmias

- Hypotension (when used for acute MI)

CENTRAL NERVOUS SYSTEM

- Cerebral edema
- Cerebral herniation
- Seizure
- New ischemic stroke; when used for ischemic stroke

HEMATOLOGIC

- Superficial or surface bleeding at puncture sites
- Serious internal bleeding, e.g. retroperitoneal, intracerebral

RESPIRATORY

- Laryngeal edema

MISCELLANEOUS

- Rash
- Uriticaria

Dosing

ADULT/ELDERLY:

ISCHEMIC STROKE (See intermittent infusion for vial preparation)

- **Patients less than 100 kg**: Withdraw 0.09 mg/kg dose and physician to give direct IV over 1 minute then start intermittent infusion of 0.81 mg/kg over 60 minutes
- **Patients equal to or greater than 100 kg:** Withdraw 9 mg dose and physician to give direct IV over 1 minute then start intermittent infusion of 81mg over 60 minutes
- Recommended total dose: 0.9 mg/kg (maximum total dose: 90 mg)

PULMONARY EMBOLISM (See intermittent infusion for vial preparation)

- Withdraw 10 mg from the 100 mg/100 mL vial. Physician to give dose direct IV over 2 minutes and then start intermittent infusion of 90 mg/90 mL (remainder of vial) over 2 hours

PROSTHETIC VALVE THROMBOSIS

- **Initial dose:** 10 mg, followed by 90 mg over 90 minutes
- Reduce dose in very small adults

CATHETER-DIRECTED THROMBOSIS OF LARGE VESSEL OCCLUSION AFTER ANGIOGRAPHIC PLACEMENT OF CATHETER TIP

- Optimal dosage and concentration has not been established; a number of delivery techniques are employed with continuous infusion being the most common
- **Fixed-dose regimen:** 0.12 to 2 mg/hour or weight-based regimen: 0.001 to 0.02 mg/kg/hour (maximum dose: 2 mg/hour)
- Duration infusion dependent upon size and location of the thrombus; typically between 6 to 48 hours

OCCLUDED CENTRAL VENOUS ACCESS DEVICES

- Refer to SHA Peripherally Inserted Central Catheter (PICC) Maintenance and Removal Clinical Procedure
- **Instillation:** 1 to 2 mg. Dwell time 30 to 120 minutes. May repeat once if unsuccessful. May extend to 24 to 72 hours
- **Infusion:** 1 to 4 mg (in 50 to 100 mL NS) over 30 minutes to 3 hours

PEDIATRIC:

OCCLUDED CENTRAL VENOUS ACCESS DEVICES

- Instillation: Use 1 mg/mL. Dwell time 30 to 120 minutes. May repeat once if unsuccessful. May extend to 24 to 72 hours
- Instill 110% of catheter lumen volume (if known). **Maximum:** 2 mL
- If catheter lumen volume is unknown, instill 1 mL (weight less than 30 kg) or 2 mL (weight greater than 30 kg)

STROKE

- Initial IV bolus of 0.09 mg/kg IV over 5 minutes, then continue with 0.81 mg/kg IV over 60 minutes (total dose given is 0.9 mg/kg) as per SHA Stroke protocol.

HEMO/PERITONEAL DIALYSIS

- Occluded central venous catheters used for hemodialysis
  Instillation: 1 to 2 mg. Dwell time 10 minutes to until next hemodialysis treatment
  Infusion: 1 to 4 mg over 30 to 60 minutes

MISCELLANEOUS

- Subcutaneous/IM administration: not applicable

Concentration Supplied/Reconstitution:

- Reconstitute vials to provide solution concentration 1 mg/mL:
- **2 mg vial** (Cathflo): add 2.2 mL SWFI
- **50 mg vial**: add 50 mL SWFI (diluent provided); (50 mg vial contains vacuum. Discard vial if vacuum not present)
- **100 mg vial**: add 100 mL SWFI (diluent provided); (no vacuum present, use transfer device provided)
- Do not shake the vial. Swirl and/or invert gently to mix. If needed, let stand undisturbed for a few minutes to allow dissipation of large bubbles
- See package insert for reconstitution instructions

Compatibility/Stability:

- Reconstituted vials are stable for 8 hours at room temperature and in fridge
- Concentrations of 0.02, 0.05 and 0.1 mg/mL in NS have been used stability for 24 hours assumed. Solutions at higher concentrations of 0.2 mg/mL in NS have been found to develop a slight cloudiness after admixing
- Stable when diluted to 0.5 mg/mL in NS or D5W for 24 hours
- May be mixed in a regular PVC IV bag

Provider/Route:

- **EMR:** Not in scope of practice
- **PCP/ICP:** Monitor Infusion *stroke only
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- https://collegeofparamedics.sk.ca/wp-content/uploads/2024/04/Protocol-Manual-Spring-2024-v7.1-FINAL.pdf
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/alteplase%20IV.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711043
- The Hospital for Sick Children Electronic Formulary

Development – November 2024
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

Blood and Blood Products

Classification

- Blood and Blood Products

Indications

EMS INDICATIONS

- Monitor Infusion only

HEALTH CANADA INDICATIONS

- *Patients receiving transfusion of blood products (i.e. fresh frozen plasma, packed red blood cells, platelets, etc.). Used for fluid replacement in situations such as hemorrhagic shock or shock itself due to plasma loss (burns), anemia, patients undergoing chemotherapy with a decreased platelet count, etc.*

Guidelines

- The transfusion must be monitored by the sending facility for at least 30 min before transport
- Personnel must ensure that the numbers for each unit of blood product infusing are recorded on the cross-match requisition and the requisition form must be taken with the patient to the receiving facility
- A Dr.'s written order must accompany the patient specifying the flow rate of the blood product
- Only NS can be infused through the same IV site as a blood product. The flow rate for the NS should be TKO unless otherwise specified by a Dr.

Monitoring

- Vital signs, including temp, q 30 min or more frequently if the patient develops signs/symptoms of a reaction.
- Vital signs, rate of transfusion and patient status must be documented on the PCR
- Blood component administration shall begin within 60 minutes from the time the component is released from temperature-controlled storage and transfusion shall not exceed 4 hours from the time-of-issue from the temperature-controlled storage.

Contraindications

- The patient must be hemodynamically stable for 30 minutes prior to transport (systolic BP greater than 90 mmHg, HR less than 100 bpm).

Adverse Effects

If Patient exhibits any signs of transfusion reaction, discontinue infusion and seek medical control for further orders.

Signs and symptoms of transfusion reaction include:

- Fever and chills
- Chest pain
- Hypotension
- Nausea and vomiting
- Flushing and urticaria
- Dyspnea
- Hemoglobinuria
- Pain at the infusion site
- Low back pain
- Headache
- Pruritus
- Anaphylactic shock (difficulty swallowing, swelling of the tongue, throat or lips, etc.)
- Bleeding at surgical or venipuncture sites
- Delayed signs include
    - Decreased hemoglobin levels
    - Jaundice

Provider/Route:

- **EMR:** Not in Scope
- **PCP/ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** IV, IO

Resources:

- SHA EMS Medical Oversite Team
- SK Transfusion Resource Manual - SaskBlood

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

DiazePAM/Valium HIGH ALERT/ELDER ALERT

Classification

- Benzodiazepine - irritant

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *Management of anxiety disorders, ethanol withdrawal symptoms or as a skeletal muscle relaxant*
- *Treatment of status epilepticus and recurrent seizures*

NON HEALTH CANADA APPROVED INDICATION BUT SUBSTANTIATED IN LITERATURE

- *Hydroxychloroquine/chloroquine toxicity (severe)*
- *Intoxication (cocaine, methamphetamine, and other sympathomimetics)*
- *Neuroleptic malignant syndrome*
- *Opioid withdrawal (autonomic instability and agitation)*
- *Serotonin syndrome (serotonin toxicity)*
- *Vertigo, acute episodes*

Mechanism of Action

- Long-acting benzodiazepine. Binds to stereospecific benzodiazepine receptors on the postsynaptic GABA neuron at several sites within the central nervous system, including the limbic system, reticular formation. Enhancement of the inhibitory effect of GABA on neuronal excitability results by increased neuronal membrane permeability to chloride ions. This shift in chloride ions results in hyperpolarization (a less excitable state) and stabilization. Benzodiazepine receptors and effects appear to be linked to the GABA-A receptors. Benzodiazepines do not bind to GABA-B receptors

Pharmacokinetics

- **Onset:** IV 1 to 3 minutes
- **Peak:** 15 minutes
- **Duration:** 15 to 60 minutes
- **Excreted** in urine (predominantly as glucuronide conjugates)

Contraindications

- Hypersensitivity to diazepam, other benzodiazepines or any component of the formulation
- Myasthenia gravis: condition may be exacerbated
- Acute narrow angle glaucoma: may have an anticholinergic effect
- Open angle glaucoma unless patients are receiving appropriate therapy

Cautions

- **HIGH ALERT, ELDER ALERT**
- Elderly or debilitated active metabolites with extended half-lives may lead to delayed accumulation and adverse effects; impaired cognition, delirium, falls and fractures
- Respiratory disease; lower dose recommended due to possible apnea
- Neonate and young infants: decreased metabolism of diazepam and active metabolite, both can accumulate with repeated use and cause increased toxicity
- When used as an adjunct in treating convulsive disorders, an increase in frequency/severity of tonic-clonic seizures may occur and require dose adjustment of antiseizure medication. Abrupt withdrawal may result in a temporary increase in the frequency and/or severity of seizures.
- Avoid use in patients with depression because of concerns about worsening mood symptoms, particularly if suicidal risk may be present, except for acute or emergency situations (eg, acute agitation, status epilepticus).
- Use benzodiazepines with caution in obese patients; may have prolonged action when discontinued.
- Use of diazepam is not recommended in place of appropriate therapy.

DRUG INTERATIONS:

- Additive CNS effects with phenothiazines, narcotic analgesics, barbiturates, alcohol, tricyclic antidepressants, and MAO inhibitors
- Is a major substrate of CYP2C19 and 3A4. Interacts with many drugs - contact pharmacy for more information. Review drug profile at time of initiation and with any change in medication regimen

PREGNANCY

- The effects of benzodiazepines, including diazepam, on the human embryo and fetus are controversial. Although a number of studies have reported an association with various types of congenital defects, other studies have not found such associations. Maternal denial of exposure, as reported in one study, and the concurrent exposure to other toxic drugs and substances (e.g., alcohol and smoking) may be confounding factors. If the drug does cause birth defects, the risk appears to be low. Continuous use during gestation has resulted in neonatal withdrawal, and a dose-related syndrome is apparent if diazepam is used close to delivery. Consequently, if the maternal condition requires the use of diazepam during pregnancy, the lowest possible dose should be taken. Moreover, abrupt discontinuance of diazepam should be avoided.

BREASTFEEDING

- Diazepam may accumulate in breastfed infants, and its use in lactating women is not recommended. In 2001, the American Academy of Pediatrics classified the effects of diazepam on the nursing infant as unknown but may be of concern.

MONITORING REQUIRED:

- Baseline RR, BP and HR, mental status, then at 5 and 15 minutes post dose

MONITORING RECOMMENDED:

- Advise patients to report burning/stinging/pain at IV site promptly
- Assess level of consciousness as required
- Assess for postural hypotension prior to ambulation

Adverse Effects

CENTRAL NERVOUS SYSTEM

- Drowsiness and excessive sedation. If treatment required, can be rapidly reversed by flumazenil IV
- Ataxia, vertigo, headache
- Slurred speech, memory impairment, depression, confusion
- Anterograde amnesia

CARDIOVASCULAR

- Hypotension and bradycardia. Cardiac arrest. Associated with excessively rapid IV administration

RESPIRATION

- Respiratory depression and partial airway obstruction. May follow rapid IV administration

MISCELLANEOUS

- Paradoxical reactions, including hyperactive or aggressive behavior, have been reported with benzodiazepines; risk may be increased in adolescent/pediatric, geriatric patients, or patients with a history of alcohol use disorder or psychiatric/personality disorders.
- Hazardous sleep-related activities such as sleep-driving, cooking and eating food, and making phone calls while asleep have been noted with benzodiazepines.

LOCAL REACTIONS/EXTRAVASATION

- Phlebitis, local pain, erythema and a burning sensation.
- Extravasation

Dosing

***Administer slowly into a large vein**

ADULT

- 2 to 10 mg every 3 to 4 hours. May be repeated in 1 hour.
- Recommended max dose; 30 mg in 8 hours.

DEBILITATED OR PATIENTS WITH LIMITED PULMONARY RESERVE:

- Begin with a small dose (2 to 5 mg) and increase in gradual increments.

STATUS EPILEPTICUS:

- 5 to 10 mg. May repeat at intervals of 10 to 15 minutes up to a total dose of 30 mg.
- If necessary, therapy may be repeated in 2 to 4 hours

ALCOHOL WITHDRAWAL

Adult 17 years or older:

- BAWS Score of 3 to 7: 10 mg IV/PO every 1 hour PRN
- BAWS Score of 8 or greater: 10 mg IV/PO every 30 minutes PRN
  *Discontinue when 2 consecutive BAWS scores are less than 3

*Brief Alcohol Withdrawal Scale (BAWS): https://www.saskhealthauthority.ca/system/files/2023-09/SHA-0327-Alcohol-Withdrawal-Assessment-Flowsheet.pdf

****Note: Diazepam is preferred benzodiazepine due to quicker onset of action and longer half-life. LORazepam is preferred for frail patients and those with severe liver disease (prolonged sedation can be harmful in hepatic encephalopathy).**

ELDERLY

- Begin with a small dose (2 to 5 mg) and increase in gradual increments

PEDIATRIC

SEDATIVE/MUSCLE RELAXANT:

- 0.04 to 0.2 mg/kg/dose. Repeat every 2 to 4 hours
- Maximum recommended dose: 0.6 mg/kg in 8 hours

STATUS EPILEPTICUS:

- 0.3 mg/kg/dose. May repeat every 10 minutes x 3

Maximum recommended dose

- less than 5 years: Max 5 mg/dose
- 5 years or older: Max 10 mg/dose

NEONATE

STATUS EPILEPTICUS:

- 0.1 to 0.2 mg/kg/dose. May repeat at intervals of 5 to 10 minutes as needed up to a total dose of 1 mg/kg

RENAL IMPAIRMENT ADJUSTMENTS

- Creatinine clearance less than 20 mL/min: use small doses and titrate to effect

HEPATIC IMPAIRMENT ADJUSTMENTS

- Half-life significantly prolonged; no dosing information available at this time

HEMO/PERITONEAL DIALYSIS

- Not removed by hemodialysis or CAPD: use small doses and titrate to effect

MISCELLANEOUS

- Can be given IM; Oral absorption is more reliable
- Subcutaneous: no information available at this time
- Parenteral form can be used rectally

Reconstitution

- None required

Compatibility/Stability

- Compatible with D5W, NS and lactated Ringer's. Conc.-dependent precipitation occurs. Stability information for preservative free product not available. Stability information on older product is conflicting
- For drug-drug compatibility contact pharmacy

Concentration Supplied:

- 10 mg/2 ml

Provider/Route:

- **EMR:** Not in Scope
- **PCP:** Not in Scope
- **ICP:** IV monitor only for Alcohol Withdrawal
- **ACP:** IV
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/diazePAM.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/6728?cesid=7i7Au6nEC3q&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3DdiazePAM%26t%3Dname%26acs%3Dtrue%26acq%3Ddiazep
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711326
- https://www.saskhealthauthority.ca/system/files/2023-08/CS-OS-9903-ED-AWS-Adults.pdf

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

DOBUTamine/Dobutrex HIGH ALERT

Classification

- Sympathomimetic

Indications

EMS INDICATIONS

- Monitor Infusion only

HEALTH CANADA APPROVED

- *When inotropic support is required in conditions characterised by a low output cardiac failure*

NON HEALTH CANADA APPROVED INDICATIONS BUT SUBSTANTIATED IN THE LITERATURE

- *Stress testing for detecting and assessing ischemic heart disease (imaging usually via myocardial perfusion scans or echocardiography)*

Mechanism of Action

- Dobutamine, a racemic mixture, stimulates myocardial $beta_1$-adrenergic receptors primarily by the (+) enantiomer and some $alpha_1$ receptor agonism by the (-) enantiomer, resulting in increased contractility and heart rate, and stimulates both $beta_2$- and $alpha_1$-receptors in the vasculature. Although $beta_2$ and $alpha_1$ adrenergic receptors are also activated, the effects of $beta_2$ receptor activation may equally offset or be slightly greater than the effects of $alpha_1$ stimulation, resulting in some vasodilation in addition to the inotropic and chronotropic actions. Lowers central venous pressure and wedge pressure, but has little effect on pulmonary vascular resistance.

Pharmacokinetics

- **Onset:** 1 to 10 minutes
- **Peak:** 10 to 20 minutes
- **Metabolism:** In tissues and hepatically (via conjugation and methylation) to inactive metabolites
- **Half-life elimination:** 2 minutes
- **Excreted**: in urine (as inactive metabolites)

Contraindications

- Hypersensitivity to DOBUTamine and any component of the formulation (e.g. sulfites)
- Pheochromocytoma, hypertrophic cardiomyopathy with outflow tract obstruction (formerly known as idiopathic hypertrophic subaortic stenosis)
- Uncorrected tachyarrhythmia or ventricular fibrillation

Cautions

- **HIGH ALERT**
- Heart failure - lower doses are preferred to minimize adverse effects
- Hypovolemia should be corrected prior to starting DOBUTamine
- An increase in BP is more common due to augmented cardiac output, but hypotension secondarily to vasodilation may occur at higher doses.
- May cause dose-related increases in heart rate.
- May exacerbate ventricular ectopy (dose related).
- Myocardial infarction - excessive doses may intensify ischemia by increasing myocardial oxygen demands
- Hyperthyroidism, hypertension - exaggerated pressor response may occur
- Atrial fibrillation with rapid ventricular response - digoxin should be used prior to instituting DOBUTamine
- Ineffective therapeutically in the presence of mechanical obstruction such as severe aortic stenosis.
- Correct electrolyte disturbances, especially hypokalemia or hypomagnesemia, prior to use and throughout therapy to minimize the risk of arrhythmias.
- Use with caution in patients with active myocardial ischemia or recent myocardial infarction; can increase myocardial oxygen demand.

DRUG INTERACTIONS:

- Monoamine oxidase inhibitors; prolonged hypertension may result from concurrent use

PREGNANCY

- Although the animal data suggest low risk, the limited human pregnancy experience prevents a better assessment of the embryo–fetal risk.

BREASTFEEDING

- No reports describing the use of dobutamine during human lactation have been located. The relatively low molecular weight (about 301) suggests that the drug will be excreted into breast milk. However, the plasma half-life of 2 minutes suggests that the amount excreted will be low. In addition, any drug in the mother's milk probably would be digested in the infant's gut. Nevertheless, waiting several hours after the end of a drug dose appears to be the safest course.

REQUIRED

- Electronic infusion device
- STRESS TESTING Under direct supervision of a physician, i.e. physician must be present and immediately available to provide assistance and direction throughout performance of procedure, see site Departmental stress testing protocol/procedure.
- Any further requirements as per Diagnostic Accreditation Standards

MONITORING REQUIRED

- Continuous ECG monitoring
- Baseline BP, then every 3 to 5 minutes x 30 minutes and until stable, then as required
- Hemodynamically stable heart failure patients on low dose infusion: continuous ECG monitoring, BP and O2 sat every 4 hours while awake

PEDIATRIC

- Consultation with Intensive Care or Transportation Team

RECOMMENDED

- Consider hemodynamic monitoring
- Ensure adequate intravascular volume
- Daily serum creatinine and serum potassium

Extravasation:

- If extravasation occurs, stop infusion immediately; leave cannula/needle in place temporarily but do NOT flush the line; gently aspirate extravasated solution, then remove needle/cannula; elevate extremity; apply dry, warm compresses

MISCELLANEOUS

- Administer via central line whenever possible

Adverse Effects

NOTE: Adverse effects can usually be corrected by adjusting the infusion rate

CARDIOVASCULAR

- Ventricular ectopic beats, increased heart rate
- Increase in BP is common
- Non-specific chest pain
- Shortness of breath
- Palpitations

CENTRAL NERVOUS SYSTEM

- Headache

GASTROINTESTINAL

- Nausea/vomiting

MISCELLANEOUS

- Decreased serum potassium concentrations, though hypokalemia is rare

Dosing

- **See SK SMART Pump Program Parenteral Manual online copy for infusion charts**
- **https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/DOBUTamine.pdf**

ADULT

- Usual initial dose: 2 to 3 mcg/kg/minute
- Increase in 2 to 3 mcg/kg/minute increments at 10 to 30 minute intervals according to response. Range: 0.5 to 40 mcg/kg/minute
- Recommended maximum rate in heart failure: 20 mcg/kg/minute

IMMEDIATE POST-CARDIAC ARREST CARE SETTING

- 5 to 10 mcg/kg/minute; titrate to effect

HEMODYNAMICALLY STABLE HEART FAILURE

- Low dose infusion; 0.5 to 7.5 mcg/kg/minute
- Dose generally adjusted only once daily if necessary (not continually titrated)

STRESS TESTING

- Administer in graded doses, beginning at 5 to 10 mcg/kg/minute, to a maximum of 30 to 40 mcg/kg/minute, for 3 minute intervals until target heart rate is reached

ELDERLY

- Start at lower end of the dosage range

PEDIATRIC

- 2 to 15 mcg/kg/minute; adjust according to response
- Recommended maximum: 40 mcg/kg/minute

NEONATE

- 2 to 25 mcg/kg/minute; start low and adjust according to response

Concentration Supplied:

- Standard concentration: 1000 mcg/mL

RECONSTITUTION
- add 250 mg DOBUTamine to 250 mL compatible IV fluid

COMPATIBILITY/STABILITY
- Compatible with NS, dextrose, dextrose-saline combinations and LR solutions
- Stable in D5W or NS for at least 24 hours at room temperature
- Solutions may have a pink coloration, which may darken with time. This does not indicate a loss of potency
- DOBUTamine, DOPamine, lidocaine, nitroGLYCERIN and sodium nitroPRUSSIDE prepared in NS or D5W are compatible given by Y-site in all possible combinations
- Incompatible with drugs having alkaline pH (e.g. sodium bicarbonate)

Route:
- Continuous IV Infusion
- IM/subcutaneous administration – no
- Intraosseous administration – may be used in post resuscitation stabilization

Provider:
- **EMR:** Not in Scope
- **PCP/ICP:** Not in Scope
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:
- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/DOBUTamine.pdf#search=DOBUTamine
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/6774?cesid=aMvpLRXT199&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3DDOBUTamine%26t%3Dname%26acs%3Dtrue%26acq%3DDOBUT
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711355

Development – July 2023
Update – June 2025

Saskatchewan Health Authority

EMS Provincial Inter-facility Transfer Medications

DOPamine HIGH ALERT

Classification

- Sympathomimetic

Indications

EMS INDICATIONS

- Monitor Infusion only

HEALTH CANADA APPROVED

- *Hemodynamic support in shock syndrome (e.g. MI, open heart surgery, renal failure, cardiac decompensation) that persists after adequate fluid volume replacement*
- *Inotropic support in advanced heart failure*

Mechanism of Action

- Stimulates both adrenergic and dopaminergic receptors, lower doses are mainly dopaminergic stimulating and produce renal and mesenteric vasodilation, higher doses also are both dopaminergic and beta$_1$-adrenergic stimulating and produce cardiac stimulation and renal vasodilation; large doses stimulate alpha-adrenergic receptors

Pharmacokinetics

- **Onset:** Within 5 minutes
- **Metabolism:** Renal, hepatic, plasma; 75% to inactive metabolites by monoamine oxidase and 25% to norepinephrine (active)
- **Half-life elimination:** ~2 minutes
- **Duration:** less than 10 minutes
- **Excreted** in urine (as metabolites)

Contraindications

- Hypersensitivity to sulphites or any other component of the formulation
- Uncorrected tachyarrhythmias or ventricular fibrillation
- Pheochromocytoma

Cautions

- **HIGH ALERT**
- Elderly; due to potential for decreased organ function and concomitant disease or drug therapy
- Hypovolemia should be corrected prior to starting DOPamine
- Cardiovascular disease, cardiac arrhythmias and/or occlusive vascular disease

- Active myocardial ischemia/post–myocardial infarction: may increase myocardial oxygen consumption
- Electrolyte imbalance: correct electrolyte disturbances, especially hypokalemia or hypomagnesemia, prior to use and throughout therapy to minimize the risk of arrhythmias
- Shock: use in adult patients with shock (majority had septic shock) demonstrated a higher incidence of adverse events (e.g. tachyarrhythmias)
- Primary pulmonary hypertension: vasoconstriction may further increase pulmonary artery pressure and resistance
- May cause increases in heart rate, increasing the risk of tachycardia and other tachyarrhythmias including ventricular arrhythmias. In heart transplant candidates, institute appropriate measures to protect patient against risks of sudden cardiac death.

DRUG INTERACTIONS:

- MAO inhibitors, tricyclic antidepressants, serotonin/norepinephrine reuptake inhibitors (e.g. venlafaxine): may potentiate pressor response
- Linezolid: may enhance hypertensive effect. Monitor for enhanced pressor response and adjust dose accordingly

PREGNANCY

- Experience with dopamine in human pregnancy is limited. No reports of embryo–fetal harm with either preparation have been located. Since injectable dopamine is indicated only for life-threatening situations, chronic use would not be expected. However, chronic use of the oral product might occur and should be discouraged during pregnancy.

BREASTFEEDING

- No reports describing the use of dopamine during lactation have been located. Because it is only indicated for life-threatening situations, it is doubtful if such reports will occur.

REQUIREMENTS

- Electronic infusion device
- Central line required – peripheral line may be used only as an interim measure until a central venous access device can be inserted; recommend 22 gauge or smaller as required; when possible avoid hand, wrist or areas of flexion

PEDIATRIC

- Central line preferred. Peripheral line may be used as interim measure until central line established or with the discretion of pediatric intensivist. Consultation with Intensive Care or Transport Team for continuous infusions
- Consultation with Intensive Care of Transportation Team

MONITORING REQUIRED

- Continuous ECG monitoring
- Continuous BP monitoring or q 3 to 5 minutes by cuff until continuous monitoring available
- If given peripherally, assess IV site for signs of extravasation (area will appear cold, hard and pale) hourly until a central line can be inserted

PEDIATRIC

- Continuous ECG monitoring
- Continuous BP monitoring or every 3 to 5 minutes by cuff until continuous monitoring available or until reduced frequency of BP monitoring ordered by pediatric intensivist
- If peripheral line is used, assess IV site every 15 minutes for signs of extravasation

MONITORING RECOMMENDED

- Advise patients to report burning/stinging/pain at IV site promptly
- Ensure adequate intravascular volume
- Assess extremities for changes in colour or temperature

EXTRAVASATION

- May result in sloughing and tissue necrosis. Use central line or large veins e.g. cephalic or basilic, to decrease risk

TREATMENT

- Stop infusion. Restart at new IV site and notify physician.
- Physician to infiltrate area of extravasation with phentolamine: 5 to 10 mg diluted in 10 mL NS (adults); 0.1 to 0.2 mg/kg up to 10 mg diluted in 10 mL NS (pediatrics)

•Use a fine needle. To be effective, use within 12 hours or use nitroglycerin 2% ointment
•Apply dry warm intermittent compresses

Adverse Effects

NOTE: Adverse effects can usually be corrected by adjusting the infusion rate

CARDIOVASCULAR

- Increased heart rate, ectopic beats, palpitations
- Ventricular arrhythmias have occurred with large doses
- Angina
- Hypotension: generally with doses below 5 mcg/kg/minute
- Vasoconstriction: generally with doses above 10 mcg/kg/minute. Can cause hypertension, headache, dyspnea, and in the extremities vascular stasis and gangrene.

DERMATOLOGIC

- Piloerection, peripheral gangrene (with prolonged or high dose, can occur with low doses with concomitant occlusive vascular disease)

GASTROINTESTINAL

- Nausea, vomiting

GENITOURINARY

- Azotemia

NERVOUS SYSTEM

- Anxiety, headache

RESPIRATORY

- Dyspnea

Dosing

- **See SK SMART Pump Program Parenteral Manual online copy for infusion charts**
- **https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/DOPamine.pdf**

ADULT/ELDERLY

HEMODYNAMIC SUPPORT

- Dosage Range: 2 to 20 mcg/kg/minute; titrate to desired response (max: 50 mcg/kg/minute)
- Doses greater than 20 mcg/kg/minute may not have a beneficial effect on blood pressure and may increase the risk of tachyarrhythmias Infusion may be gradually increased by 5 to 10 mcg/kg/minute increments until optimal response is obtained

HYPOTENSION ESPECIALLY IF ASSOCIATED WITH SYMPTOMATIC BRADYCARDIA IN THE IMMEDIATE POSTCARDIAC ARREST SETTING

- Initial: 5 to 10 mcg/kg/minute; titrate to effect
- If dosages greater than 20 to 30 mcg/kg/minute are needed, a more direct-acting vasopressor may be more beneficial (i.e. EPINEPHrine, norepinephrine)

INOTROPIC SUPPORT IN ADVANCE HEART FAILURE

- 5 to 15 mcg/kg/minute; lower doses are preferred

PEDIATRIC

HEMODYNAMIC SUPPORT

- Dosage Range: 2 to 20 mcg/kg/minute; titrate to desired response (max: 50 mcg/kg/minute)
- Doses greater than 20 mcg/kg/minute may not have a beneficial effect on blood pressure and may increase the risk of tachyarrhythmias
- Infusion may be gradually increased by 5 to 10 mcg/kg/minute increments until optimal response is obtained
- If dosages greater than 20 to 30 mcg/kg/minute are needed, a more direct-acting vasopressor may be more beneficial (ie, EPINEPHrine, norepinephrine)

TO MAINTAIN CARDIAC OUTPUT FOR POST RESUCUTATION STABILIZATION

- Dose range: 2 to 20 mcg/kg/minute

NEONATE

HYPOTENSION

- 2 to 5 mcg/kg/minute, then increase to 20 mcg/kg/minute as required for desired effect

MISCELLANEOUS

- Consider intraosseous access if an IV can not be easily obtained during cardiac arrest: dosage is as for IV above

Concentration Supplied:

- Standard premixed bags available 400 mg/250 ml D5W

RECONSTITUTION

- None required

COMPATIBILITY/STABILITY

- Compatible with normal saline, dextrose, dextrose-saline combinations and lactated Ringer's solutions
- Discoloured solutions should not be used as discolouration indicates decomposition

Route:

- Consider intraosseous access if an IV can't be easily obtained during cardiac arrest: dosage is as for IV above
- Continuous IV Infusion
- IM and subcutaneous administration; not applicable

Provider:

- **EMR:** Not in Scope
- **PCP/ICP:** Not in Scope
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/DOPamine.pdf#search=dopamine
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/6784?cesid=5k1e06cyNt6&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3DDOPamine%26t%3Dname%26acs%3Dtrue%26acq%3Ddop
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711363

Development – July 2023
Update – June 2025

Saskatchewan Health Authority

EMS Provincial Inter-Facility Transport Medications

FentaNYL HIGH ALERT

Classification

- Opiate agonist - Narcotic Analgesic

Indications

EMS INDICATIONS

- Monitor Infusion only

HEALTH CANADA APPROVED

- *In anesthesia as an analgesic, an adjunct to general and regional anesthesia, and as an anesthetic for induction and maintenance*

NON HEALTH CANADA APPROVED INDICATIONS BUT SUBSTANTIATED IN THE LITERATURE

- *Temporary relief of moderate to severe pain*

Mechanism of Action

- Binds with stereospecific receptors at many sites within the CNS, increases pain threshold, alters pain reception, and inhibits ascending pain pathways.

Pharmacokinetics

- **Onset: IV:** Almost immediate (maximal analgesic and respiratory depressant effects may not be seen for several minutes)
- **Peak:** Not listed
- **Duration: IV:** 0.5 to 1 hour
- **Metabolized** through the liver and other tissues by a combination of reactions
- **Excretion:** Urine 75% (primarily as metabolites, less than 7% to 10% as unchanged drug); feces ~9%.

Contraindications

- Hypersensitivity to fentaNYL or any component of formulation. Cross reaction may occur with meperidine and SUFentanil

Cautions

- **HIGH ALERT**
- Elderly: May be more sensitive to adverse effects, including life-threatening respiratory depression.
- Cachectic or debilitated patients: Is a greater potential for critical respiratory depression, even at therapeutic dosages
- Respiratory disease: Monitor for respiratory depression in patients with significant chronic obstructive pulmonary disease or cor pulmonale and patients having a substantially decreased respiratory reserve, hypoxia,

hypercarbia, or preexisting respiratory depression, particularly when initiating therapy and titrating therapy; critical respiratory depression may occur, even at therapeutic dosages
- Hypovolemia, cardiovascular disease (including acute MI), circulatory shock: Potential vasodilation + hypotension
- CNS depression/coma: Are susceptible to intracranial effects of CO2 retention
- Biliary tract dysfunction or acute pancreatitis: May cause constriction of sphincter of Oddi
- Sleep-disordered breathing: Use with caution for chronic pain and titrate dosage cautiously in patients with risk factors for sleep-disordered breathing, including heart failure and obesity
- Head trauma, intracranial lesions, or elevated intracranial pressure: Respiratory depressant effects (with CO2 retention and secondary elevation of CSF pressure) may be markedly exaggerated
- Abdominal conditions: May obscure diagnosis or clinical course
- Adrenocortical insufficiency: including Addison disease. Long-term opioid use may cause secondary hypogonadism
- Delirium tremens, hepatic or renal impairment, obesity, prostatic hyperplasia/urinary stricture, psychosis, thyroid dysfunction. Seizure disorders: May cause or exacerbate preexisting seizures
- Patients on opioids for chronic pain, patient with opioid use disorder, patient on opioid agonist therapy – may require consultation to specialist (e.g. anesthesiology, addictions medicine)
- fentaNYL can accumulate in lipid stores when used for extended periods of time and may result in prolonged sedation and reduced ability to liberate from mechanical ventilator
- Potentially life-threatening serotonin syndrome (SS) has occurred with concomitant use of fentanyl and serotonergic agents (eg, selective serotonin reuptake inhibitors, serotonin and norepinephrine reuptake inhibitors, triptans, tricyclic antidepressants, 5-HT3 receptor antagonists, mirtazapine, trazodone, tramadol) and agents that impair metabolism of serotonin (eg, monoamine oxidase inhibitors). Monitor patients closely for signs of SS such as mental status changes (eg, agitation, hallucinations, delirium, coma); autonomic instability (eg, tachycardia, labile BP, diaphoresis); neuromuscular changes (eg, tremor, rigidity, myoclonus); and GI symptoms (eg, nausea, vomiting, diarrhea). Discontinue fentanyl if SS is suspected.

DRUG INTERACTIONS

- Benzodiazepines or other CNS depressants: May result in profound sedation, respiratory depression, coma, and death
- Is metabolized by cytochrome P450 3A4; concomitant use with any 3A4 inhibitors may result in an increase in fentaNYL plasma concentrations, which could increase or prolong adverse reactions and may cause potentially fatal respiratory depression. Discontinuation of a concomitantly used 3A4 inducer may result in an increase in fentaNYL plasma concentration. Review drug profile at time of initiation and with any change in medication regimen
- Other potentially significant interactions may exist, requiring dose or frequency adjustment, additional monitoring, and/or selection of alternative therapy. Consult drug interactions database for more detailed information

PREGNANCY

- The National Birth Defects Prevention Study discussed below found evidence that opioid use during organogenesis is associated with a low absolute risk of congenital birth defects.
- Respiratory depression in the newborn is a potential complication if fentanyl is used closed to delivery. As with all opioids, neonatal withdrawal may occur after chronic, long-term exposure during pregnancy.

BREASTFEEDING

- Fentanyl is excreted into milk. A study published in 1992 measured fentanyl colostrum concentrations in 13 healthy women who had received fentanyl (2 mcg/kg) during cesarean section or postpartum tubal ligation. Serum and colostrum samples were collected at six intervals up to 10 hours after drug administration. The peak serum and colostrum fentanyl levels occurred at 0.75 hours, with mean values of 0.19 and 0.40 ng/mL, respectively, falling to undetectable and 0.05 ng/mL, respectively, at 10 hours. Colostrum fentanyl concentrations were always greater than serum levels at every measurement. It was concluded that breastfeeding was safe because of the low colostrum concentrations and the low oral bioavailability of fentanyl.
- In 2001, the American Academy of Pediatrics classified fentanyl as compatible with breastfeeding.

REQUIREMENTS

- Electronic infusion device

PEDIATRIC

- 50 mcg/mL concentrations must be co-infused with a maintenance solution due to hypo-osmolarity

MONITORING REQUIRED

ADULT BASELINE

- RR, HR, BP, sedation scale before dose or start of infusion

DIRECT IV

- RR, HR, BP, sedation scale, at 5 and 15 minutes post dose/post infusion

CONTINUOUS INFUSION

- RR and sedation scale at 5 and 15 minutes then every 2 hours

PEDIATRIC/NEONATE BASELINE

- RR, HR, BP, sedation scale before dose or start of infusion
- Continuous electronic respiratory monitoring and pulse oximetry during and for 15 minutes post dose
- Observe patient continually for 15 minutes post dose for signs/symptoms of apnea and/or muscle rigidity

CONTINUOUS INFUSION

- RR, HR, BP, sedation scale, at 5 and 15 minutes post dose/post infusion
- Continuous electronic respiratory monitoring and pulse oximetry during and for 15 minutes post dose
- Observe patient continually for 15 minutes post dose for signs/symptoms of apnea and/or muscle rigidity
- Continuous electronic respiratory monitoring and continuous pulse oximetry

MONITORING RECOMMENDED

- Monitor fluid intake and urine output; check for bladder distension
- Check for abdominal distension, gas or constipation

NEONATE

- Monitor for chest wall rigidity is related to high doses and rapid escalation to moderate doses; rigidity may be prevented by concomitant use of neuromuscular blocking agents with mechanical ventilation
- For Intubation: monitor urine output post dose

Adverse Effects

CARDIOVASCULAR

- Bradycardia; which may be treated with atropine
- Hypotension. Orthostatic hypotension in ambulatory patients
- Peripheral edema

CENTRAL NERVOUS SYSTEM

- Sedation (common)
- Confusion
- Dizziness
- Fatigue

GASTROINTESTINAL

- Nausea/vomiting
- Constipation - diminished propulsive peristaltic waves in GI tract

RESPIRATORY

- Respiratory depression and apnea; may be severe, requiring maintenance of an adequate airway, use of resuscitative equipment, and administration of oxygen, naloxone, and/or other resuscitative drugs
- Muscular rigidity. Treatment: naloxone IV and respiratory support as required. Associated with speed of administration, reduced by use of slow intravenous injection

NEONATE – INTUBATION

- Possible chest wall rigidity. Muscle relaxation (succinylcholine) overcomes this

MISCELLANEOUS

- Hyperhidrosis (excessive sweating)

- Hypokalemia

NEONATE

- Neonatal withdrawal syndrome: may be life-threatening. Signs and symptoms include irritability, hyperactivity, abnormal sleep pattern, high-pitched cry, tremor, vomiting, diarrhea, and failure to gain weight. Onset, durations and severity depend on the drug used, duration of use, maternal dose, and rate of drug elimination by the newborn

Dosing

Optimal analgesic dose varies widely among patients; while doses should be titrated to pain management, consideration of sedation level and respiratory status will also guide dosing

***NOTE: The following should only be considered as guidelines**

ADULT:

INTERMITTENT DOSING CRITICALLY ILL PATIENTS

- Dilute in 50 mL D5W or NS
- 25 to 35 mcg (based on approximately 70 kg patient) or 0.35 to 0.5 mcg/kg every 30 minutes to 1 hour as needed
- Note: More frequent dosing may be needed (e.g. mechanically-ventilated patients)

CONTINUOUS INFUSION

- 2000 mcg in 100 mL D5W or NS

CONTINUOUS INFUSION FOR CRITICALLY ILL PATIENTS

- 50 to 700 mcg/hour (based on approximately 70 kg patient) or 0.7 to 10 mcg/kg/hour

ELDERLY:

- Elderly have been found to be twice as sensitive as younger patients to effects of fentaNYL. A wide range of doses may be required. Start with a low dose and titrate as tolerated

PEDIATRIC:

INTERMITTENT INFUSION

BOLUS DOSE

- Usual concentration: 5 to 50 mcg/mL
- Maximum standard concentration: 50 mcg/mL Administer over 3 to 10 minutes

CONTINUOUS INFUSION

- See SK SMART Pump Program Parenteral Manual for dosing and infusion charts
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/fentaNYL.pdf

NEONATAL:

INTERMITTENT INFUSION

- BOLUS DOSE
- Usual concentration: 5 to 25 mcg/mL
- Maximum concentration: 25 mcg/mL Administer over 3 to 10 minutes

CONTINUOUS INFUSION

- See SK SMART Pump Program Parenteral Manual for dosing and infusion charts
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/fentaNYL.pdf

MISCELLANEOUS

- 100 mcg fentaNYL is approximately equianalgesic to 10 mg morphine

Concentration Supplied:

- 50 mcg/mL (5 mL vial)

COMPATIBILITY/STABILITY

- Stable in D5W and NS for at least 24 hours at room temperature and in refrigerator when mixed on patient care unit

- Compatible with NS, D5W, Ringer's and LR solutions
- Products premixed by pharmacy are individually labelled with an expiry date and storage instructions

Provider/Route:

- **EMR:** Not in scope of practice
- **PCP/ICP:** Not in scope of practice
- **ACP:** Monitor infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/fentaNYL.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/6903?cesid=8hbpSUZoMia&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3DfentaNYL%26t%3Dname%26acs%3Dtrue%26acq%3Dfentan
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711456

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

Furosemide/Lasix

Classification

- Diuretic

Indications

EMS INDICATIONS

- In facility medicine and infusion monitoring

HEALTH CANADA APPROVED

- *When rapid onset and intense diuresis desired e.g. acute pulmonary edema, cerebral edema and when oral route is unavailable*

NON HEALTH CANADA APPROVED INDICATIONS BUT SUBSTANTIATED IN THE LITERATURE

- *Diagnostic aid as an adjunct in renal radionuclide imaging*

Mechanism of Action

- Primarily inhibits reabsorption of sodium and chloride in the ascending loop of Henle and proximal and distal renal tubules, interfering with the chloride-binding cotransport system, thus causing its natriuretic effect

Pharmacokinetics

- **Onset:** 5 min IV
- **Peak**: 0.5 hour IV
- **Duration:** 2 hours IV
- **Metabolism:** minimally hepatic
- **Excretion:** Urine (Oral: 50%, IV: 80%) within 24 hours; feces (as unchanged drug); non-renal clearance prolonged in kidney impairment.

Contraindications

- Hypersensitivity to furosemide or any component of formulation
- Anuria, hepatic coma
- Severe - hypokalemia, hypovolemia or hypotension
- Newborns with jaundice, infants with conditions which might induce hyperbilirubinemia or kernicterus

Cautions

- Hypersensitivity to sulphonamides; while listed as a contraindication by manufacturers, reviews conclude absolute risk of cross-reaction is extremely low. Consider alternative therapy only if a moderate-to–severe reaction is documented or recalled
- Elderly; severe loss of sodium and/or increase in urea can cause confusion. For any change in mental status, monitor electrolytes and renal function
- Cardiac, hepatic or renal disease, uremia - greater risk of ototoxicity
- Diabetics, patients with a history of gout
- Furosemide is a potent diuretic that, if given in excessive amounts, can lead to a profound diuresis with water and electrolyte depletion. Therefore, careful medical supervision is required and dose and dose schedule must be adjusted to the individual patient's needs.
- Avoid use of diuretics for treatment of elevated blood pressure in patients with primary adrenal insufficiency (Addison disease). Adjustment of glucocorticoid/mineralocorticoid therapy and/or use of other antihypertensive agents is preferred to treat hypertension.
- Use with caution in cirrhosis and ascites due to increased risk of hepatic encephalopathy and coma with sudden alterations of fluid and electrolytes; initiate with conservative doses and close monitoring.
- Prostatic hyperplasia/urinary stricture: May cause urinary retention due to increased urine production, especially upon initiation of therapy.
- May cause systemic lupus erythematosus exacerbation or activation.
- May lead to nephrocalcinosis or nephrolithiasis in premature infants and in infants and children less than 4 years of age with chronic use. May prevent closure of patent ductus arteriosus in premature infants.
- Surgical patients: If given the morning of surgery, furosemide may render the patient volume depleted and blood pressure may be labile during general anesthesia.

DRUG INTERACTIONS

- Interacts with many drugs - contact pharmacy or specialised on-line references for more information

PREGNANCY

- Consult pharmacy or specialised on-line references for most recent information
- Administration of furosemide during pregnancy does not significantly alter amniotic fluid volume. Serum uric acid levels, which are increased in toxemia, are further elevated by furosemide. No association was found in a 1973 study between furosemide and low platelet counts in the neonate. Unlike the thiazide diuretics, neonatal thrombocytopenia has not been reported for furosemide. Cardiovascular disorders, such as pulmonary edema, severe hypertension, or congestive heart failure, are probably the only valid indications for this drug in pregnancy.

BREAST FEEDING

- Consult pharmacy or specialised on-line references for most recent information
- Furosemide is excreted into breast milk. No reports of adverse effects in nursing infants have been found. Thiazide diuretics have been used to suppress lactation.

REQUIREMENTS

- Electronic IV Infusion Device for continuous infusion or intermittent infusion of doses greater than 240 mg

RECOMMENDED

- Fluid balance, daily weights; serum electrolytes and creatinine, blood pressure, urine output and renal function
- Monitor for decreased hearing in high-risk patients, including patients: receiving large IV doses (greater than 120 mg); receiving other ototoxic drugs; with renal disease; uremic patients

Adverse Effects

CARDIOVASCULAR

- Orthostatic hypotension

CENTRAL NERVOUS SYSTEM

- Tinnitus and hearing loss, associated with rapid infusion of large doses (rates faster than 4 mg/minute and doses greater than 240 mg)

GASTROINTESTINAL

- Anorexia
- Constipation
- Cramping
- Diarrhea
- Nausea/vomiting

HEMATOLOGIC

- Hyponatremia
- Hypochloremic alkalosis
- Hypokalemia
- Hypomagnesemia
- Hypocalcemia
- Hyperglycaemia
- Glycosuria

Dosing

***As always follow physician's orders for your particular patient.**

ADULT

INITIAL

- 20 to 40 mg/dose; if response is not adequate, may repeat the same dose or increase dose in increments of 20 mg/dose and administer 2 hours after previous dose
- Maximum Single Dose: 200 mg/dose
- Maximum total Daily Dose: 600 mg/day
- Individually determined dose should then be given once or twice daily although some patients may initially require dosing as frequent as every 6 hours
- IV boluses of 1 to 2.5 times that of a patient's home oral dose furosemide (or equivalent) every 12 hours or over 24 hours as a continuous infusion have been recommended for acute heart failure

CONTINUOUS IV INFUSION

- Initial bolus dose 40 to 100 mg, followed by continuous infusion of 5 to 40 mg/hour; repeat loading dose before increasing infusion rate.
- If urine output is less than 1 mL/kg/hour, consider adjuvant diuretics

ACUTE PULMONARY EDEMA

- 40 mg/dose. If response not adequate within 1 hour, may increase dose to 80 mg
- Note: Minimal additional response is gained by single doses over 160 to 200 mg; Maximum: 200 mg/dose

NUCLEAR MEDICINE DIAGNOSTIC AID

- 0.5 mg/kg to max dose 40 mg

ELDERLY

INITIAL

- 20 mg/day; increase slowly to desired response

CONTINUOUS IV INFUSION

- Initial bolus dose 20 to 40 mg over 1 to 2 minutes, followed by continuous IV infusion doses of 5 to 20 mg/hour

PEDIATRIC

INITIAL

- 0.5 to 2 mg/kg/dose every 6 to 12 hours
- Maximum single dose: 2 mg/kg

CONTINUOUS INFUSION

- 0.1 to 0.5 mg/kg/hour

NUCLEAR MEDICINE DIAGNOSTIC AID

- 1 mg/kg to a Maximum dose of 20 mg

NEONATE

INITIAL

- 1 to 2 mg/kg/dose.

Dosing interval:

- every 24 hours in preterm infants
- every 12 hours in full-term infants
- up to every 6 hours in infants greater than 1 month

CONTINUOUS INFUSION

- 0.1 to 0.4 mg/kg/hour

RENAL IMPAIRMENT ADJUSTMENTS

- Higher initial doses are required in renal failure and are well tolerated
- Avoid use in oliguric states, creatinine clearance (GFR) less than 5 mL/minute

ACUTE OR CHRONIC RENAL FAILURE

- Initial dose required can range from 100 mg to 2 grams
- If large doses are required, give as an infusion, with doses individualised and titrated to maximum therapeutic effect
- Manufacturer recommends Maximum daily dose: 1 gram

HEPATIC IMPAIRMENT ADJUSTMENTS

- Diminished natriuretic effect with increased sensitivity to hypokalemia and volume depletion in cirrhosis; monitor effects, particularly with high doses

Route:

ADULT

Doses of 120 mg or less:

- Administer by Direct IV over 1 to 2 minutes

Doses greater than 120 mg:

- Administer by intermittent infusion Dilute dose in 50 mL D5W or NaCl mini bag
- Maximum rate: 240 mg/hour

Continuous Infusion

- Dilute 250 mg in 250 mL D5W or NS for a final concentration of 1 mg/mL
- Maximum rate: 240 mg/hour

PEDIATRIC

Direct IV

- Administer undiluted OR diluted with compatible IV fluid over 1 to 5 minutes
- Maximum rate: 0.5 mg/kg/minute OR 4 mg/minute whichever is less
- Maximum concentration: 10 mg/mL

Intermittent Infusion

- Standard Concentration: 2 mg/mL and 10 mg/mL
- Add 1 mL (10 mg/mL) to 4 mL SW for total of 5 mL = 2 mg/mL
- Infuse over 30 minutes (Range of 10 to 30 minutes)

Continuous Infusion

***See SK SMART Pump Program Parenteral Manual for Peds continuous infusion doses and infusion tables**

- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/furosemide.pdf

NEONATE

Direct IV

- Standard concentration: 2 mg/mL
- Add 1 mL (10 mg/mL) to 4 mL SW for total of 5 mL = 2 mg/mL
- Give over 5 minutes Maximum rate: 0.5 mg/minute
- Maximum concentration: 10 mg/mL

Intermittent Infusion

- Standard Concentration: 2 mg/mL
- Add 1 mL (10 mg/mL) to 4 mL SW for total of 5 mL = 2 mg/mL
- Infuse over 30 minutes (Range of 5 to 30 minutes)

Continuous Infusion

***See SK SMART Pump Program Parenteral Manual for Neonate continuous infusion doses and infusion tables**

- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/furosemide.pdf

Compatibility/Stability:

- Stable in D5W and NS solutions for 24 hours at room temperature
- Compatible with dextrose and saline solutions and LR and dextrose 5% in LR
- Do not use if solution is yellow

Provider:

- **EMR:** Not in scope of practice
- **PCP/ICP:** Not in scope of practice

- **ACP:** Monitor infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/furosemide.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/6959?cesid=9pJXkx0EnkM&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dfurosemide%26t%3Dname%26acs%3Dtrue%26acq%3Dfuros
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711494

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

Glycoprotein IIb/IIIa Inhibitors (Aggrastat, Integrilin) HIGH ALERT

Classification

- Antiplatelet – platelet aggregation inhibitor, Glycoprotein IIb/IIIa Inhibitor

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *Patients having acute coronary syndrome, MI or who may undergo percutaneoustransluminal coronary angioplasty (PCI).*
- *Indicated for the management of adult patients with non-ST-elevation acute coronary syndrome (NSTE-ACS) including patients who may subsequently undergo percutaneous coronary intervention (PCI) to decrease the rate of refractory ischemic conditions, new myocardial infarction and death*
- *Is intended for use in combination with anticoagulants (e.g. heparin) and other antiplatelet therapies, including acetylsalicylic acid (ASA)*

NON HEALTH CANADA APPROVED INDICATIONS BUT SUBSTANTIATED IN LITERATURE

- *Management of ST-elevation myocardial infarction*

Mechanism of Action

- Glycoproteins are receptor inhibitor drugs that prevent the binding of fibrinogen to platelets
- A reversible antagonist of fibrinogen binding to the glycoprotein (GP) IIb/IIIa receptor, the major platelet surface receptor involved in platelet aggregation. When administered intravenously, it inhibits ex vivo platelet aggregation in a dose- and concentration-dependent manner. When given according to the recommended regimen, greater than 90% inhibition is attained within 10 minutes after initiation. Platelet aggregation inhibition is reversible following cessation of the infusion.

Pharmacokinetics

- **Onset:** varies with drug; usually within 10 minutes
- **Peak:** varies with drug
- **Duration:** varies with drug; in ~90% of patients, ex vivo platelet aggregation returns to near baseline in 4 to 8 hours after discontinuation
- **Excreted** via the urinary system; Urine (65%) and feces (25%) primarily as unchanged drug

Contraindications

- Pt must be stable
- Not compatible for infusion with other medications.
- Hypersensitivity to any component of the formulation
- Patients with active or recent (within the previous 30 days) internal bleeding or a history of bleeding diathesis

- Patients with a history of intracranial hemorrhage or neoplasm, arteriovenous malformation, aneurysm or who had a stroke within 30 days prior to hospitalization or any history of hemorrhagic stroke
- Patients with a history, symptom or findings suggestive of aortic dissection, known coagulopathy, platelet disorder or history of thrombocytopenia
- Patients with malignant or severe uncontrolled hypertension (systolic blood pressure greater than 180 mmHg and/or diastolic blood pressure of greater than 110 mmHg), angina precipitated by obvious provoking factors (e.g. arrhythmia, severe anemia, hyperthyroidism or hypotension), acute pericarditis, active or known history of vasculitis or that have an intraaortic balloon pump
- Patients with acute pericarditis
- Patients who had a major surgical procedure or relevant trauma within the previous 6 weeks, or who had a recent epidural procedure
- Patients who are currently taking another GP IIb/IIIa inhibitor or developed thrombocytopenia following prior exposure to tirofiban any other GP IIb/IIIa inhibitor
- Patients with cirrhosis or clinically significant liver disease
- Clotting disturbances (e.g. prothrombin time greater than 1.3 time normal or INR greater than 1.5)

Cautions

- **HIGH ALERT**
- ELDERLY: Elderly patients receiving tirofiban with heparin or heparin alone had a higher incidence of bleeding in clinical trials. Caution must be used when using other drugs affecting hemostasis, which are commonly used in elderly.
- Other medications requiring IV infusion must be given at a second site
- Should be used with caution in patients with recent clinically relevant bleeding (less than 1 year), including a history of gastrointestinal bleeding or genitourinary bleeding of clinical significance. As well as puncture of a noncompressible vessel with 24 hours
- Should be discontinued immediately if circumstances arise that require emergency coronary artery bypass graft (CABG) operation, OR at least 4 hours prior to CABG surgery, whenever possible
- Use cautiously in patients with low platelet counts
- Severe acute or chronic heart failure, cardiogenic shock or cardiopulmonary resuscitation
- Patients receiving chronic hemodialysis
- Patients with mild to moderate liver insufficiency
- Concurrent administration of non-thienopyridines P2Y12 inhibitors, adenosine, dipyridamole, sulfinpyrazone, and prostacyclin
- Initial therapy for acute coronary syndrome (ACS) typically includes oral antiplatelet therapy (eg, aspirin plus a P2Y12 inhibitor) and an IV anticoagulant (eg, bivalirudin or heparin). A glycoprotein (GP) IIb/IIIa inhibitor is not routinely used due to limited benefit on ischemic outcomes and more bleeding complications. However, use may be considered in high-risk patients (eg, significant thrombus burden) when percutaneous coronary intervention (PCI) is planned.

DRUG INTERACTIONS

- Is not recommended in patients with concomitant use of drugs that increase the risk of bleeding to a relevant degree, including thrombolytics
- Use caution when used with other drugs that affect hemostasis (e.g., warfarin, ticlopidine)
- Cannot be administered in the same IV line as diazepam
- Serious/numerous drug interactions have been known occur
- For drug-drug compatibility contact pharmacy or specialised on-line references for most recent information

PREGNANCY

- Contact pharmacy or specialized online resources for most up to date information
- The primary risk, however, appears to be from maternal hemorrhage during drug administration. If this is adequately controlled, the benefits of the drug to the mother appear to far outweigh the unknown risks to the fetus.

BREAST FEEDING

- Contact pharmacy or specialized online resources for most up to date information
- The molecular weight (about 495), limited metabolism, and moderate plasma protein binding (65%) suggest that the drug will be excreted into breast milk, but the short half-life (2 hours) should limit excretion. The drug is commonly combined with heparin and sometimes with aspirin. The effect of this exposure on a nursing infant is unknown, as is its oral bioavailability. However, the safest course is to hold breastfeeding during the infusion.

Adverse Effects

HEMATOLOGIC

- Hemorrhage - minor or severe femoral artery access site, minor at other invaded or disturbed sites or severe involving GI, GU, oropharyngeal, or retroperitoneal bleeding may occur
- Thrombocytopenia - the platelet count should be monitored frequently

BLEEDING

- Mild mucosal or catheterization-site bleeding
- Gastro-intestinal
- Retro-peritoneal
- Intracranial
- Hemorrhoidal
- Post-operative bleeding
- Epidural hematoma in the spinal region
- Increased presence of urine and fecal occult blood
- Hemopericardium and pulmonary (alveolar) hemorrhage

HYPERSENSITIVITY

- Anaphylaxis

MISCELLANEOUS

MONITOR

- Vital Signs q 15 min
- Observe patient for signs of bleeding
- Patient must be hemodynamically stable

TREATMENT

- Pressure dressings can be used to manage minor bleeding. For severe bleeding prolonged mechanical pressure should be applied
- When bleeding cannot be controlled with pressure, discontinue the infusion and contact sending/receiving MD

Dosing

DOSE

- Individual doses may vary greatly. Institutional glycoprotein IIb/IIIa inhibitor protcols should be used whenever possible
- The rate of administration must be in writing and is not to be changed unless under the direction of a MD

Concentration Supplied:

- Glycoprotein IIB/IIIA inhibitor is added to IV solution by RN or MD prior to transport. Ensure the med sticker is affixed to the IV bag with the name of the glycoprotein inhibitor being infused and drip rate

Route:

- Must be administered by an IV pump

Provider:

- **EMR:** Not in Scope
- **PCP:** Not in Scope
- **ICP/ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- https://collegeofparamedics.sk.ca/wp-content/uploads/2019/11/Drug-Monographs-Final-v1.pdf
- http://online.lexi.com/lco/action/doc/retrieve/docid/allergy_f/1197279?cesid=9J0hhzWUJw7&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dglycoprotein%2Biib%252Fiiia%2Binhibitor%26t%3Dname%26acs%3Dtrue%26acq%3Dglycoprotein%2B2b
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5712109

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

Heparin HIGH ALERT/ELDER ALERT

Classification

- Anticoagulant

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- ***Anticoagulation:*** *Prophylaxis and treatment of thromboembolic disorders (e.g. venous thromboembolism, pulmonary embolism) and thromboembolic complications associated with atrial fibrillation; prevention of clotting in arterial and cardiac surgery; as an anticoagulant for extracorporeal circulation and dialysis procedures*

NON HEALTH CANADA APPROVED INDICATION BUT SUBSTANTIATED IN THE LITERATURE

- *Anticoagulant in several conditions in addition to those above, such as: Superficial vein thrombosis, patients with atrial fibrillation undergoing cardioversion, nonbacterial thrombotic endocarditis and systemic or pulmonary emboli, cerebral venous sinus thrombosis, acute arterial emboli or thrombosis, non-ST-elevation acute coronary syndrome, adjunct to fibrinolysis with ST-elevation myocardial infarction, bridge during oral anticoagulation interruption in those with valvular heart disease*

Mechanism of Action

- Potentiates the action of antithrombin III and thereby inactivates thrombin (as well as other coagulation factors IXa, Xa, XIa, XIIa, and plasmin) and prevents the conversion of fibrinogen to fibrin; heparin also stimulates release of lipoprotein lipase (lipoprotein lipase hydrolyzes triglycerides to glycerol and free fatty acids).

Pharmacokinetics

- **Onset:** IV Immediate
- **Peak:** 30 minutes
- **Duration:** 1 to 2 hours
- **Excreted** in urine (small amounts as unchanged drug); **Note:** At therapeutic doses, elimination occurs rapidly via non renal mechanisms. With very high doses, renal elimination may play more of a role

Contraindications

- Hypersensitivity to heparin or pork protein or any component of the formulation (except in life threatening situations) commercially available heparin is derived from porcine intestinal mucosa. Heparin derived from beef lung (Special Access Program) may be used in patients hypersensitive to heparin derived from pigs
- Severe thrombocytopenia; uncontrolled active bleeding except when due to disseminated intravascular coagulation
- History of heparin-induced thrombocytopenia (HIT) especially within 100 days of previous episode
- Some preparations contain sulfite which may cause allergic reactions.

Cautions

- **HIGH ALERT, ELDER ALERT**
- Elderly: increased risk of bleeding, especially in women over 60 years of age
- Any condition in which bleeding constitutes a substantial hazard or would be difficult to control because of its location, e.g. ulcer, renal calculus, or malignant neoplasm
- Disease states where risk of bleeding may be increased, i.e. subacute bacterial endocarditis, arterial sclerosis, aneurysm, severe hypertension, alcohol abuse
- Intermittent infusion is associated with more bleeding, continuous infusion preferred
- Febrile illness, infections associated with thrombosing tendencies, pulmonary embolism, myocardial infarction, extensive thrombotic disorders especially those associated with neoplastic disease and following surgery: possible increased resistance to heparin
- Avoid IM injections; avoid invasive procedures
- Hepatic, biliary or renal impairment
- Heparin resistance: Dose requirements greater than 35,000 units/24 hours to maintain a therapeutic aPTT may occur in patients with antithrombin deficiency, increased heparin clearance, elevations in heparin-binding proteins, and elevations in factor VIII and/or fibrinogen; frequently encountered in patients with fever, thrombosis, thrombophlebitis, infections with thrombosing tendencies, myocardial infarction, cancer, and in postsurgical patients; measurement of anticoagulant effects using anti-Factor Xa levels may be of benefit.
- Hepatic effects: Elevations in serum aminotransferases have been observed during therapy. These elevations should be evaluated with caution as they may occur and resolve in the setting of the underlying condition for which heparin is being used.
- Hypersensitivity reactions: Hypersensitivity reactions, including fever, chills, urticaria, asthma, rhinitis, lacrimation, and anaphylaxis, have been reported. In patients with a documented hypersensitivity reaction, heparin should only be considered in life-threatening situations when use of an alternative anticoagulant is not possible.
- Confirm the concentration of all heparin injection vials prior to administration; do not use heparin injection as a "catheter lock flush" as the injection is supplied in various concentrations including highly concentrated strengths. Fatal hemorrhages have occurred in pediatric patients when higher concentrations of heparin injection were confused with lower concentrations of heparin lock flush.

DRUG INTERATIONS

- Protamine sulphate neutralizes heparin activity.
- Interacts with many drugs – contact pharmacy for more information

PREGNANCY

- No reports linking the use of heparin during gestation with developmental toxicity have been located. Because heparin probably does not cross the placenta, other fetal complications are related to the severe maternal disease necessitating anticoagulant therapy.

BREASTFEEDING

- Heparin is not excreted into breast milk because of its high molecular weight (15,000). Moreover, it is not absorbed after oral administration.

MONITORING REQUIRED

- Observe patient for signs of bleeding (e.g. bleeding gums, bruises, petechiae, nosebleeds, tarry stools

MONITORING RECOMMENDED

- Baseline PTT, then every 4 to 6 hours after initial bolus and each dose adjustment until stabilization, then once daily at the same time of day
- Baseline CBC and platelet count, then every 2 to 4 days, frequency depending on risk factor for HIT

Adverse Effects

HEMATOLOGIC

- Hemorrhage - minor at invaded or disturbed sites or severe involving gastrointestinal, genitourinary, retroperitoneal or intracerebral sites may occur. For severe bleeding, discontinue infusion. Protamine sulphate neutralizes heparin activity. See protamine IV monograph
- Thrombocytopenia. Early, benign, reversible non-immune thrombocytopenia – platelets recover despite continued heparin. Late, more serious, IgG-mediated immune thrombocytopenia, associated with thrombotic complications. In heparin naïve patients' onset between 5 to 10 days, in those previously exposed to heparin onset may occur within 24 hours

HYPERSENSITIVITY

- Fever, chills and urticaria
- Asthma, conjunctivitis, rhinitis, angioedema and anaphylactoid reactions have occurred

MISCELLANEOUS

- Asymptomatic elevation of liver enzymes
- Itching or burning of the plantar surfaces of the feet

Dosing

DOSE

- Individual doses may vary greatly. Institutional heparin protocols should be used whenever possible
- See Parenteral manual for Infusion charts/tables https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/heparin.pdf

ADULT

TREATMENT OF VENOUS THROMBOEMBOLISM (DVT/PE)

- Initial anticoagulation: 80 units/kg (or alternatively 5000 units) bolus followed by an initial continuous infusion of 18 units/kg/hour (or alternatively 1000 units/hour) Adjust to target PTT of 1.5 to 2.5 times control

ACUTE CORONARY SYNDROMES

- ST-elevation myocardial infarction (STEMI)*:* Adjunct to fibrinolysis and non-ST-elevation acute coronary syndrome (NSTE-ACS)*:* Initial bolus of 60 units/kg (**Maximum**: 4000 units), then 12 units/kg/hour (**Maximum**: 1000 units/hour) as continuous infusion. Adjust to target PTT of 1.5 to 2 times control

CARDIOPULMONARY BYPASS

- Initial dose: 150 to 400 unit/kg depending on length of procedure. Subsequent doses titrated to maintain activated clotting time between 400 to 500 seconds

ELDERLY

- Patients greater than 60 years of age may have higher serum levels and clinical response (longer PTTs) as compared to younger patients receiving similar dosages. Lower dosages may be required

PEDIATRIC

SYSTEMIC HEPARINIZATION

- 75 unit/kg bolus (Maximum: 5000 units) followed by an initial continuous infusion of:
- 1 year or less: 28 unit/kg/hour.
- Older than 1 year: 20 unit/kg/hour.
- Adolescent: 18 unit/kg/hour
- Adjust rate in response to PTT values

PARENTAL NUTRITION ADDITIVE, VENOUS LINE PATENCY

- Central and peripheral: 0.5 to 1 unit/mL

PERIPHERAL ARTERIAL CATHETERS

- Continuous infusion of 5 units/mL

NEONATE

- 75 units/kg bolus. Maintenance: 28 units/kg/hour as continuous infusion. Adjust rate in response to anti-Xa or aPTT values

PARENTAL NUTRITION ADDITIVE, VENOUS LINE PATENCY

- Central and peripheral: 0.5 to 1 unit/mL

ARTERIAL CATHETERS

- Peripheral and umbilical continuous infusion of 0.5 to 1 units/mL

MISCELLANEOUS

- IM injection (especially in the arm or thigh) and shallow subcutaneous injection is not recommended. Duration of effect is shortened and is more likely to produce pain and hematoma
- Deep subcutaneous injection; use of a 1 mL tuberculin syringe with a No. 25 or No. 26 - ½ inch needle is recommended
- Heparin is available in vials, pre-mixed bags, and single dose pre-filled syringes

Reconstitution

- None required

Compatibility/Stability

- Compatible with dextrose, saline, dextrose-saline combinations, Ringer's and lactated Ringer's solution
- Commercially prepared premixed solutions are stable in outer wrap until labelled expiry date
- For drug-drug compatibility, consult pharmacy or specialised on-line references
- B-braun product guide states heparin solution and intravenous administration apparatus need to be replaced at least once every 24 hours
- See specific product guide when using other than B-braun pre-mixed heparin

Concentration Supplied:

- 25 000 units in 500 mL

Provider/Route:

- **EMR:** Not in Scope
- **PCP/ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/heparin.pdf
- https://online-lexi-com.shal.idm.oclc.org/lco/action/doc/retrieve/docid/patch_f/7022?cesid=4u1z8LVoTAn&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dheparin%26t%3Dname%26acs%3Dfalse%26acq%3Dheparin#

Development – July 2023
Update – June 2025

Saskatchewan Health Authority

EMS Provincial Inter-facility Transfer Medications

Insulin/HumuLIN HIGH ALERT

Classification

- Antidiabetic agent

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *Emergency treatment of diabetic coma and pre-coma, and in diabetics undergoing surgery*

NON HEALTH CANADA APPROVED INDICATION BUT SUBSTANTIATED IN THE LITERATURE

- *Hyperglycemia during critical illness, cadaveric organ recovery (hormonal resuscitation)*
- *Adjunct of parenteral nutrition; diabetic ketoacidosis (DKA); hyperkalemia; hyperosmolar hyperglycemic state (HHS)*
- *Diagnostic testing: insulin tolerance test*
- *Treatment of calcium channel blocker or beta blocker overdose/toxicity*

Mechanism of Action

- Insulin acts via specific membrane-bound receptors on target tissues to regulate metabolism of carbohydrate, protein, and fats. Target organs for insulin include the liver, skeletal muscle, and adipose tissue.
- Within the liver, insulin stimulates hepatic glycogen synthesis. Insulin promotes hepatic synthesis of fatty acids, which are released into the circulation as lipoproteins. Skeletal muscle effects of insulin include increased protein synthesis and increased glycogen synthesis. Insulin stimulates lipoprotein lipase synthesis and activity; this results in hydrolysis of triglycerides into free fatty acids and storage of free fatty acids in adipocytes, thereby reducing circulating triglyceride levels. In addition, insulin stimulates the cellular uptake of amino acids and increases cellular permeability to several ions, including potassium, magnesium, and phosphate. By activating sodium-potassium ATPases, insulin promotes the intracellular movement of potassium.
- Normally secreted by the pancreas, insulin products are manufactured for pharmacologic use through recombinant DNA technology using either *E. coli* or *Saccharomyces cerevisiae*. Regular insulin has an identical structure to that of native human insulin. Insulins are categorized based on the onset, peak, and duration of effect (e.g. rapid-, short-, intermediate-, and long-acting insulin). Insulin regular is a short-acting insulin analog.
- The benefit of hyperinsulinemia-euglycemic therapy (HIET) in patients experiencing toxicity secondary to a calcium channel blocker (CCB) or beta blocker is not fully understood. It is hypothesized HIET improves myocyte glucose uptake and utilization; insulin may also act directly as a concentration-dependent inotrope. Exogenous insulin administration may help to overcome the hypoinsulinemia caused by CCB-induced blockage of L-type calcium channels in pancreatic beta cells.

Pharmacokinetics

- **Onset:** varies with formulation; IV ~10 to 21 minutes
- **Peak:** varies with formulation; IV ~5 hours
- **Duration:** varies with formulation; IV 1.5 hours after stopping infusion
- **Excreted** in urine (small amounts as unchanged drug); **Note:** At therapeutic doses, elimination occurs rapidly via non renal mechanisms. With very high doses, renal elimination may play more of a role

Contraindications

- Hypersensitivity to regular insulin or any component of the formulation
- During episodes of hypoglycemia
- Insulin tolerance test is contraindicated in patients with seizure disorders, coronary heart disease, and cardiac failure

Cautions

- **HIGH ALERT**
- Do not stop insulin infusion abruptly, e.g. before sending patient to surgery, ensure subsequent therapy is ordered
- Hyper- or hypoglycemia may result from changes in insulin strength, manufacturer, type, and/or administration method. The most common adverse effect of insulin is hypoglycemia. The timing of hypoglycemia differs among various insulin formulations. Hypoglycemia may result from changes in meal pattern (eg, macronutrient content, timing of meals), changes in the level of physical activity, increased work or exercise without eating, or changes to coadministered medications. Use of long-acting insulin preparations (eg, insulin degludec, insulin detemir, insulin glargine) may delay recovery from hypoglycemia. Patients with renal or hepatic impairment may be at a higher risk. Symptoms differ in patients and may change over time in the same patient; awareness may be less pronounced in those with long-standing diabetes, diabetic nerve disease, patients taking beta-blockers, or in those who experience recurrent hypoglycemia. Profound and prolonged episodes of hypoglycemia may result in convulsions, unconsciousness, temporary or permanent brain damage, or even death. Insulin requirements may be altered during illness, emotional disturbances, or other stressors. Instruct patients to use caution with ethanol; may increase risk of hypoglycemia.
- Severe, life-threatening, generalized allergic reactions, including anaphylaxis, may occur. If hypersensitivity reactions occur, discontinue therapy, treat the patient with supportive care and monitor until signs and symptoms resolve.
- Hypokalemia: Insulin (especially IV insulin) causes a shift of potassium from the extracellular space to the intracellular space, possibly producing hypokalemia. If left untreated, hypokalemia may result in respiratory paralysis, ventricular arrhythmia, and even death. Use with caution in patients at risk for hypokalemia (eg, loop diuretic use). Monitor serum potassium frequently with IV insulin use and supplement potassium when necessary.
- Cardiac disease: Concurrent use with peroxisome proliferator-activated receptor (PPAR)-gamma agonists, including thiazolidinediones, may cause dose-related fluid retention and lead to or exacerbate heart failure, particularly when used in combination with insulin. If PPAR-gamma agonists are prescribed, monitor for signs and symptoms of heart failure. If heart failure develops, consider PPAR-gamma agonist dosage reduction or therapy discontinuation.
- Hepatic impairment: Use with caution in patients with hepatic impairment; increased risk of hypoglycemia. Dosage requirements may be reduced and patients may require more frequent dose adjustment and glucose monitoring.
- Renal impairment: Use with caution in patients with renal impairment; increased risk of hypoglycemia. Dosage requirements may be reduced and patients may require more frequent dose adjustment and glucose monitoring.

- **Do not administer concentrated U-500 regular insulin or mixtures of insulin formulations IV.** Do not use if solution is viscous or cloudy; use only if clear and colorless. U-100 regular insulin may be administered IV with close monitoring of blood glucose and serum potassium; appropriate medical supervision is required. **Note:** A 100 units/100 mL premixed solution is also available for IV infusion.
- IV infusions: To minimize insulin adsorption to plastic IV tubing: Insulin loss will occur by adsorption to plastic (ie, PVC, polyethylene, polyolefin, polypropylene) IV containers and tubing. Therefore, flush the IV tubing with a priming infusion of 20 mL from the insulin infusion, whenever a new IV tubing set is added to the insulin infusion container.
- High-dose insulin therapy (for treating calcium channel blocker or beta-blocker toxicity): *U-100 regular insulin:* Administer as a continuous IV infusion. Additional precautions should be implemented to ensure accurate infusion pump settings, with particular attention to infusion concentration required. Refer to institution-specific protocols where appropriate.

DRUG INTERACTIONS

- Many drugs have an effect on blood glucose concentrations and may alter insulin requirements
- Non selective beta-adrenergic blocking agents, e.g. propranolol, may mask certain symptoms of developing hypoglycemia

PREGNANCY

- Insulin, a naturally occurring polypeptide hormone, is the drug of choice for the control of diabetes mellitus in pregnancy.

BREASTFEEDING

- Insulin is a naturally occurring constituent of the blood and is excreted into breast milk. In a 2012 study, milk samples were obtained from breastfeeding mothers, five without diabetes, four with type 1 diabetes, and five with type 2 diabetes. Samples were analyzed for total and endogenous insulin and for c-peptide. The type 1 diabetics were treated with artificial insulin (aspart plus glargine), whereas the type 2 diabetics received a diabetic diet either with (N = 3) or without (N = 2) metformin. Insulin was present in all of the samples, but only artificial insulin was detected in the milk of type 1 diabetics. The results showed that insulin, both endogenous and exogenous, is actively transported from the blood into milk and is protected from degradation and, presumably, has a functional or developmental role in the infant. If so, the authors suggested, it might be beneficial for formula-fed infants if insulin was added to formula milk.

REQUIREMENT

Continuous Infusion

- Non-DEHP, Non-PVC administration set. Should the administration set contain DEHP or PVC, insulin will adhere to the tubing. Prime tubing with the insulin to be infused and let dwell/stand for 20 to 30 minutes. When dwell time is complete, flush an additional 20 mL of the insulin infusion while detached from the patient and discard. Start infusion immediately after this process. This is to be done with each new large volume administration tubing set that contains DEHP or PVC. Infusion can be started without any dwell time.

MONTORING REQUIRED

Continuous Infusion

- Monitor blood glucose as per indication-specific insulin protocol when appropriate

MONITORING RECOMMENDED

- Check blood glucose at any time if symptoms of (or concerns of) hypoglycemia as per regional guideline
- Additional monitoring will vary depending on indication for use and severity of clinical condition
- Serum potassium at baseline and during treatment as clinically indicated
- Vital signs, arterial blood gases (initial), venous pH, CBC with differential, urinalysis, serum glucose, BUN, creatinine, electrolytes, calcium, magnesium, phosphate, anion gap, fluid status, blood β-hydroxybutyrate (BOHB) concentration; neurological observations; mental status.

Adverse Effects

CARDIOVASCULAR

- Peripheral edema

HEMATOLOGIC

- Hypoglycemia. Refer to regional hypoglycemia guidelines. If patient is conscious carbohydrates can be given orally. If patient is unconscious, IV glucagon or dextrose may be required
- Hypokalemia

HYPERSENSITIVITY

- Local reactions: Erythema and pruritus at injection site

Dosing

DOSE

- **Refer to institution-specific protocols where appropriate**
- **Refer to the parenteral manual for infusion charts/tables**
  https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/insulin%20-%20regular.pdf

ADULT/ELDERLY

HYPERGLYCEMIC CRISIS IN DIABETES (DKA, HHS)

- Correct potassium deficit prior to initiating low dose insulin infusion
- Initial IV loading dose 0.1 units/kg (optional), followed by 0.1 units/kg/hour infusion titrated to blood glucose

HYPERGLYCEMIA – CRITICALLY ILL

- Initiate therapy when blood glucose is greater than 10 mmol/L with a goal to maintain blood glucose between 6 to 10 mmol/L

CADAVERIC ORGAN RECOVERY (HORMONAL RESUSCITATION)

- Initiate therapy when blood glucose is greater than 10 mmol/L with a goal to maintain blood glucose between 7 to 10 mmol/L

HYPERKALEMIA – MODERATE TO SEVERE

- 50 mL D50W over 5 minutes followed by 10 units regular insulin IV push over seconds (or 10 units regular insulin mixed with 25 g dextrose (50 mL D50W) given over 15 to 30 minutes)
- Effects on potassium are temporary. As appropriate, consider methods of enhancing potassium removal/excretion

INSULIN TOLERANCE TEST

- 0.1 to 0.15 units/kg
- 0.1 unit/kg is preferred if pituitary or adrenal insufficiency is suspected

CALCIUM CHANNEL BLOCKER AND/OR BETA BLOCKER OVERDOSE/TOXICITY

- Contact Poison and Drug Information Service (PADIS) at 1-866-454-1212 for complete information regarding dosing

PEDIATRIC

HYPERGLYCEMIC CRISES IN DIABETES (DKA, HHS)

- Infusion: 0.05 to 0.1 units/kg/hour
- Loading dose no longer recommended

HYPERGLYCEMIA

- 0.1 to 0.2 units/kg/hour
- Infusion rate is further adjusted according to blood glucose determinations

SEVERE HYPERKALEMIA WITH ECG CHANGES

- **Children less than 50 kg:** dextrose 500 mg/kg (2 mL/kg **D25W**) followed by insulin 0.1 units/kg IV push
- **Children 50 kg or greater:** dextrose 500 mg/kg (1 mL/kg D50W) followed by insulin 0.1 units/kg IV push

INSULIN TOLERANCE TEST

- 0.1 units/kg; round up dose to nearest half-unit

NEONATE

HYPERGLYCEMIA

- Start infusion at 0.05 units/kg/hour
- Titrate infusion to maintain blood glucose concentrations between 7 to 10 mmol/L

SEVERE HYPERKALEMIA WITH ECG CHANGES

- Start insulin infusion with concomitant dextrose infusion to maintain euglycemia (maintain a 1:4 ratio of insulin to dextrose, e.g. 1 unit of insulin: 4 grams of dextrose)
- Start infusion at 0.05 units/kg/hour (use standard concentration 0.1 unit/mL in NS) plus D10W 2 mL/kg/hour (200 mg/kg/hour) by continuous infusions
- May increase insulin to 0.1 unit/kg/hour and D10W to 4 mL/kg/hour (400 mg/kg/hour)
- Run separate D10W and insulin infusions to simplify adjustment of infusion rate of either D10W or insulin in response to hyperglycemia or hypoglycemia

RENAL IMPAIRMENT ADJUSTMENTS

- Creatinine Clearance (mL/minute)
    - Greater than 50 – Dose - 100%
    - 10 to 50 – Dose - 75%
    - Less than 10 – Dose – 50%

HEPATIC IMPAIRMENT ADJUSTMENTS

- Dosage requirements may be reduced and patients may require more frequent dose adjustment and glucose monitoring

HEMO/PERITONEAL DIALYSIS

- Not dialysed. No supplement required for either hemodialysis or CAPD. Diabetic patients receiving IDPN, may require a supplemental insulin dose

Concentration Supplied:

- Must first dilute insulin regular to 1 unit/mL
    - Add 0.5 mL (50 units) of insulin regular (100 units/mL) to 49.5 mL of D5W or NS for a total volume of 50 mL and final concentration of 1 unit/mL

COMPATIBILITY/STABILITY

- Do not use solution if cloudy, discoloured, or unusually viscous
- Vial in use may be stored at room temperature for 28 days
- Compatible with D5W and NS. Stability for 24 hours at room temperature is assumed
- Because of insulin adsorption to plastic IV tubing or infusion bags, actual amount of insulin being administered via IV infusion could be substantially less than apparent amount. Therefore, adjustment of **infusion rate should be based on effect and not solely on apparent insulin dose**. Apparent dose may be used as a starting point for determining subsequent subcutaneous dosing regimen
- For drug-drug compatibility contact pharmacy or specialised on-line references for most recent information

Route:

- Can be given IM and subcutaneously

Provider:

- **EMR:** Not in Scope
- **PCP/ICP:** Not in Scope
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Childrens Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/insulin%20-%20regular.pdf#search=insulin
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/320101?cesid=0Iyanjq7qSE&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dinsulin%2Bregular%26t%3Dname%26acs%3Dtrue%26acq%3DInsul
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711578

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EMS Provincial Inter-facility Transfer Medications

IV ANTIMICROBIALS

Classification

- Antimicrobials

Indications

EMS INDICATIONS

- Monitor infusion only

HEALTH CANADA APPROVED

- *Kill or prevent the replication of microbes in an infected host*

Contraindications

- Any specific to the antimicrobial being administered.

Cautions

- The majority of antimicrobial can be administered over 10 to 15 minutes, so will seldom need to be infused during inter-facility transfer
- A dosage sticker must be affixed to the IV mini-bag
- An infusion control device at a predetermined rate according to the local pharmacy protocol must be used

Adverse Effects

CENRTRAL NERVOUS SYSTEM

- Photosensitivity
- Dizziness
- Headache

RESPIRATORY

- Cough
- Anaphylactic shock (difficulty swallowing, swelling of the tongue, throat or lips, etc.)

GASTROINTESTINAL

- Nausea/vomiting
- Diarrhea
- Bloating
- Constipation

GENITOURINARY

- Yeast infection

Dosing

- The majority of antimicrobial can be administered over 10 to 15 minutes, so will seldom need to be infused during inter-facility transfer
- A medication label must be affixed to the IV mini-bag stating medication and concentration
- Document route, medication, concentration, infusion rate and time of completion on PCR.
- Bolus IV antimicrobial therapy is only permitted in the pre-hospital setting when treating severe sepsis/septic shock.

Concentration Supplied:

- Various preparations

Provider/Route:

- **EMR:** Not in scope of practice
- **PCP/ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- https://collegeofparamedics.sk.ca/wp-content/uploads/2019/11/Drug-Monographs-Final-v1.pdf
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/cefTRIAXone.pdf

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EMS Provincial Inter-facility Transfer Medications

Ketamine/Ketalar HIGH ALERT

Classification

- Anesthetic – general

Indications

EMS INDICATIONS

- Monitor Infusion only

SHA EMS Medical Direction Note:

- Not to be used for first line pain management

HEALTH CANADA APPROVED

- *Induction and maintenance of anaesthesia*

NON HEALTH CANADA APPROVEINDICATIONS BUT SUBSTANTIATED IN THE LITERATURE

- *Dissociative sedation prior to painful and frightening procedures*
- *Symptomatic relief of moderate to severe pain*
- *Adjunctive therapy for severe status asthmaticus, adjunctive 4th line therapy for refractory status epilepticus*
- *Adjunctive therapy for refractory status epilepticus after conventional therapies have failed*
- *Sedation/analgesia in mechanically ventilated patients in Critical Care*
- *Treatment resistant depression*

Mechanism of Action

- Produces a cataleptic-like state in which the patient is dissociated from the surrounding environment by direct action on the cortex and limbic system. Ketamine is a non-competitive NMDA receptor antagonist that blocks glutamate

Pharmacokinetics

- **Onset: IV:** ANESTHETIC EFFECT: Within 30 seconds
- **Peak**: **IV:** Not listed
- **Duration: IV:** ANESTHETIC EFFECT: 5 to 10 minutes; RECOVERY: 1 to 2 hours
- **Excretion:** Urine (91%); feces (3%)

Contraindications

- Hypersensitivity to ketamine or any component of the formulation
- Conditions where a significant elevation of blood pressure is hazardous (e.g. patients with poorly controlled hypertension, aneurysms, acute right- or left-sided heart failure, angina, recent myocardial infarction)
- Infants less than 3 months of age; known or suspected schizophrenia (even if currently stable or controlled with medications)

Cautions

- **HIGH ALERT**
- Patients with mild-to-moderate hypertension, chronic congestive heart failure, tachyarrhythmias, or myocardial ischemia
- History of psychosis or substance use (schizophrenia, acute psychosis); increased incidence of emergence symptoms
- Age less than 3 months, due to an increased frequency of airway complication
- Acute intermittent porphyria, glaucoma or elevated intraocular pressure, globe injuries
- Hyperthyroidism or patients receiving thyroid replacement (increased risk of hypertension, tachycardia)
- Pulmonary or upper respiratory infection; ketamine sensitises the gag reflex, potentially causing laryngospasm
- Intracranial mass lesions, presence of head injury, hydrocephalus; may increase ICP
- Some consider the use of ketamine in patients with CNS masses, CNS abnormalities, or hydrocephalus a relative contraindication due to multiple reports that ketamine may increase intracranial pressure in these patients; use caution, especially at higher doses. However, assuming adequate ventilation, some evidence suggests that ketamine has minimal effects on intracranial pressure and may even improve cerebral perfusion and reduce intracranial pressure.
- Recurrent use (eg, abuse/misuse, medically supervised unapproved use) may cause hepatobiliary dysfunction (usually a cholestatic pattern) and biliary duct dilatation with or without evidence of biliary obstruction.
- May cause CNS depression, which may impair physical or mental abilities; patients must be cautioned about performing tasks that require mental alertness (eg, operating machinery, driving). When used for outpatient surgery, the patient should be accompanied by a responsible adult. Driving, operating hazardous machinery, or engaging in hazardous activities should not be undertaken for greater than or equal to 24 hours after anesthesia, according to the manufacturer.

DRUG INTERACTIONS

- CNS depressants including benzodiazepines; will prolong recovery time and may increase risk of apnea
- Is a substrate of cytochrome P450 isoenzymes CYP2B6 (major), CYP2C9 (major), CYP3A4 (major); Interacts with many drugs - contact pharmacy for more information. Review drug profile at time of initiation and with any change in medication regimen

PREGNANCY

- Although ketamine anesthesia close to delivery may induce dose-related, transient toxicity in the newborn, these effects are usually avoided with the use of lower maternal doses. No reports of malformations in humans or in animals attributable to ketamine have been located. Experience with the anesthetic agent during human organogenesis apparently has not been published.

BREASTFEEDING

- Because ketamine is a general anesthetic agent, breastfeeding would not be possible during use of the drug, and no reports have been located that measured the amount of the agent in milk. The elimination half-life of ketamine has been reported to be 2.17 hours in unpremedicated patients. Thus, the drug should be undetectable in the mother's plasma approximately 11 hours after a dose. Nursing after this time should not expose the infant to pharmacologically significant amounts of ketamine.

Adverse Effects

CARDIOVASCULAR

- Increased heart rate
- Elevated blood pressure. Elevation of BP begins shortly after injection, reaches a maximum within a few minutes and usually returns to baseline values within 15 minutes of injection
- Hypotension
- Arrhythmia
- Bradycardia

CENTRAL NERVOUS SYSTEM

- Elevation of intracranial and intraocular pressures

GASTROINTESTINAL

- Vomiting – occurs late in recovery phase

RESPIRATORY

- Moderate and transient (less than 30 seconds) respiratory depression
- Hypersalivation and increased tracheobronchial secretions
- Severe respiratory depression is associated with an over dosage or too rapid a rate of administration. Mechanical support of respiration is preferred to administration of analeptics

MISCELLANEOUS

- Emergence reaction; characterised by vivid dreams, dissociative or extracorporeal (out-of-body) experiences, floating sensations, hallucinations, delirium, confusion, or "weird trips". Generally subsides within a few hours. More common in those between 15 to 45 years of age, rapid IV administration and females. Pre-administration of a benzodiazepine may help to diminish incidence
- Self-limiting rash
- Random movement of head and extremities
- Rigidity
- Skeletal muscle hypertonicity

Dosing

ADULT/ELDERLY

ADJUNCT TO ANALGESIA

- Bolus: 0.125 to 0.25 mg/kg, repeated until adequate analgesia.
- Maximum single dose: to be administered by RN is 0.25 mg/kg
- Doses must be spaced at least 10 minutes apart
- If more than 5 doses are required per hour contact physician for reassessment

DISSOCIATIVE SEDATION

- Pre-administration of a benzodiazepine recommended to avoid or minimize emergence reactions
- Bolus: 1 to 1.5 mg/kg over 2 to 3 minutes
- **Continuous infusion** of 0.3 to 1.2 mg/kg/hour (5 to 20 mcg/kg/minute)

CONTUNUOUS INFUSION

SEVERE EXACERBATION OF ASTHMA:

- Bolus (optional): 0.5 to 1 mg/kg
- **Continuous infusion** 0.15 to 2.5 mg/kg/hour

REFRACTORY STATUS EPILEPTICUS:

- Bolus: 0.9 to 3 mg/kg
- **infusion rates** ranging from 0.3 to 5.8 mg/kg/hour have been used

DEPRESSIVE EPISODE ASSOCIATED WITH MAJOR DEPRESSIVE DISORDER (unipolar), TREATMENT REFRACTORY (Off label use)

- Standard/Maximum Dose: 0.5mg/kg
- IV: 0.5 mg/kg twice weekly as an IV infusion
- Treatment up to 6 weeks has been studied

PEDIATRIC

- Pre-administration of a benzodiazepine recommended to avoid or minimize emergence reactions
- Individualize dose and titrate to effect. May be used in combination with anticholinergic agents to decrease hypersalivation.

PROCEDURAL SEDATION

- Usually 0.5 to 2 mg/kg is used for nonsurgical procedures

ADJUNCT to INTUBATION

- 1 to 2 mg/kg

SEVERE BRONCOSPASM

- bolus dose of 0.5 to 2mg/kg followed in some patients by continuous infusion of 0.3 to 3.6 mg/kg/hour

NEONATE PROCEDURAL SEDATION/ANALGESIA

- Limited data available: 0.5 to 2 mg/kg/dose

RENAL IMPAIRMENT ADJUSTMENTS

- Only small amounts of ketamine are excreted unchanged in the urine and its duration of action is not prolonged in the presence of decreased renal function
- Dose adjustments do not appear warranted in renal insufficiency

HEPATIC IMPAIRMENT ADJUSTMENTS

- Ketamine is metabolised in the liver and hepatic clearance is required for termination of clinical effects
- Prolonged duration of action may occur in patients with cirrhosis or other type of liver impairment; dose reductions should be considered in these patients

Route:

ADULT

INTERMITTENT INFUSION

PSYCHIATRIC/ANESTHESIA INDICATIONS:

- Dilute dose in 50 mL of D5W or NS Infuse over a minimum of 60 minutes

PSYCHIATRIC INDICATIONS:

- Dilute dose in 250 mL of D5W or NS Infuse over a minimum of 30 minutes

CRITICAL CARE INDICATIONS:

- Dilute 200 mg in 100 mL of D5W or NS
- Dilute 1000 mg in 500 mL of D5W or NS

NON-CRITICAL CARE INDICATIONS

- Dilute 100mg in 100mL of D5W or NS

PEDIATRIC

***See SK SMART Pump Program Parenteral Manual for Peds doses and infusion tables**

- **https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/ketamine.pdf**

REQUIREMENTS

INTERMITTENT INFUSION:

- Electronic IV Infusion Device

ADULT

- Doses less than 0.25 mg/kg: no further requirements
- Adult doses 0.25 mg/kg to 1.5 mg/kg: intubated patient or if patient not intubated, physician with airway management skills to be immediately available to manage airway complications

PEDIATRIC

- Doses 2 mg/kg or less: intubated patient or if patient not intubated, physician with airway management skills to be immediately available to manage airway complications

CONTINUOUS INFUSION:

- Electronic IV Infusion Device
- Continuous infusion requires either an intubated patient or a physician with airway management skills who must be immediately available to manage airway complications

MONITORING REQUIRED

ADULT

INTERMITTENT INFUSIONS

- Baseline: BP, HR, RR, oxygen saturation, sedation scale

CONTINUOUS INFUSION

- Doses 0.25 mg/kg to 1.5 mg/kg: Blood pressure, heart rate, respiratory rate, oxygen saturation, and sedation scale at 5 and 15 minutes post dose
- NOTE: Doses 0.5 mg/kg or less, patient should remain fully orientated and readily rousable at all times

PEDIATRIC

- Doses 2 mg/kg or less: Continuous pulse oximetry and ECG monitoring until recovery is well established

CONTINUOUS INFUSION

- Continuous monitoring of oxygen saturation
- At the start of infusion and with each dose change: baseline BP, HR, RR, oxygen saturation, sedation scale at 5 and 15 minutes post dose

RECOMMENDED

- Monitor for emergence symptoms
- Monitor cardiac function in patients with increased blood pressure or cardiac decompensation
- Monitor continuous oxygen saturation in high-risk patients (i.e. airway instability, severe obstructive sleep apnea, severe renal or hepatic disease, home oxygen use)

MISCELLANEOUS

- IV - onset of action; immediate. Recovery period typically 1 to 2 hours
- May be given IM. Onset of action: 3 to 4 minutes
- When given IM follow requirements and required monitoring as for IV administration
- Can be given subcutaneously and intranasal

Concentration Supplied:

- 50 mg/mL (10 mL vial)

COMPATIBILITY/STABILITY

- Compatible with D5W and normal saline solutions
- Stability for 24 hours at room temperature is assumed
- Compatible in a syringe with atropine or glycopyrolate

Provider/Route:

- **EMR:** Not in scope of practice
- **PCP/ICP:** Not in scope of practice
- **ACP:** Monitor infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/ketamine.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/7135?cesid=9VQ2TRoj7Zw&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dketamine%2Bdrip%26t%3Dname%26acs%3Dtrue%26acq%3Dketam
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711620

Development – July 2023
Update – June 2025

EMS Provincial Medications

LORazepam/Ativan HIGH ALERT

Classification

- Benzodiazepine

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *To produce sedation, anterograde amnesia and relief of anxiety*
- *Management of status epilepticus*

NON HEALTH CANADA APPROVED BUT SUBSTANTIATED IN THE LITERATURE

- *Treatment of acute alcohol withdrawal*

Mechanism of Action

- Short-to-intermediate-acting benzodiazepine (based on half-life). Binds to stereospecific benzodiazepine receptors on the postsynaptic GABA neuron at several sites within the central nervous system, including the limbic system, reticular formation. Enhancement of the inhibitory effect of GABA on neuronal excitability results by increased neuronal membrane permeability to chloride ions. This shift in chloride ions results in hyperpolarization (a less excitable state) and stabilization. Benzodiazepine receptors and effects appear to be linked to the GABA-A receptors. Benzodiazepines do not bind to GABA-B receptors.

Pharmacokinetics

- **Onset:** 10 to 20 minutes depending on route
- **Duration:** ~6 to 8 hours
- **Elimination:** Urine (~88%; predominantly as inactive metabolites); feces (~7%)

Contraindications

- Hypersensitivity to LORazepam, other benzodiazepines, or any component of formulation
- Untreated acute narrow-angle glaucoma, severe respiratory insufficiency (except during mechanical ventilation)
- Hypersensitivity to polyethylene glycol, propylene glycol, or benzyl alcohol; sleep apnea; intra-arterial injection; use in premature infants; severe respiratory insufficiency (except during mechanical ventilation)
- Myasthenia gravis: listed as a contraindication by manufacturer and Canadian labelling

Cautions

- **HIGH ALERT IV only**
- Elderly: more sensitive to therapeutic and adverse effects (e.g. ataxia, dizziness, over sedation)
- Use with extreme caution in patients who are at risk of falls; benzodiazepines have been associated with falls and traumatic injury.
- If a benzodiazepine is indicated, lorazepam may be a preferred agent to use in older adult patients because it is relatively short-acting with an inactive metabolite
- Reduce dose or avoid use in patients receiving opioids or with significant chronic disease (e.g. respiratory compromise, COPD, sleep apnea syndrome, and the very young). Avoid use in patients with a history of substance use, misuse of medications, or depression, except for acute or emergency situations (e.g. acute agitation, status epilepticus)
- Concomitant use of benzodiazepines and opioids may result in profound sedation, respiratory depression, coma, and death
- Sleep-related activities: Hazardous sleep-related activities, such as sleep-driving, cooking and eating food, and making phone calls while asleep, have been noted with benzodiazepines.
- Avoid use in patients with depression because of concerns about worsening mood symptoms, particularly if suicidal risk may be present, except for acute or emergency situations (eg, acute agitation, status epilepticus).
- Use with caution in patients with hepatic impairment, insufficiency, and/or encephalopathy. Dose adjustment (lower doses) may be needed. May worsen hepatic encephalopathy.
- Use with caution in patients with renal impairment.
- Counsel patients at increased risk on proper use and monitoring for signs and symptoms of abuse, misuse, and substance use disorder. Institute early treatment or refer patients in whom substance use disorder is suspected. Limit dosages and durations to the minimum required.
- Does not have analgesic, antidepressant, or antipsychotic properties. Status epilepticus should not be treated with injectable benzodiazepines alone; requires close observation and management and possibly ventilatory support. When used as a component of preanesthesia, monitor for heavy sedation and airway obstruction; equipment necessary to maintain airway and ventilatory support should be available.
- Lorazepam is a short half-life benzodiazepine. Duration of action after a single dose is determined by redistribution rather than metabolism. Tolerance develops to the sedative, hypnotic, and antiseizure effects. It does not develop to the anxiolytic effects. Chronic use of this agent may increase the perioperative benzodiazepine dose needed to achieve desired effect.
- Use with caution in neonates, especially in preterm infants; several cases of neurotoxicity and myoclonus (rhythmic myoclonic jerking) have been reported.

PREGNANCY

- LORazepam and its metabolite cross the human placenta
- Consult pharmacy or specialised on-line references for most recent information
- Lorazepam is a benzodiazepine indicated for the treatment of status epilepticus and as a preanesthetic sedative. One report found a significant association with anal atresia. When used close to delivery, “floppy infant” syndrome and neonatal withdrawal have been reported. The long-term effects of in utero exposure on neurobehavior, especially when the exposure occurs in the latter half of pregnancy, have not been studied but are of concern.

BREASTFEEDING

- In 2001, the American Academy of Pediatrics classified the effects of lorazepam on the nursing infant as unknown but may be of concern if exposure is prolonged. The most common adverse reactions observed in adults are sedation, dizziness, weakness, and unsteadiness. If a woman is receiving this drug while breastfeeding, her nursing infant should be monitored for these effects.

DRUG INTERACTIONS

- Additive CNS effects with phenothiazines, narcotic analgesics, barbiturates, alcohol, antidepressants, scopolamine, and MAO inhibitors
- Flumazenil may cause withdrawal in patients receiving long-term benzodiazepine therapy.

REQUIREMENTS

- Continuous infusion: mechanically ventilated patient, IV infusion device, non-PVC container (e.g. glass bottle and vented set or polyolefin bag), in line filter (0.2 to 5 micron)
- Equipment and personnel necessary for resuscitation and ventilation must be readily available

MONITORING REQUIRED

DIRECT IV/INTERMITTENT INFUSION:

- Baseline RR, BP and HR, then at 5 and 15 minutes post dose

CONTINUOUS INFUSION:

- Baseline RR, BP and HR, with start of infusion and with any rate increase; then every 15 minutes until stable, then every 1 hour

RECOMMENDED

- Advise patients to report burning/stinging/pain at IV site promptly
  Assess level of consciousness as required
- Clinical signs of propylene glycol toxicity, including serum creatinine, BUN, serum lactate, osmol gap

Adverse Effects

CENTRAL NERVOUS SYSTEM

- Drowsiness and excessive sedation, especially in patients over 50 years. Can be rapidly reversed by flumazenil IV if treatment required
- Vertigo
- Weakness
- Unsteadiness
- Restlessness
- Confusion
- Depression
- Delirium
- Hallucinations
- Diplopia
- Anterograde Amnesia

CARDIOVASCULAR

- Hypotension

RESPIRATORY

- Respiratory depression and partial airway obstruction

MISCELLANOUS

- Pain at injection site and erythema.

Dosing

ADULT

PREOPERATIVE SEDATION:

- **IV**: 0.044 mg/kg (usual dose: 2 mg; **maximum**: 4 mg) administered 15 to 20 minutes before procedure
- **Maximum** recommended dose in patients over 50 years is usually 2 mg
- **IM:** 0.05 mg/kg to a maximum of 4 mg. Administer 2 hours before procedure

STATUS EPILEPTICUS:

- **Initial dose IV:** 0.05 to 0.1 mg/kg (**maximum** single dose: 4 mg); may repeat at 5 to 10 minutes If seizures continue (**maximum** total dose: 8 mg)
- **Continuous infusion IV:** 1 mg/hr with continuous EEG monitoring. Increase by 1 mg/hour at 15 minute intervals until seizures stop.

ALCOHOL WITHDRAWAL SEDATION:

- **Mild symptoms IV**: 0.5 to 4 mg every 4 hours x 24 hours. Dose should then be tapered and discontinued over the next 3 days

- **Severe symptoms IV:** 2 to 4 mg every 1 to 2 hours until symptoms are controlled, then regularly scheduled doses should be used. Once vital signs are stabilized, dose should be tapered over the next few days
- **Continuous infusion IV:** 1 to 4 mg/hour has been found to be effective

SEDATION IN CRITICAL CARE:

- **Initial dose IV:** 0.02 to 0.04 mg/kg (maximum dose: 4 mg)
- **Maintenance dose IV:** 0.02 to 0.06 mg/kg every 2 to 6 hours (maximum single dose: 4 mg); titrate to clinical effect
- **Continuous infusion IV:** 0.01 to 0.1 mg/kg/hour (0.5 to 10 mg/hour); titrate to clinical effect (**maximum** dose: 10 mg/hour)

CHEMOTHERAPY-INDUCED NAUSEA AND VOMITTING

- **IV:** 0.5 to 2 mg administered 30 minutes prior to chemotherapy and every 4 to 6 hours as needed
- **IM:** 0.025 to 0.05 mg/kg administered 30 minutes prior to chemotherapy (maximum dose: 4 mg)

PALLIATIVE CARE ANXIETY AND AGITATION

- **SUBQ:** 0.25 to 2 mg every 3 to 6 hours as needed

PALLIATIVE CARE STATUS EPILEPTICUS

- **SUBQ:** 2 mg; may repeat at 10 minutes if seizures continue

ELDERLY

- Refer to adult dosing. Dose selection should generally be on low end of dosage range (initial dose not to exceed 2 mg)

PEDIATRIC

- Do not administer into small veins
- Administer over 2 to 5 minutes; do not exceed 0.05 mg/kg/minute over 2 to 5 minutes or 2 mg/minute

STATUS EPILEPTICUS

- 0.1 mg/kg/dose IV up to 4 mg. May repeat dose once in 5 to 10 minutes
- **IM** route may be used if IV access not available. Note: midazolam is preferred over lorazepam for IM administration.

ANXIETY

- 0.05 mg/kg/dose IM/IV every 4 to 8 hours
- **Maximum:** 2 mg per dose

PROCEDURAL SEDATION

- 0.05 mg/kg/dose IV 2 hours before procedure

INTERMITTENT INFUSION

- Administer close to catheter and with minimal length of tubing (risk of precipitation).
- Infuse over 15 minutes (range 15 to 30 minutes)

NEONATE

STATUS EPILEPTICUS:

- Initial; 0.05 to 0.1 mg/kg/dose. May repeat dose in 15 minutes.
- Maintenance; dose not determined, but 0.05 to 0.1 mg/kg/dose every 6 to 8 hours as needed is suggested

SEDATION:

- similar dosing as above can be used for sedation, though limited information is available at this time

INTERMITTENT INFUSION

- Intermittent IV Infusion - Administer close to catheter and with minimal length of tubing (risk of precipitation). Infuse over 20 minutes (range 10 to 30 minutes)
  *No Continuous IV Infusion

RENAL IMPAIRMENT ADJUSTMENTS

- Duration of action may be increased. Titrate repeat doses to effect

HEPATIC IMPAIRMENT ADJUSTMENTS

- Duration of action may be increased. Titrate repeat doses to effect

Concentration Supplied:

- 2 mg/mL ([DSC]); 4 mg/mL (1 mL)

RECONSTITUTION

ADULT

- Direct IV – Dilute with equal volume compatible diluent
- Intermittent Infusion – Dilute 2 mg in 50 mL compatible diluent
- Continuous Infusion – Dilute 10 mg in 100 mL compatible diluent
- Subcutaneous Injection – Undiluted (4 mg/mL) or dilute to 1 mg/mL concentration
- Intramuscular Injection – Undiluted

PEDIATRIC

- Direct IV - Usual concentration: 2 mg/mL (range 0.4 to 2 mg/mL)
- Intermittent Infusion – Dilute with sterile water for injection (preferred) or Normal Saline: Usual concentration 0.5 to 1 mg/mL; Maximum Concentration: 1 mg/mL
- Subcutaneous Injection – no information
- Intramuscular Injection – Undiluted 4 mg/mL

NEONATE

- Direct IV - Add 0.25 mL of 4 mg/mL LORazepam to 9.75 mL of D5W to make 0.1 mg/mL solution
- IV Direct preferred; risk of precipitation
- Dilute with sterile water for injection (preferred) or Normal Saline
- Intermittent Infusion - Usual Concentration: 0.5 to 1 mg/mL; Maximum Concentration: 1 mg/mL

COMPATIBILITY

- Compatible with NS, D5W, and lactated Ringer's solutions
- For drug-drug compatibility consult pharmacy or specialised on-line references

STABILITY

- IV Direct preferred; risk of precipitation
- Refrigerate and protect vial from light. Do not use if discoloured or contains a precipitate
- STABILITY OF FINAL ADMIXTURE: use immediately; discard unused portion (may crystallize)
- Neonate DIRECT IV mixture use within 1 hour of mixing
- STABILITY OF FINAL ADMIXTURE: use immediately; discard unused portion (may crystallize)
-

Route:

- Can be given IM into large muscle mass (not preferred route: may cause pain, burning, redness)
- has been used subcutaneously in palliative care

Provider:

- **EMR:** Not in scope of practice
- **PCP:** Not in scope of practice
- **ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/LORazepam.pdf#search=LORazepam
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/7195?cesid=0OgRQmXvVoD&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3DLORazepam%26t%3Dname%26acs%3Dtrue%26acq%3DLora
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711669

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transport Medications

Midazolam/Versed HIGH ALERT

Classification

- Benzodiazepine/Sedative

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *For sedation/anxiolysis/amnesia prior to and during short endoscopic or diagnostic procedures and direct current cardioversion*
- *Induction and maintenance of anesthesia; sedation in MFI*

NON HEALTH CANADA APPROVED INDICATIONS BUT SUBSTANTIATED IN THE LITERATURE

- *Refractory status epilepticus, agitation, intoxication, palliative and end-of-life care*

Mechanism of Action

- Short-acting benzodiazepine that binds to stereospecific benzodiazepine receptors on the postsynaptic GABA neuron at several sites within the central nervous system, including the limbic system and reticular formation. Enhancement of the inhibitory effect of GABA on neuronal excitability results by increased neuronal membrane permeability to chloride ions. This shift in chloride ions results in hyperpolarization (a less excitable state) and stabilization. Benzodiazepine receptors and effects appear to be linked to the GABA-A receptors. Benzodiazepines do not bind to GABA-B receptors.

Pharmacokinetics

- **Onset: IV:** 1 to 5 minutes (dose dependent)
- **Peak: IV**: 3 to 5 minutes
- **Duration: IV:** 7 to 75 minutes
- **Excretion: IV:** Urine (primarily as metabolites)

Contraindications

- Hypersensitivity to midazolam, any component of the formulation or other benzodiazepines
- Acute pulmonary insufficiency or severe COPD, acute narrow angle glaucoma
- Outside of ICU setting: shock, coma, myasthenia gravis or severe depression of vital signs

Cautions

- **HIGH ALERT**
- Elderly, obese or debilitated patient, those with COPD, an impaired gag reflex, heart failure, renal failure or severe alcoholic cirrhosis: decreased dose required
- In the elderly if concomitant CNS depressant medications are used, the midazolam dose should be at least 50% less than doses used in healthy, young, unpremedicated patients. There is an increased risk of paradoxical reactions (ie, agitation) in older adults when small doses are used. Because of increased volume of distribution of fat in the elderly, time to onset may be delayed with midazolam, and patience must be employed in titration to account for this.
- Do not discontinue abruptly in patients on prolonged midazolam infusions.
- Use IV midazolam with caution in patients with uncompensated acute illnesses, such as severe fluid or electrolyte disturbances.
- Use with caution in patients with glaucoma; may increase intraocular pressure. May consider use in patients with open-angle glaucoma only if receiving appropriate therapy; consider evaluating ophthalmologic status after midazolam use.
- Use with caution in patients with renal impairment; half-life of midazolam and metabolites may be prolonged.
- Does not have analgesic, antidepressant, or antipsychotic properties. Does not protect against increases in intracranial pressure, heart rate, and/or blood pressure during intubation. Do not use in shock, coma, or acute alcohol intoxication with depression of vital signs. Avoid intra-arterial administration or extravasation of parenteral formulations. Use during upper airway procedures (ie, endoscopy, dental care) may increase risk of hypoventilation. Prolonged responses have been noted following extended administration by continuous infusion (possibly due to metabolite accumulation) or in the presence of drugs which inhibit midazolam metabolism.
- Some patients may develop a protracted withdrawal syndrome lasting greater than or equal to 12 months; may be difficult to differentiate withdrawal symptoms from reemergence or continuation of symptoms for which benzodiazepines were prescribed. Flumazenil may cause withdrawal in patients receiving long-term benzodiazepine therapy.
- Midazolam is a short half-life benzodiazepine and may be of benefit in patients where a rapidly and short-acting agent is desired (eg, for acute agitation). Duration of action after a single dose is determined by redistribution rather than metabolism. Tolerance develops to the sedative and antiseizure effects. It does not develop to the anxiolytic effects.
- Neonates: avoid rapid IV injection: severe hypotension and seizures have been reported; risk may be increased with concomitant fentaNYL use

DRUG INTERACTIONS

- CNS depressants including narcotics, barbiturates and alcohol; may enhance hypnotic effect and increase risk of apnea
- protease inhibitor; concurrent use of injectable midazolam with fosamprenavir.
- Is a substrate of cytochrome P450 3A4 (major); Interacts with many drugs - contact pharmacy for more information. Review drug profile at time of initiation and with any change in medication regimen

ANTIDOTE

- Effects can be reversed by flumazenil

PREGNANCY

- No reports have been located that describe the use of midazolam in humans during the 1st or 2nd trimesters. Use immediately near birth has resulted in adverse neonatal neurobehavior. Based on animal data, a warning was issued by the FDA in 2016 about concerns with fetal/child brain development after repeated or lengthy use of general anesthetic and sedation medications during the 3rd trimester and children under 3 years of age.

BREASTFEEDING

- In 2001, the American Academy of Pediatrics classified midazolam as a drug for which the effect on a nursing infant is unknown but may be of concern if exposure is prolonged.

Adverse Effects

CARDIOVASCULAR

- Decreased/increased mean arterial pressure
- Increased/decreased pulse rate
- Hypotension particularly in pediatric patients or patients with hemodynamic instability. Hypotension may occur more frequently in patients who have received opioid analgesics.
- Cardiac arrest
- Permanent neurologic injury
- Risk of adverse events is increased in patients with abnormal airway anatomy, cyanotic congenital heart disease, sepsis, or severe pulmonary disease.

CENTRAL NERVOUS SYSTEM

- Headache
- Drowsiness
- Excessive sedation
- Dizziness
- Paradoxical reactions in children (e.g., agitation, restlessness, combativeness); Paradoxical reactions, including hyperactive or aggressive behavior, have been reported with benzodiazepines; risk may be increased in adolescent/pediatric patients, older adults, or patients with a history of alcohol use disorder or psychiatric/personality disorders. Midazolam may cause involuntary movements (eg, tonic/clonic movements, tremor) and combativeness when used for sedation; may cause agitation when used for sedation or status epilepticus. Reactions may be due to improper dosing or administration; cerebral hypoxia should also be considered as a cause.
- Anterograde Amnesia
- Impair physical or mental abilities; patients must be cautioned about performing tasks that require mental alertness (eg, operating machinery, driving). A minimum of one day should elapse after midazolam administration before attempting these tasks. Elapsed time to resume these tasks must be individualized, as pharmacologic effects are dependent on dose, route, duration of procedure, and presence of other medications.

GASTROINTESTINAL

- Nausea/vomiting

RESPIRATORY

- Decreased respiratory rate/tachypnea
- Apnea
- Respiratory depression
- Airway obstruction
- Respiratory arrest

Dosing

- Dose must be individualized. Use smaller doses in elderly patients or those pre-medicated with narcotics or other CNS depressants
- For continuous infusions gradually taper dose before discontinuing

ADULT

PROCEDURAL SEDATION

- Use 1 mg/mL solution

PT less than 55 years old

NON-PREMEDICATED PATIENT

INITIAL DOSE

- No more than 2 to 2.5 mg

TOTAL DOSE

- Some patients may respond to as little as a total dose of 1 mg
- Do not exceed 0.1 mg/kg

PREMEDICATED PT (Narcotics or CNS depressants)

- Reduce dosage by about 30%

PT age 55 or older (Debilitated patients; Chronically ill patients; Patients with limited pulmonary reserve)

NON-PREMEDICATED PATIENT

INITIAL DOSE

- No more than 1 to 1.5 mg

TOTAL DOSE

- More than a total dose of 3.5 mg is not usually necessary
- Do not exceed 0.07 mg/kg

PREMEDICATED PT (Narcotics or CNS depressants)

- Reduce dosage by about 30% (i.e. 60% less than for healthy young non pre-medicated patients)

SEDATION IN CRITICAL CARE

INITIAL DOSE IV:

- 0.01 to 0.05 mg/kg (approximately 0.5 to 5 mg); may repeat at 5 to 15 minute intervals until adequate sedation achieved

MAINTENANCE INFUSION IV:

- 0.01 to 0.1 mg/kg/hour (approximately 1 to 8 mg/hour); titrate to clinical effect. Higher doses may be required in some circumstances (traumatic brain injury, acute respiratory distress syndrome, status asthmaticus, COVID-19, refractory agitation)

REFRACTORY STATUS EPILEPTICUS

INITIAL DOSE IV:

- 0.2 mg/kg; may repeat at 5 minute intervals until seizure stops (up to a maximum of 2 mg/kg)

CONTINUOUS INFUSION IV: of 0.05 to 2 mg/kg/hour. Titrate to clinical effect. Doses up to 3 mg/kg/hour have been used

- If unsuccessful within 45 to 60 minutes, an alternative agent should be started

ELDERLY

- Consider reducing dose by 20% to 50%

PEDIATRIC

PRODEDURAL SEDATION

- 0.15 mg/kg IV (**maximum:** 5 mg IV). May repeat doses of 0.05 to 0.1 mg/kg as needed every three minutes

Maximum total dose:

- 0.5 to 5 years – 0.6 mg/kg
- 6 to 12 years – 0.4 mg/kg

SEDATION IN CRITICAL CARE

Loading dose IV:

- 0.2 to 0.25 mg/kg

Maintenance infusion IV:

- 0.02 to 0.2 mg/kg/hour. Begin with a low dose and increase as required

REFRACTORY STATUS EPILEPTICUS

Status epilepticus dosing is titrated to effect

Loading dose IV:

- 0.2 mg/kg over 2 to 3 minutes followed by continuous infusion of 0.12 mg/kg/hour. Titrate upward by 0.06 mg/kg/hour every 5 minutes until seizures are controlled
- May consider bolus with 0.15 mg/kg IV with each increase in infusion rate
- **Maximum** IV infusion rate: 0.6 mg/kg/hour

NEONATE

ANTICONVULSANT

Seizures refractory to phenobarbital and phenytoin despite therapeutic phenytoin level (40 to 80 micromol/L) and supratherapeutic phenobarbital level (170 to 215 micromol/L)

Loading dose IV:

- 0.15 to 0.2 mg/kg, followed by maintenance infusion

Maintenance infusion IV:

- Start at 0.06 mg/kg/hour. If seizures persist, increase by 0.06 mg/kg/hour IV every 10 minutes. Administer additional loading doses of 0.2 mg/kg IV as necessary. Once seizures have stopped or burst suppression achieved, maintain effective infusion rate for 48 hours. If no seizures are observed, wean infusion by 0.06 mg/kg/hour IV every 15 minutes. If seizures recur resume previously effective infusion rate

SEDATION

Not used with an opioid

Loading dose:

- 0.2 mg/kg.

Maintenance infusion:

- 0.03 to 0.07 mg/kg/hour (reduce dose in premature infants)

Combined with an opioid

Loading dose:

- none.

Maintenance infusion:

- 0.05 mg/kg/hour

Intermittent dosing:

- 0.05 to 0.15 mg/kg. Repeat as required, usually every 2 to 4 hours.
- Dosage requirements are decreased by concurrent use of narcotics

Continuous infusion:

- 0.01 to 0.06 mg/kg/hour.
- Dosage may need to be increased after several days of therapy because of development of tolerance and/or increased clearance

RENAL IMPAIRMENT ADJUSTMENTS

- Bolus dosing: use sparingly and titrate according to response
- Continuous infusion: may experience prolonged sedation sometimes for days after discontinuation. No dosing guidelines available at this time

HEPATIC IMPAIRMENT ADJUSTMENTS

- Single dose (e.g. induction): No dosage adjustment recommended; may be more sensitive to effects; anticipate longer duration of action
- Multiple dosing or continuous infusion: Expect longer duration of action and accumulation; based on patient response, dosage reduction likely to be necessary

REQUIREMENTS

- Electronic infusion device

MONITORING REQUIRED

DIRECT IV

- Baseline BP, HR and RR and O2. Repeat every 5 minutes x 3 and until stable, then every 15 minutes x 3

CONTINUOUS INFUSION

- Continuous O2 sat and continuous BP or non - invasive BP monitoring every 5 minutes
- HR and RR every 15 minutes until stable, then every 1 hour

CONTINUOUS INFUSION – PEDIATRIC

- Critical Care or Transport team should be consulted
- Continuous O2 sat and continuous BP or non - invasive BP monitoring every 5 minutes
- HR and RR every 15 minutes until stable, then every 1 hour

PROCEDURAL SEDATION

- Baseline BP, HR, RR, O2 sat and sedation rating, then every 5 to 15 minutes until procedure is complete and every 15 minutes until level 1 on the conscious sedation rating scale
- *See conscious sedation rating scale link below
- https://www.saskhealthauthority.ca/system/files/2023-07/CS-G-0155-Guideline-Using-Pain-Sedation-Assessment-Tools.pdf

MONITORING RECOMMENDED

- Level of sedation, respiratory rate, heart rate, blood pressure, oxygen saturation (ie, pulse oximetry); evidence of delirium (when used for sedative properties); withdrawal symptoms with prolonged duration of therapy.

Concentration Supplied:

- 5 mg/mL (2 mL vial)

RECONSTITUTION

ADULT CONTINUOUS INFUSION

- Use commercially prepared bag (midazolam 100 mg/100 mL) where available
  OR If commercially prepared bag is unavailable, remove 20 mL from 100 mL bag and add 20 mL of midazolam (5 mg/mL) to prepare 100 mg/100 mL

PEDIATRIC INTERMITTENT INFUSION

- Bolus dose: (via syringe pump) Infuse over 2 to 20 minutes

PEDIATRIC CONTINUOUS INFUSION

- See SK SMART Pump Program Parenteral Manual for dosing and infusion charts
  https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/midazolam.pdf

NEONATE INTERMITTENT INFUSION

- Bolus dose: (via syringe pump) Infuse over 10 to 30 minutes

NEONATE CONTINUOUS INFUSION

- See SK SMART Pump Program Parenteral Manual
  https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/midazolam.pdf

NEONATE DIRECT IV

- Use 5 mg/mL solution and dilute with preservative free sterile water to 0.5 mg/mL to minimize benzyl alcohol exposure.

COMPATIBILITY/STABILITY

- Stable in D5W and NS for 24 hours at room temperature
- Conflicting information regarding compatibility with lactated Ringer's solution

Provider:

- **EMR:** Not in scope of practice
- **PCP:** Not is scope of practice
- **ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/midazolam.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/7296?cesid=ab2cRQaMRrH&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dmidazolam%26t%3Dname%26acs%3Dtrue%26acq%3Dmidaz
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711732

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

NitroGLYCERIN/Glyceryl Titrate HIGH ALERT

Classification

- Vasodilating agent

Indications

EMS INDICATIONS

- Monitor only (Unless ACP has completed the mandatory education)
- Change rate with Dr.'s orders (Unless the ACP has completed the mandatory education)

***Note: ACPs can *initiate* a nitro infusion with Pulmonary Edema only. Monitoring of IV Nitro Infusions for IFT's as set by the facility in all circumstances has not changed.**

HEALTH CANADA APPROVED

- *Control of blood pressure in preoperative hypertension and in the immediate post-surgical period*
- *Congestive heart failure associated with acute myocardial infarction*
- *Severe unstable angina that cannot be controlled by other measures*
- *To produce controlled hypotension during surgical procedures*

NON HEALTH CANADA APPROVED INDICATION BUT SUBSTANTIATED IN THE LITERATURE

- *Acute pulmonary edema*
- *To induce transient and rapid uterine relaxation*

Mechanism of Action

- Vascular smooth muscle relaxant resulting in general vasodilation
- Decreases cardiac workload/oxygen demand by dilating vessels which reduces the pressure against the pumping of blood (afterload) and the amount of blood that returns (preload)
- Dilates coronary and systemic arteries
- Promotes collateral circulation to ischemic regions where normal blood flow is interrupted
- Nitroglycerin forms free radical nitric oxide. In smooth muscle, nitric oxide activates guanylate cyclase which increases guanosine 3'5' monophosphate (cGMP) leading to dephosphorylation of myosin light chains and smooth muscle relaxation. Produces a vasodilator effect on the peripheral veins and arteries with more prominent effects on the veins. Primarily reduces cardiac oxygen demand by decreasing preload (left ventricular end-diastolic pressure); may modestly reduce afterload; dilates coronary arteries and improves collateral flow to ischemic regions.

Pharmacokinetics

- **Onset: IV** Immediate
- **Peak: IV** Immediate
- **Duration: IV** 3 to 5 minutes
- **Excretion:** Urine (as inactive metabolites)

Contraindications

- Hypersensitivity to nitroglycerin, any component of formulation or a known idiosyncratic reaction to organic nitrates
- Hypotension or uncorrected hypovolemia (e.g. hemorrhage)
- Increased intracranial pressure (e.g. head trauma or cerebral hemorrhage)
- Constrictive pericarditis and pericardial tamponade
- Concurrent use with soluble guanylate cyclase (sGC) stimulators (eg, riociguat); acute circulatory failure or shock; increased intracranial pressure; severe anemia.
- Use of phosphodiesterase-5 inhibitors; delay nitrate therapy for 12 hours or more after taking avanafil, 24 hours for sildenafil (viagra) or vardenafil: 48 hours for tadalafil (Cialis) within 48 hours
- When used for management of ST-elevation or non-ST-elevation myocardial infarctions avoid nitroglycerin in the following conditions: Hypotension (SBP less than 90 mm Hg or greater than or equal to 30 mm Hg below baseline), marked bradycardia (heart rate less than 50bpm) or tachycardia, and right ventricular infarction

Cautions

- **HIGH ALERT**
- Elderly: Hypotension is enhanced due to decreased baroreceptor response, decreased venous tone, and often hypovolemia (dehydration) or other hypotensive drug
- Low or normal pulmonary capillary wedge pressure predisposes to the hypotensive effects
- Patients with depleted blood volume may be subject to hypotensive crisis
- Some products contain substantial amounts of propylene glycol +/or ethanol, which may produce toxicity at high doses

DRUG INTERACTIONS

- Heparin - anticoagulant effect may be decreased, monitor PTT

EXTRAVASATION MANAGEMENT

- sympathomimetic vasopressors (alternative agent) (off-label use): Stop vesicant infusion immediately and disconnect IV line (leave needle/cannula in place); gently aspirate extravasated solution from the IV line (do NOT flush the line); remove needle/cannula; apply dry warm compresses; elevate extremity.

PREGNANCY

- Consult pharmacy or specialized on-line references for most recent information
- The use of nitroglycerin during pregnancy does not seem to present a risk to the fetus. However, the number of women treated during pregnancy is limited, especially during the 1st trimester. With the smaller doses reported, transient decreases in the mother's blood pressure may occur, but these do not appear to be sufficient to jeopardize placental perfusion. Nitroglycerin appears to be a safe, effective, rapid-onset, short-acting tocolytic agent. The use of transdermal nitroglycerin patches may also prove to be effective when longer periods of tocolysis are required. With any route of administration, however, additional studies are required to determine the safest effective dose.

BREAST FEEDING

- Consult pharmacy or specialized on-line references for most recent information
- The molecular weight (about 227) suggests that the drug will be excreted into breast milk, but the short half-life should limit exposure. The most common adverse reaction observed in adults was headache. If a woman is receiving this drug while breastfeeding, her nursing infant should be monitored for these effects.

Adverse Effects

CARDIOVASCULAR

- Hypotension, may be sudden and severe, responds to elevation of the legs, reducing or stopping infusion
- Flushing
- Reflex tachycardia
- Paradoxical bradycardia

- Paradoxical increase of anginal pain

CENTRAL NERVOUS SYSTEM

- Headache
- Dizziness
- Restlessness
- Intracranial hypertension leading to vomiting, blurred vision and bradycardia(rare, associated with high doses)
- Wernicke's encephalopathy (rare, associated with high doses)

GASTROINTESTINAL

- Nausea/vomiting
- Abdominal pain

MISCELLANEOUS

- Immediate hypersensitivity reactions (e.g. itching, tracheobronchitis, wheezing)
- Methemoglobinemia (rare; increased risk with high dose or prolonged therapy)
- Tolerance to anti-anginal and hemodynamic effects, associated with high doses and continuous infusions, may occur within 24 hours

Dosing

***See SK SMART Pump Program Parenteral Manual for infusion tables and peds/neonate dosing**

- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/nitroGLYCERIN.pdf

ADULT

ACUTE PULMONARY EDEMA

- **IV** 50 mcg to 2 mg
- May repeat every 3 to 5 minutes until patient becomes either asymptomatic or develops a systolic BP of less than 95 mmHg
- Doses as high as 3 mg have been used

UTERINE RELAXATION

- **IV** 50 to 100 mcg
- May repeat every 90 seconds to 3 minutes (**Maximum** dose: **200** mcg over 15 minutes)
- Uterine relaxation is achieved within 40 to 90 seconds and lasts for about 1 minute

CONTINUOUS INFUSION

- Initially: 10 to 20 mcg/minute
- Titrate by 5 to 10 mcg/minute increments every 3 to 5 minutes. Others suggest 10 to 20 mcg/minute every 5 to 15 minutes until desired hemodynamic or clinical response occurs
- Generally accepted **Maximum** dose: 400 mcg/minute; though some consider those who do not respond hemodynamically to 200 mcg/minute non-responders
- Alternatively: 0.1 to 0.25 mcg/kg/minute. Adjust in increments of 0.1 to 0.25 mcg/kg/minute every 3 to 5 minutes until desired hemodynamic or clinical response occurs. Usual range 0 to 5 mcg/kg/minute. Higher rates have been used

ELDERLY

- Start at low end of dosing range

PEDIATRIC

- Start at 0.1 to 1 mcg/kg/minute and increase by 0.5 to 1 mcg/kg/minute every 3 to 5 minutes until desired clinical effect
- Dose range: 0.5 to 10 mcg/kg/minute

NEONATE

- Initial: 0.5 to 1 mcg/kg/minute
- Titrate dose by 0.5 to 1 mcg/kg/minute every 3 to 5 minutes as needed

- Usual dose: 1 to 5 mcg/kg/minute
- Maximum dose: 10 mcg/kg/minute

REQUIREMENTS:
- Electronic IV Infusion Device
- Non-PVC container or glass container
- Vented set if premixed solution in glass bottle is used for continuous infusion
- Direct IV for External Cephalic Version (ECV) or Uterine Tachysystole (UT): Physician must be physically present

PEDIATRIC: Consult Critical Care or Transport Team

MONITORING REQUIRED

DIRECT IV
- Baseline BP, HR and RR, then every 5 minutes x 2 and until stable
- ECG monitoring. **Exception:** Continuous ECG monitoring not required for External Cephalic Version or Uterine Tachysystole in healthy non-cardiac patients with a physician physically present

EXTERNAL CEPHALIC VERSION OR UTERINE TACHYSYSTOLE
- Baseline BP, HR and RR then every 5 minutes x 30 minutes
- Continuous SpO2 monitoring during procedure and 30 minutes post dose
- Continuous fetal heart rate monitoring for at least 60 minutes post dose

CONTINUOUS INFUSION
- Continuous ECG monitoring
- Baseline BP, then every 5 minutes x 3 and until stable while titrating dose, then at least every 1 hour for duration of therapy

RECOMMENDED
- Continuous BP or non-invasive BP monitoring

Concentration Supplied:
- **IV infusion:** 50 mg in 250 mL (concentration: 200 **mcg**/mL) **or** 100 mg in 250 mL (concentration: 400 **mcg**/mL) of D5W
- Premixed glass container 50 mg in 250 mL D5W.

RECONSTITUTION
- If not premixed, dilute 50 mg in 250 mL D5W or NS; vials contain ethanol; may contain propylene glycol
- Prepare in glass bottles or containers not made with PVC. Adsorption occurs to soft plastic (eg, PVC); use administration sets intended for nitroglycerin. Avoid in-line IV filters that adsorb nitroglycerin. Administer via infusion pump.

COMPATIBILITY/STABILITY
- Compatible with D5W, saline, dextrose-saline combinations, Ringer's and lactated Ringer's solutions
- Commercially available pre-mixed solution is stable until labelled expiry date. Other dilutions in D5W or NS, in PVC infusion bags, are stable for at least 24 hours at room temperature and in the refrigerator
- DOBUTamine, DOPamine, lidocaine, nitroglycerin and sodium nitroPRUSSIDE prepared in D5W or NS, are compatible by Y-site in all possible combinations
- Premixed (glass container): Protect from light until time of use. Avoid excessive heat; protect from freezing.
- For additional drug-drug compatibility, consult pharmacy or specialised on-line references for most recent information depending on brand

Provider/Route:
- **EMR:** Not in Scope
- **PCP/ICP:** Not in Scope
- **ACP:** Monitor IV infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/nitroGLYCERIN.pdf
- https://online.lexi.com/lco/action/search?q=nitroglycerin&t=name&acs=true&acq=nitro
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711792

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

Pantoprazole

Classification

- H+ , K+ -ATPase inhibitor (Proton Pump Inhibitor)

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *To rapidly reduce gastric acid secretion in patients who cannot tolerate oral medication*

NON HEALTH CANADA APPROVED INDICATION BUT SUBSTANTIATED IN THE LITERATURE

- *Prophylaxis against recurrent GI bleed*

Mechanism of Action

- Proton pump inhibitor, suppresses gastric acid secretion by inhibiting the parietal cell H^+/K^+ ATP pump

Pharmacokinetics

- **Onset IV:** 15 to 30 minutes.
- **Peak:** 2 hours
  - Children and Adolescents: IV (2 to 16 years of age): 0.34 ± 0.12 hours
- **Duration:** 24 hours
- **Excretion:** Urine (71% as metabolites); feces (18%); pantoprazole clearance increased with weight and age

Contraindications

- Hypersensitivity to pantoprazole, other substituted benzimidazoles (e.g. esomeprazole, ompeprazole) or any component of formulation
- Coadministration with rilpivirine due to significant decrease in rilpivirine exposure and loss of therapeutic effect

Cautions

- ELDERLY: Avoid scheduled use for greater than 8 weeks unless given for high-risk patients (eg, oral corticosteroid or chronic nonsteroidal anti-inflammatory drug use), patients with erosive esophagitis, Barrett esophagitis, or a pathological hypersecretory condition, or if the patient has demonstrated a need for maintenance therapy (eg, failure of drug discontinuation trial or failure of H2 blockers).
- ELDERLY: Use has been associated with Clostridioides difficile infection (CDI), bone loss and fractures, and hypomagnesemia. Long-term therapy in older adults may also lead to deficiencies in iron and vitamin B12.

- ELDERLY: Although older adults may present less frequently with the typical symptoms of heartburn, including acid regurgitation and/or epigastric, old age is known to be a significant risk factor for severe complications of gastroesophageal reflex disease (eg, esophagitis, stricture, Barrett esophagus) as well as chronic relapses. Additional risk factors for relapse beyond older age include the presence of typical symptoms, hiatal hernia, and a severe grade of esophagitis. Maintenance therapy with antisecretory drugs is the most effective prevention for relapse. The prevalence of nonspecific symptoms (eg, anorexia, weight loss, anemia, vomiting, dysphagia) significantly increases with age.
- ELDERLY: In a recent prospective cohort study, proton pump inhibitors were associated with increased risk of atherosclerotic cardiovascular disease, particularly amongst middle age and older adult participants without indications or prophylactic use.
- Bone loss and fractures (especially in patients on high-dose or long-term therapy [greater than or equal to 1 year]), Clostridioides difficile-associated diarrhea (CDAD), serum magnesium (baseline and periodically thereafter; especially if receiving digoxin or drugs known to cause hypomagnesemia [eg, diuretics] or who are receiving prolonged treatment), serum calcium (baseline and periodically in patients at risk [eg, hypoparathyroidism]), serum zinc (baseline and periodically in patient at risk), and serum gastrin levels; signs or symptoms of vitamin B12 deficiency, cutaneous lupus erythematosus or systemic lupus erythematosus.
- Prolonged treatment (greater than or equal to 2 years) may lead to malabsorption of dietary vitamin B12 and subsequent vitamin B12 deficiency

DRUG INTERACTIONS:

- Medications whose absorption is pH-dependent (e.g. ketoconazole) (pH 9 to 10.5)
- PPIs may diminish the therapeutic effect of clopidogrel, thought to be due to reduced formation of the active metabolite of clopidogrel. The manufacturer of clopidogrel recommends either avoidance of both omeprazole (even when scheduled 12 hours apart) and esomeprazole or use of a PPI with comparatively less effect on the active metabolite of clopidogrel. Of the PPIs, pantoprazole has the lowest degree of CYP2C19 inhibition in vitro and has been shown to have less effect on conversion of clopidogrel to its active metabolite compared to omeprazole. In contrast to these warnings, others have recommended the continued use of PPIs, regardless of the degree of inhibition, in patients with a history of GI bleeding or multiple risk factors for GI bleeding who are also receiving clopidogrel since no evidence has established clinically meaningful differences in outcome; however, a clinically significant interaction cannot be excluded in those who are poor metabolizers of clopidogrel.
- Some dosage forms may contain edetate sodium; use caution in patients who are at risk for zinc deficiency if other EDTA-containing solutions are coadministered.

PREGNANCY

- The animal and limited human data suggest that pantoprazole represents a low risk in pregnancy. A study showing an association between in utero exposure to gastric acid-suppressing drugs and childhood allergy and asthma requires confirmation. The human pregnancy experience with other proton pump inhibitors (PPIs) has not shown a causal relationship with congenital malformations. However, malformations may have been missed, because of the design and size of the studies. If pantoprazole is required or if inadvertent exposure does occur early in gestation, the known risk to the embryo–fetus appears to be low. Long-term follow-up of offspring exposed during gestation is warranted.

BREASTFEEDING

- The results of the above case are consistent with the relatively low molecular weight (about 432 for the hydrated form) that suggests pantoprazole will be excreted into breast milk. In addition, pantoprazole is unstable at acidic pH so the amount actually absorbed by the infant may have been less than estimated. The most common adverse reactions observed in adults were headache, diarrhea, nausea, abdominal pain, vomiting, flatulence, dizziness, and arthralgia. If a woman is receiving this drug while breastfeeding, her nursing infant should be monitored for these effects.

Adverse Effects

CENTRAL NERVOUS SYSTEM

- Headache

GASTROINTESTINAL

- Abdominal pain/discomfort
- Cramps
- Bloating
- Diarrhea
- Vomiting/retching

MISCELLANOUS

- Injection site reactions (inflammation, bruises)
- Hypersensitivity reactions, including anaphylaxis, erythema multiform, Stevens-Johnson syndrome, and toxic epidermal necrolysis, have been reported

Dosing

ADULT/ELDERLY

- When oral ingestion is not practical; 40 mg once daily
- Switch to oral therapy as soon as possible

PATHOLOGICAL HYPERSECRETION ASSOCIATED WITH ZOLLINGER-ELLISON SYNDROME

- 80 mg every 12 hours
- Doses up to 240 mg/day have been used

UPPER GI BLEED

- 80 mg initial bolus, followed by 8 mg/hour
- Maximum duration of infusion: 72 hours

PEDIATRIC

STRESS ULCER PROPHYLAXIS

- 1 mg/kg IV every 24 hours
- **Maximum**: 40 mg/dose
- Higher doses (1 mg/kg every 12 hours) have been used

ACUTE UPPER GI BLEED

- Weight:
  - 5 to 40 kg - **Dose**: 2 mg/kg/dose x 1 followed by 0.2 mg/kg/hour
  - Greater than 40 kg –**Dose:** 80 mg x 1 followed by 8 mg/hour
- **Maximum** infusion rate: 8 mg/hour
- **Maximum** duration of infusion: 72 hours

NEONATE

ACUTE UPPER GI BLEED

- 2 mg/kg loading dose x 1, followed by 0.2 mg/kg/hour
- **Maximum** duration of infusion: 72 hours

ADMINISTRATION

ADULT

DIRECT IV: **UNDILUTED**

- over at least 2 minutes

INTERMITTENT INFUSION: **DILUTE**

- Add 80 mg in 100 mL D5W or 0.9% Sodium Chloride Infuse over 15 minutes

CLINICAL USE – BOLUS:

- Add 80 mg in 100 mL and run over 15 minutes

CONTINUOUS INFUSION: 0.8 mg/mL

- Add 80 mg to 100 mL 0.9% Sodium Chloride OR
- 200 mg to 250 mL 0.9% Sodium Chloride Infuse at 8 mg/hour

PEDIATRIC

DIRECT IV:

- Give over 2 to 5 minutes Maximum concentration: 4mg/mL

INTERMITTENT INFUSION:

- Usual concentration: 1 to 4 mg/mL Maximum concentration: 4 mg/mL Infuse over 15 to 30 minutes

CONTINUOUS INFUSION:

- Standard concentration: 0.8 mg/mL Maximum rate: 8 mg/hour
- Add 10 mL (40 mg) of 4 mg/mL solution to 40 mL 0.9% Sodium Chloride for a concentration of 0.8 mg/mL in 50mL final volume

NEONATE

DIRECT IV:

- Give over 5 minutes Standard concentration: 0.8 mg/mL

INTERMITTENT INFUSION:

- Standard concentration: 0.8 mg/mL Infuse over 15 to 30 minutes
- Dilute to final concentration of 0.8 mg/mL:
  - Add 2mL (8 mg) of 4 mg/mL solution to 8 mL of 0.9% Sodium Chloride or D5W for a final concentration 0.8 mg/mL in 10 mL final volume

CONTINUOUS INFUSION:

- Standard concentration: 0.8 mg/mL
- Dilute to a final concentration 0.8 mg/mL: Add 10 mL (40 mg) of 4 mg/mL solution to 40 mL 0.9% Sodium Chloride for a concentration of 0.8 mg/mL in 50 mL final volume

Concentration Supplied:

- Reconstitute 40 mg vial with 10 mL preservative free NS resulting in a final concentration of 4 mg/mL
- If drug is being added to a bag of NS a reconstitution device may be used
- If drug is being added to a bag of D5W a reconstitution device cannot be used. Drug should first be reconstituted with 10 mL preservative free NS

Route: **Do not give via IM or subcutaneous route**

COMPATIBILITY/STABILITY

- **Available in 2 formulations – with and without disodium edetate. Stability and compatibility information is different for the 2 formulations.** The information below applies to both formulations
- Stable in 0.9% NS and D5W for at least 24 hours at room temperature
- Compatible with NS, D5W and 2/3+1/3
- Pantoprazole when diluted in NS is compatible via Y-site with the following drugs, if they are mixed in D5W; ampicillin, ceFAZolin, cefTRIAXone, DOPamine, EPINEPHrine, regular insulin, morphine, nitroGLYCERIN, potassium chloride, and vasopressin
- When dimenhyDRINATE and furosemide are mixed in D5W minibags, they are compatible with pantoprazole in NS via Y-site; no information on compatibility if either dimenhyDRINATE or furosemide are given direct IV,
- Incompatibility with calcium chloride, ciprofloxacin, clindamycin, DOBUTamine, esmolol, HYDROmorphone, labetalol, magnesium sulfate, midazolam, moxifloxacin, norepinephrine, octreotide, potassium phosphate or zinc
- For additional drug-drug compatibility consult pharmacy or specialised on-line references for most recent information

Provider:

- **EMR**: Not in Scope
- **PCP**: Not in Scope
- **ICP**: Monitor Infusion
- **ACP**: Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/pantoprazole.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/7436?cesid=09CoID5cvtU&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3Dpantaloc%26t%3Dname%26acs%3Dfalse%26acq%3Dpantaloc
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711843

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

Potassium Chloride HIGH ALERT/ELDER ALERT

Classification

- Electrolyte – irritant at concentrations greater than 0.1 mmol/mL

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *Treatment or prevention of hypokalemia*

NON HEALTH CANADA APPROVED INDICATION BUT SUBSTANTIATED IN THE LITERATURE

- *Based on the American Diabetes Association consensus statement on hyperglycemic crises in adult patients with diabetes, potassium is effective and recommended in the treatment and prevention of hypokalemia associated with diabetic ketoacidosis or hyperosmolar hyperglycemic state*
- *Based on the American Society for Parenteral and Enteral Nutrition recommendations on appropriate parenteral nutrition dosing and recommendations on parenteral nutrition safety, potassium is recommended as a component of parenteral nutrition formulations*

Mechanism of Action

- Potassium is the major cation of intracellular fluid and is essential for the conduction of nerve impulses in heart, brain, and skeletal muscle; contraction of cardiac, skeletal and smooth muscles; maintenance of normal renal function, acid-base balance, carbohydrate metabolism, and gastric secretion

Pharmacokinetics

- **Onset:** IV Not listed
- **Peak:** Not listed
- **Duration:** Not listed
- **Excreted** Primarily urine; skin and feces (small amounts); most intestinal potassium reabsorbed

Contraindications

- IV: Hypersensitivity to potassium chloride or any component of the formulation; clinically significant hyperkalemia, clinically significant hyperglycemia (dextrose-containing solutions only).
- Renal impairment with oliguria or azotaemia, untreated Addison's disease, hyperadrenalism associated with adrenogenital syndrome
- Extensive tissue breakdown as in severe burns, acute dehydration and heat cramps
- Digitalis-induced, second- or third-degree heart block

Cautions

- **HIGH ALERT, ELDER ALERT**

∗ Elderly: increased risk of hyperkalemia

- Potentially fatal hyperkalemia can develop rapidly and be asymptomatic. Use with caution or avoid use in patients with predisposing conditions for hyperkalemia (eg, chronic or severe renal impairment, extensive burns or tissue injury, heart failure, acute dehydration, systemic acidosis, adrenal insufficiency, or the administration of potassium-sparing diuretics)
- Hypersensitivity/infusion reactions, including anaphylaxis and chills, may occur with parenteral administration of potassium containing solutions. Discontinue immediately if signs/symptoms of hypersensitivity/infusion reactions develop.
- Parenteral administration may cause hyponatremia; risk may be increased in children, elderly patients, postoperatively, in patients with psychogenic polydipsia, and with concurrent use of medications that may decrease sodium (eg, diuretics).
- Premature neonates, chronic renal disease, adrenal insufficiency or any other condition, which impairs potassium excretion
- Chronic renal disease, adrenal insufficiency or any other condition, which impairs potassium excretion
- Cardiac disease, renal disease or acidosis. Renal tubular acidosis – potassium citrate PO or potassium acetate IV is preferred. Diabetic ketoacidosis – potassium phosphate may be indicated
- Diseases associated with heart block, since increased serum potassium may increase degree of block
- Use extreme caution with parenteral administration
- Parenteral administration may exacerbate or cause hyperchloremia, especially in patients with or at risk of hyperchloremia
- Monitor serum potassium concentrations closely
- Inappropriate parenteral administration may be fatal

DRUG INTERACTIONS

- Potassium-sparing diuretics (e.g. spironolactone or triamterene), ACE-inhibitors (e.g. captopril, enalapril) – can produce hyperkalemia

PREGNANCY

- Potassium chloride is a natural constituent of human tissues and fluids. Exogenous potassium chloride may be indicated as replacement therapy for pregnant women with low serum potassium levels, such as those receiving diuretics. Because high or low levels are detrimental to maternal and fetal cardiac function, serum levels should be closely monitored.

BREAST FEEDING

- Breast milk is naturally high in potassium with levels that are 3–4 times those in plasma. The concentration of potassium in mature milk is about 55–57 mg/dL (about 14–15 mEq/L). Because potassium freely passes into and out of milk, the use of potassium chloride by a lactating woman with normal plasma potassium levels would have no adverse effect on a nursing infant.
- Consult pharmacy or specialised on-line references for most recent information

Adverse Effects

CARDIOVASCULAR

- Bradycardia, chest pain

RESPIRATORY

- Dyspnea

DERMATLOGIC

- Skin Rash

METABOLIC

- Hyperkalemia, characterized by paraesthesia of extremities, flaccid paralysis, listlessness, mental confusion, weakness, hypotension, ventricular arrhythmias, heart block, ECG changes and cardiac arrest

- Hyponatremia (Encephalopathy)

GASTROINTESTINAL

- Abdominal distress, abdominal pain, diarrhea, flatulence, hemorrhage, irritation, obstruction, perforation, ulcer, nausea, vomiting

HYPERSENSITIVITY

- Angioedma, hypersensitivity reaction

INFUSION RELATED

- Pain at injection site if given into a small vein, phlebitis – dependent on concentration, rate of administration and duration of infusion
- Extravasation leading to tissue necrosis

TREATMENT:

- If extravasation occurs, stop infusion immediately; leave needle/cannula in place temporarily but do **NOT** flush the line; gently aspirate extravasated solution, then remove needle/cannula; elevate extremity; apply dry warm compresses; physician to initiate hyaluronidase antidote.

Dosing

NOTE: 1 mmol K+ = 1 mEq K+

- Individual doses may vary greatly. Institutional potassium protocols should be used whenever possible.

ADULT

NORMAL DAILY REQUIREMENTS

- 40 to 80 mmol/24 hours

MODERATE HYPOKALEMIA (greater than 2.5 mmol/L and without ECG changes)

- Rate generally should not exceed 10 mmol/hour, up to a maximum of 200 mmol/24 hours

SEVERE HYPOKALEMIA (less than 2 mmol/L and with ECG changes or paralysis)

- Infusion rate of up to 40 mmol/hour, up to a **Maximum** of 400 mmol in 24 hours
- Rapid administration should be done for as short a time as possible, with slowing of the infusion rate when T waves become isoelectric or upright

HYPOKALEMIA IN PRESENCE OF ANY FORM OF HEART BLOCK

- **Maximum** recommended infusion rates 5 to 10 mmol/hour

ELDERLY

- Lower-end initial doses may be appropriate based on potential for decreased organ function and concomitant disease or drug therapy
- If large doses fail to correct hypokalemia, determination of serum magnesium is indicated

PEDIATRIC

- Symptomatic hypokalemia: 0.5 to 1 mmol/kg/dose to a **maximum** of 40 mmol/dose
- Normal daily requirements: 2 to 5 mmol/kg/24 hours

NEONATE

- Symptomatic hypokalemia: 0.5 to 1 mmol/kg/dose
- Normal daily requirements: 2 to 3 mmol/kg/24 hours

RENAL IMPAIRMENT ADJUSTMENTS

- Maximum recommended rate of infusion 5 to 10 mmol/hour

HEMO/PERITONEAL DIALYSIS/CRRT

- Is removed by dialysis

Concentration Supplied:

- From stores and pharmacy: in a variety of premixed large volume infusion bags and mini bags
- pH: 4 to 8

COMPATIBILITY/STABILITY

- Compatible with dextrose, saline, dextrose-saline combinations, Ringer's and lactated Ringer's solutions
- All products are individually labelled with an expiry date and storage instructions
- In severe hypokalemia, solutions without dextrose are preferred (dextrose might decrease serum potassium)
- For drug-drug compatibility contact pharmacy

Route:

- If mixed with potassium phosphate in the same solution, total concentration of potassium dictates **Maximum** concentration and rate of infusion
- IV infusion: peripheral - final concentration must be ≤80 mEq/L (0.08 mEq/mL); usual reported concentration is 40 to 60 mEq/L (0.04 to 0.06 mEq/mL): Central line - reported range: 120 to 300 mEq/L (0.12 to 0.3 mEq/mL); a higher concentration of 400 mEq/L (0.4 mEq/mL) has been reported
- IM: contraindicated
- Subcutaneous: literature supports continuous subcutaneous infusions

REQUIREMENTS

PEDIATRIC/NEONATE

- Electronic IV Infusion Device

ADULTS

- Electronic IV Infusion Device is recommended for all infusions and required for rates of greater than 10 mmol K+ /hour or concentrations greater than 20 mmol K+ /L

MONITORING REQUIRED

ADULT

- For infusion rates of greater than 20 mmol K+ /hour: Continuous ECG monitoring

PEDIATRIC

- All intermittent infusions regardless of rate and continuous infusions at rates greater than 0.3 mmol K+ /kg/hour or greater than 10 mmol K+ /hour whichever is less: Continuous ECG monitoring

NEONATE

- All intermittent infusions regardless of rate: Continuous ECG monitoring; and as per unit standard

RECOMMENDED

- Advise patients to report burning/stinging/pain at IV site promptly
- Serum electrolytes (potassium, calcium, chloride, magnesium, phosphate, sodium), creatinine, and glucose, acid-base balance, renal function, cardiac monitor

Provider:

- **EMR:** Not in Scope
- **PCP/ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- The Hospital for Sick Children Electronic Formulary
- https://collaboration.web.ehealthsask.ca/sites/smartpump/Monographs/potassium%20chloride.pdf
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/7528?highlight=Electrolyte+Supplement%2C+Parenteral&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3DElectrolyte%2BSupplement%252C%2BParenteral%26t%3Dpharmacatm%26db%3Dpatch_f#doa
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711913

Development – July 2023
Update – June 2025

EMS Provincial Inter-facility Transfer Medications

Total Parenteral Nutrition HIGH ALERT

Classification

- Caloric Agent; Intravenous Nutritional Therapy

Indications

EMS INDICATIONS

- Monitor only

HEALTH CANADA APPROVED

- *Kabiven, Perikabiven: A source of calories, protein, electrolytes, and essential fatty acids for adult patients requiring parenteral nutrition when oral or enteral nutrition is not possible, insufficient, or contraindicated; prevention of essential fatty acid deficiency or treatment of negative nitrogen balance in adult patients.*
- *Limitations of use: These fixed-content formulations are not recommended for use in children less than 2 years of age, including preterm infants, because they do not meet nutritional requirements for this age group.*

Mechanism of Action

- Combination of amino acids, dextrose, lipids, and electrolytes to provide parenteral nutrition.

Pharmacokinetics

- **Onset:** Not listed
- **Peak:** Not listed
- **Duration:** Not listed
- **Excretion:** Not listed

Contraindications

- Kabiven, Perikabiven: Hypersensitivity to egg, soybean, peanut, or any component of the formulation; severe disorders of lipid metabolism with hypertriglyceridemia (serum triglycerides greater than 1,000 mg/dL); inborn errors of amino acid metabolism; cardiopulmonary instability, including pulmonary edema, cardiac insufficiency, myocardial infarction, acidosis, and hemodynamic instability requiring significant vasopressor support; hemophagocytic syndrome; neonates (less than or equal to 28 days of age) receiving concurrent treatment with ceftriaxone, even if separate lines are used.
- *Canadian labeling:* Additional contraindications (not in US labeling): **Note:** Contraindications may vary by product; also refer to product labeling: Severe liver or kidney insufficiency (not on dialysis or hemofiltration); hepatic coma; severe blood coagulation disorders; uncontrolled hyperglycemia; elevated serum electrolyte levels of any of the included electrolytes; unstable conditions (e.g. severe posttraumatic conditions, uncompensated diabetes mellitus, stroke, embolism, metabolic acidosis, severe sepsis, hypotonic dehydration, hyperosmolar coma); hypertriglyceridemia-associated acute pancreatitis.

  Note: Contraindications for *peripheral* parenteral nutrition regardless of formulation (premixed or patient-specific formulations) include significant malnutrition, severe metabolic stress, large nutrient or electrolyte

needs, fluid restriction, need for prolonged parenteral nutrition (ie, greater than 2 weeks), and kidney or liver impairment. *Central* parenteral nutrition in these conditions is recommended.

Cautions

- **HIGH ALERT**
- ABRUPT WITHDRAWAL: If parenteral nutrition is discontinued abruptly, rebound hypoglycemia may occur. Infuse dextrose 10% at same rate and monitor capillary blood glucose for hypoglycemia at 30 minutes to 1 hour after parenteral nutrition is discontinued. To reduce the risk of rebound hypoglycemia in susceptible patients (e.g. patients requiring large doses of insulin), taper down the infusion rate for 1 to 2 hours or half the infusion rate.
- CONCURRENT **CEFTRIAXONE** ADMINISTRATION: Kabiven, Perikabiven: Avoid simultaneous administration via Y-site with ceftriaxone; may administer sequentially after proper flushing of IV lines between infusions for patients other than neonates. Avoid concurrent administration in neonates, even if separate IV lines are used.
- LABORATORY TESTS: Lipids in the bloodstream may interfere with some laboratory tests (e.g. hemoglobin, lactate dehydrogenase, bilirubin, oxygen saturation). Conduct these tests greater than or equal to 6 hours after stopping the infusion. Kabiven and Perikabiven contain vitamin K which may counteract anticoagulant activity.
- MULTIVITAMINS: Multivitamins and potentially trace elements must be added to Kabiven and Perikabiven to provide balanced, complete parenteral nutrition and to avoid micronutrient deficiency.

PREGNANCY

- The use of total parenteral hyperalimentation (TPN) does not pose a significant risk to the fetus or newborn provided that normal procedures, as with nonpregnant patients, are followed to prevent maternal complications.

BREASTFEEDING

- No problems should be expected in nursing infants whose mothers are receiving TPN.

MONITORING

- Serum triglycerides (baseline, with each dose change, and regularly during therapy), fluid and electrolytes, blood glucose, serum osmolarity, hepatic and kidney function, blood ammonia, blood count (including platelets and coagulation factors). Fluid status should be closely monitored in patients with heart failure, kidney impairment, or pulmonary edema. Signs and symptoms of infection (especially catheter-related infection), hypersensitivity reactions, essential fatty acid deficiency, lipid overload syndrome, refeeding syndrome.
- Monitor for signs of catheter occlusion or catheter-related infection. Track intake and output and daily weight.

Adverse Effects

HEMATOLOGIC

- Hypertriglyceridemia: May occur in patients with impaired lipid metabolism (e.g. diabetes mellitus, metabolic syndrome, obesity) or those being overfed with dextrose, receiving high-dose lipid-based medications. Monitor triglycerides closely (e.g. baseline and weekly). Reduce dose of fixed combination solutions or eliminate lipid injectable emulsion from the parenteral nutrition regimen with serum triglycerides greater than 400 mg/dL (greater than 1000 mg/dL is associated with pancreatitis); may reinitiate lipid injectable emulsion when less than 400 mg/dL. Monitor all sources of lipids, dextrose, and medications that may interfere with their metabolism.
- Lipid overload syndrome: A reduced or limited ability to metabolize lipids accompanied by prolonged plasma clearance may rarely occur. Lipid overload syndrome may result in a sudden deterioration in patient condition along with anemia, coagulation disorders, CNS manifestations (e.g. coma), deteriorating liver function and hepatomegaly, fever, hyperlipidemia, leukopenia, or thrombocytopenia; usually reversible upon discontinuation.
- Hyperglycemia: Use with caution in patients with diabetes mellitus or insulin resistance. Hyperglycemia and hyperosmolar syndrome may occur with therapy. Hyperglycemia may also occur in patients without diabetes; risk factors include age, severity of illness, and rate of infusion (Clement 2004). Monitor administration rate as well as serum glucose; insulin may be required for optimal glucose control.

- Respiratory effects: Pulmonary embolism, including fatalities, and respiratory distress have occurred in patients developing pulmonary vascular precipitates due to receiving parenteral nutrition. Risk is increased with excessive addition of calcium and phosphates. The prepared solution, infusion set, and catheters should be inspected for precipitates prior to administration. Discontinue therapy and initiate medical evaluation in patients who develop signs of pulmonary embolism or respiratory distress.

HYPERSENSITIVITY

- Allergic or hypersensitivity reactions (e.g. altered mentation, bronchospasm, cyanosis, flushing, dyspnea, headache, hypotension, hypoxia, rash, sweating, tachycardia, tachypnea, vomiting) may occur; discontinue infusion immediately if signs or symptoms of hypersensitivity or allergic reactions occur.

MISCELLANEOUS

- CATHETER OCCLUSION: Recognized when unable to infuse due to resistance or unable to aspirate blood due to resistance. May be due to thrombotic (most common) or nonthrombotic causes; treat as appropriate.
- INFECTION: Patients requiring parenteral nutrition may be at high risk of infection, including sepsis, due to malnutrition, the underlying disease state, or catheters required for administration. Proper aseptic technique should be followed; monitor for signs of early infection. Diabetic patients are at a greater risk of developing catheter-related infections compared with nondiabetic patients.
- INTESTINAL FAILURE–ASSOCIATED LIVER DISEASE: Has been reported in patients receiving parenteral nutrition for extended periods of time, especially preterm infants. Intestinal failure–associated liver disease may present as cholestasis or hepatic steatosis progressing to steatohepatitis with fibrosis and cirrhosis. Cholecystitis and cholelithiasis have also occurred. Consider discontinuation or dose reduction in patients who develop LFT abnormalities).
- REFEEDING SYNDROME: Use with caution in patients at risk for refeeding syndrome (e.g. severely malnourished). Refeeding syndrome may occur in severely undernourished patients and is due to the intracellular shift of magnesium, phosphorus, and potassium resulting in generalized fatigue, muscle weakness, edema, hemolysis, and cardiac arrhythmia (may result in cardiopulmonary arrest); thiamine deficiency may also develop. In patients at risk, initiate and advance caloric intake slowly.

PEDIATRIC

- Acute respiratory distress, metabolic acidosis, hypertriglyceridemia, and death have been reported in neonates and infants after rapid infusion. Do not exceed recommended daily doses or hourly infusion rates. Preterm infants and low birth weight infants have poor clearance of IV lipid emulsion and increased free fatty acid plasma levels following lipid emulsion infusion.

HEPATIC IMPAIRMENT

- Use caution in patients with hepatic impairment. Hepatobiliary disorders (e.g. cholecystitis, cholelithiasis, cholestasis, cirrhosis, hepatic steatosis, fibrosis) may occur in patients without liver disease and may lead to hepatic failure. If hepatobiliary complications occur during treatment, among other strategies for treatment, consider reducing dextrose or lipid injectable emulsion component, providing a balance between dextrose and lipid injectable emulsion, or cycling parenteral nutrition (ASPEN [Mueller 2017]). Increased blood ammonia and hyperammonemia may occur with amino acid therapy; evaluate patients for hepatic insufficiency or an unknown inborn error of amino acid metabolism.

KIDNEY IMPAIRMENT: Use with caution in patients with kidney impairment; risk of electrolyte and fluid volume imbalance may be increased.

DOSAGE FORM SPECIFIC ISSUES:

- ALUMINUM: Kabiven, Perikabiven: May contain aluminum; toxic aluminum concentrations may be seen with prolonged use or kidney dysfunction. Premature neonates are at higher risk due to immature kidney function and aluminum intake from other parenteral sources. Parenteral aluminum exposure of greater than 4 to 5 mcg/kg/day is associated with CNS and bone toxicity in patients with kidney dysfunction (including premature infants); tissue loading may occur at lower doses.

MONITORING

- Vesicant; ensure proper needle or catheter placement prior to and during IV infusion. Avoid extravasation.

TREATMENT:

- If extravasation occurs, stop infusion immediately and disconnect (leave needle/cannula in place). Gently aspirate extravasated solution (do **NOT** flush the line), initiate hyaluronidase antidote, remove needle/cannula, and apply dry cold compresses. Elevate extremity.

Dosing

ADULT

FIXED-COMBINATION SOLUTIONS

- **Note:** Dosage should be individualized based on patient status. These products contain a fixed combination of amino acids, dextrose, lipids, and electrolytes. Continue therapy for as long as required based on patient status. Correct severe fluid, electrolyte, or acid-base disorders prior to infusion. Also refer to the American Society for Parenteral and Enteral Nutrition for more detailed information.
- **Kabiven (Central line use only) IV:** 19 to 38 mL/kg/day infused over 12 to 24 hours; maximum daily dose: 40 mL/kg/day.
- **Perikabiven (peripheral or central line**): **IV:** 27 to 40 mL/kg/day infused over 12 to 24 hours; maximum daily dose: 40 mL/kg/day.
- *Dosage adjustment for increased serum triglycerides:* Stop infusion and monitor if triglycerides greater than 400 mg/dL; restart at a lower infusion rate and advance in smaller increments once triglycerides are less than 400 mg/dL. Use is contraindicated with triglycerides greater than 1000 mg/dL.

ALTERED KIDNEY FUNCTION

- Kabiven, Perikabiven: Use with caution in patients with kidney impairment; dosage adjustment may be necessary. Correct severe fluid or electrolyte imbalances prior to administration. Closely monitor electrolytes and adjust administered volume as necessary. Supplement protein as indicated for patients with acute or chronic kidney impairment or those requiring frequent dialysis or CRRT (ASPEN 2019). Additional amino acid solution may be added to the premixed solutions or infused separately.

HEPATIC IMPAIRMENT

- There is no dosage adjustment provided in the manufacturer's labeling; use with caution; dosage adjustments may be necessary.

ELDERLY

- Refer to adult dosing.

PEDIATRICS

- Limitations of use: These fixed-content formulations are not recommended for use in children less than 2 years of age, including preterm infants, because they do not meet nutritional requirements for this age group.

Concentration Supplied:

- Kabiven, Perikabiven: Supplied as a 3-chamber bag that must be activated prior to infusion (detailed instructions and video available from the manufacturer). The contents of 1 chamber should be white and 2 chambers should be clear prior to activation; do not use if more than 1 chamber is white, the solution is yellow, or any seals have been broken prior to activation. Compatible additions may be made once the bag is mixed. The additive port may be pierced up to 10 times using an 18- to 23-gauge $1^1/_2$-inch needle; mix thoroughly after each addition. Discard if precipitate forms following mixing or addition of additives or if the emulsion separates.

COMPATIBILITY/STABILITY:

- Kabiven: Prior to activation (mixing of bag components), store in protective bag at 5°C to 25ºC (41°F to 77°F). Do not freeze; discard if frozen. Protect from excessive heat. Do not remove container from overpouch until intended for use. Once bag is activated (bag components are mixed), use immediately or store under refrigeration (2°C to 8°C [36°F to 46°F]) for up to 7 days; use within 48 hours once removed from refrigerator. If additives are introduced after activation (after bag components are mixed), use immediately or store up to 24 hours under refrigeration. Infuse within 24 hours after removal from refrigerator.
- Perikabiven: Prior to activation (mixing of bag components), store in protective bag at 5°C to 25°C (41°F to 77°F). Do not freeze; discard if frozen. Protect from excessive heat. Do not remove container from overpouch until intended for use. Once bag is activated (bag components are mixed), use immediately or may store at 25°C (77°F) for up to 24 hours. If additives are introduced after activation (after bag components are mixed), use immediately or store up to 24 hours under refrigeration (2°C to 8°C [36°F to 46°F]); use within 24 hours once removed from refrigerator.

- **Compounded patient-specific parenteral nutrition solutions:** USP Chapter 797 Guidelines consider parenteral nutrition a medium-risk preparation and state that (in the absence of passing a sterility test) storage period should not exceed 30 hours at room temperature, 7 days at cold temperature, and 45 days in a solid frozen state at −20°C (−4°F) or colder (USP 797). For patients on home parenteral nutrition, multiple vitamins should be added just prior to parenteral nutrition administration, due to limited stability of multiple vitamins.

Route:

- Parenteral nutrition may be administered as a continuous 24-hour infusion or as a cyclic infusion (generally, over 8 to 12 hours) in selected stable patients (e.g. expected to have a longer course or home infusion). All parenteral nutrition should be infused through a 1.2-micron filter. ASPEN suggests that parenteral nutrition with an osmolarity up to 900 mOsm/L may be administered peripherally; monitor closely for extravasation. Abrupt discontinuation may cause hypoglycemia; infusion tapering may decrease this risk.
- Kabiven and Perikabiven are fixed combinations of amino acids, dextrose, lipids, and electrolytes and come in several sizes; selection will be based on fluid requirements and duration of infusion. **Note:** Always check compatibility with parenteral nutrition before simultaneously administering any drug via Y-site; contact manufacturer for product-specific compatibility as most databases (e.g. Trissel's) only provide parenteral nutrition containing soybean oil lipid emulsion. If patient is receiving ceftriaxone, do not administer ceftriaxone simultaneously via Y-site due to precipitation (Kabiven and Perikabiven contain calcium); if the infusion line is thoroughly flushed between infusions with a compatible fluid, may sequentially administer ceftriaxone and Kabiven or Perikabiven.
- *Kabiven:* Infuse over 12 to 24 hours via central vein only using a 1.2-micron inline filter. Maximum infusion rate: 2.6 mL/kg/hour (corresponds to amino acids 0.09 g/kg/hour; dextrose 0.25 g/kg/hour [rate-limiting component]; lipids 0.1 g/kg/hour). Administer through a dedicated line without any connections. Do not use administration lines and sets containing DEHP (sets containing PVC components have DEHP as a plasticizer). Vein irritation, damage, and/or thrombosis may occur if administered via peripheral vein.
- *Perikabiven:* Infuse over 12 to 24 hours via peripheral or central vein using a 1.2-micron inline filter. Maximum infusion rate: 3.7 mL/kg/hour (corresponds to amino acids 0.09 g/kg/hour; dextrose 0.25 g/kg/hour [rate-limiting component]; lipids 0.13 g/kg/hour). Administer through a dedicated line without any connections. Do not use administration lines and sets containing DEHP (sets containing PVC components have DEHP as a plasticizer).

Provider:

- **EMR:** Not in Scope
- **PCP/ICP:** Monitor Infusion
- **ACP:** Monitor Infusion
- **CCP:** As per scope of practice

Resources:

- SHA EMS Medical Director & Advisors
- https://online.lexi.com/lco/action/doc/retrieve/docid/patch_f/362822?cesid=7ldfDk9UjRP&searchUrl=%2Flco%2Faction%2Fsearch%3Fq%3DTPN%26t%3Dname%26acs%3Dfalse%26acq%3DTPN
- https://online.lexi.com/lco/action/doc/retrieve/docid/1090/5711549

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