

Acetaminophen

Classification

■ Analgesic and antipyretic

Indications

- PCP and higher: treatment of mild to moderate pain
- ACP: reduction of fever

Contraindications

- Severe hepatic impairment or liver disease
- Acetaminophen-induced liver disease
- Hypersensitivity to acetaminophen, or any component of the formulation

Adult dosages

- PCP (analgesia) and ■ ACP (analgesia and antipyresis):
 - **500 - 1,000 mg PO**
 - May repeat this dose once after 4 hours
 - 24 hour maximum: 4,000 mg
 - In patients with liver disease, the 24 hour maximum should be lowered to 1,000-2,000 mg
 - May be used concurrently with ibuprofen for analgesia
- ACP only: follow analgesia dosing for antipyresis

Pediatric Considerations And Dosing

- PCP (analgesia) and ■ ACP (analgesia and antipyresis):
 - [Follow weight-based dosing.](#)
 - < 30 kg: **15 mg/kg PO** (use liquid preparation)
 - 30-50 kg: **500 mg PO** (may use liquid preparation or tablets, depending on patient ability)
 - > 50 kg: **500-1,000 mg PO**
 - May repeat this dose once after 4 hours
 - 24 hour maximum: 75 mg/kg or 1,000 mg
 - Do not exceed 5 doses in 24 hours in patients under the age of 12
- ■ ACP only: follow analgesia dosing for antipyresis

Mechanism Of Action

Acetaminophen inhibits prostaglandin synthetase in the central nervous system, reducing pain and fever.

Pharmacokinetics

Completely and rapidly absorbed from the gastrointestinal tract.

- Onset: 30 minutes to 1 hour
- Peak: 1-3 hours
- Duration: 3-8 hours

Metabolism takes place in the liver, and acetaminophen is excreted in the urine.

Adverse Effects

Adverse reactions are uncommon with short-term use of acetaminophen. Rash and hives are rarely reported, but can occur. Constipation can develop with longer term use.

Overdose

Toxicity may occur after a single dose of more than 7,500 mg (adults) or 150 mg/kg (children).

Warning And Precautions

Acetaminophen is the leading cause of serious liver injury in Canada. Patients with pre-existing liver disease (regardless of underlying cause), chronic users of acetaminophen, and children are most at risk. Acetaminophen is a component of many over-the-counter medications, and patients may inadvertently be consuming much higher doses than expected. Paramedics must ensure that a complete medication history is obtained prior to the administration of acetaminophen, including over-the-counter preparations.

Drug Interactions

Alcohol may potentiate acetaminophen's hepatotoxic effects.

Acetylsalicylic Acid

Classification

Antiplatelet

Antithrombotic

Indications

- EMR: Chest pain or signs and symptoms consistent with cardiac ischemia

Contraindications

- Hypersensitivity to ASA or drug components
- Patients who have experienced bronchospasm or other respiratory reaction precipitated by ASA or non-steroidal anti-inflammatory drugs
- Active or recent bleeding of any kind, including head injury and peptic ulcer disease
- Pediatric patients with signs and symptoms consistent with viral illnesses

Adult dosages

- EMR: chest pain or signs and symptoms consistent with cardiac ischemia

- 162 mg PO chewed and swallowed

Pediatric Considerations And Dosing

Chest pain in children is unlikely to be the result of ischemia; ASA is therefore not indicated unless there are rare, specific histories of disease. Consultation with CliniCall is required in these cases.

Mechanism Of Action

ASA inhibits the formation of thromboxane A₂, which is a potent platelet aggregator and vasoconstrictor. The platelet effects are irreversible, and last for the life of the platelet (7-10 days).

Pharmacokinetics

Following oral administration, ASA is rapidly absorbed from the stomach and proximal small intestine. Absorption is more rapid when ASA is chewed or crushed prior to administration.

- Onset: 1 hour (20 minutes if chewed)
- Peak: 1-2 hours
- Duration: 4-6 hours

Adverse Effects

The most common adverse effects involve irritation of the gastrointestinal tract. Antiplatelet effects may result in minor bruising or bleeding.

Overdose

ASA can be toxic at doses higher than 150 mg/kg. Early symptoms include nausea, vomiting, diaphoresis, and tinnitus. Hyperventilation can occur.

Warning And Precautions

ASA should not be used in children, teenagers, or young adults with chickenpox, influenza, or other flu-like illness due to the risk of the development of Reye syndrome.

Alcohol use can increase the risk of gastrointestinal bleeding.

Drug Interactions

The antiplatelet effects of ASA may increase the risk of bleeding, particularly in patients who are already taking anticoagulant medications. These risks must be balanced against the benefit of ASA in patients who are experiencing cardiac ischemia. When in doubt, consult with ClinicaCall.

Adenosine

Classification

Antiarrhythmic and endogenous nucleoside

Indications

- ACP: Conversion and termination of supraventricular tachycardias

Contraindications

- Hypersensitivity
- Second- or third-degree AV node block or sick sinus syndrome in patients without an artificial pacemaker

Adult dosages

Adenosine must be given very quickly into a proximal vein as close to central circulation as possible. Attach both the adenosine and a 20-30 mL saline flush to the same IV line. Push the drug as quickly as possible and follow its administration immediately with the saline flush to ensure the medication clears the intravenous tubing. Maintain pressure on the downstream plunger during administration.

Ensure an ECG is being recorded during administration of adenosine.

- ACP: Termination of SVT/PSVT

- Initial dose: 6 mg IV rapid push
- Follow-up dose: 12 mg IV rapid push

Pediatric Considerations And Dosing

Adenosine must be given very quickly into a proximal vein as close to central circulation as possible. Attach both the adenosine and a 20-30 mL saline flush to the same IV line. Push the drug as quickly as possible and follow its administration immediately with the saline flush to ensure the medication clears the intravenous tubing. Maintain pressure on the downstream plunger during administration.

Ensure an ECG is being recorded during administration of adenosine.

[Follow weight-based dosing.](#)

- ACP: Termination of SVT/PSVT

- Initial dose: 0.1 mg/kg to maximum of 6 mg IV rapid push
- Follow-up dose: 0.2 mg/kg to maximum of 12 mg IV rapid push

Mechanism Of Action

Adenosine slows the conduction of electrical impulses through the atrioventricular node.

Pharmacokinetics

Once administered intravenously, adenosine is rapidly cleared from circulation.

- Onset and peak: rapid
- Duration: 1-2 minutes
- Half-life: 10-20 seconds

Adverse Effects

The most common adverse effects are lightheadedness, flushing, shortness of breath, chest pressure, and nausea. These effects are normal and generally self-limiting. Patients should be warned that these sensations may occur.

Overdose

Because of adenosine's extremely short lifespan once administered, it is very unlikely for an overdose to occur.

Warning And Precautions

Arrhythmias during conversion from SVT/PSVT are common and usually transient, however it is imperative that resuscitation equipment be immediately available.

Rare cases of ventricular fibrillation have been reported following adenosine administration, and has been associated with patients taking digoxin, or digoxin and verapamil. Caution should be used in these patients. Consultation with CliniCall is encouraged.

Adenosine has the potential to worsen bronchoconstriction in patients with chronic obstructive pulmonary disease and asthma.

Drug Interactions

- Methylxanthines (such as caffeine and theophylline) competitively antagonize the action of adenosine. Larger doses of adenosine may be required in patients taking these types of medications.
- Carbamazepine may produce higher degrees of heart block during adenosine use
- Dipyridamole potentiates the effects of adenosine, requiring smaller doses

In these cases, consultation with CliniCall is recommended.

Amiodarone

Classification

Antiarrhythmic

Indications

- ACP: Ventricular fibrillation
- ACP: Pulseless ventricular tachycardia
- ACP: Unstable ventricular tachycardia
- ACP: Recurrent ventricular tachycardia following cardioversion

Contraindications

- Hypersensitivity
- Cardiogenic shock
- Marked symptomatic sinus bradycardia
- Second- or third-degree atrioventricular node block

Adult dosages

- ACP: ventricular fibrillation and pulseless ventricular tachycardia
 - 300 mg IV push. May repeat 150 mg IV after 10 minutes if VF/VT persist.
- ACP: unstable ventricular tachycardia and recurrent ventricular tachycardia following cardioversion
 - 150 mg IV over 10 minutes

Pediatric Considerations And Dosing

Safety and efficacy in children has not been established. Contact CliniCall if required.

Mechanism Of Action

Amiodarone is a Class III antiarrhythmic, but also possesses characteristics of all four Vaughn-Williams classes of medications. It blocks sodium channels in the heart, antagonizes beta adrenoreceptors to inhibit some sympathetic activity, produces negative chronotropic effects in nodal tissues, lengthens the cardiac action potential, and also slows conduction and prolongs refractoriness by blocking potassium channels.

Pharmacokinetics

Following intravenous administration:

- Onset: minutes
- Peak: 10-15 minutes
- Duration: prolonged (days)

Adverse Effects

Hypotension is the most commonly reported side effect following intravenous administration. In patients with a perfusing rhythm who are receiving amiodarone, if hypotension develops or worsens, slow the rate of the infusion. Nausea and bradycardia have also been reported.

QT interval prolongation has also been reported. QTc values greater than 500 ms may provoke Torsade de Pointes.

Overdose

Accidental overdose of intravenous amiodarone is likely to produce hypotension, bradycardia, or cardiogenic shock. These should be managed by stopping or slowing the intravenous administration and providing volume replacement. Transcutaneous pacing may be required.

Warning And Precautions

Amiodarone is toxic to tissues if extravasation occurs.

Drug Interactions

Amiodarone may enhance or potentiate the effects of beta blockers, calcium channel blockers, or digoxin and should be used with caution in these patients.

Atropine

Classification

Anticholinergic

Antimuscarinic

Indications

- ACP: Restoration of heart rate in bradycardia
- ACP: Sinus bradycardia (rate < 50/minute) with hemodynamic compromise
- ACP: Bradycardia secondary to atrioventricular nodal blocks
- ACP: Treatment of organophosphate poisoning
- ACP: Control of secretions in palliative care (requires additional endorsement)

Contraindications

- Hypersensitive to atropine or other anticholinergics
- Tachycardia
- Narrow-angle glaucoma
- Thyrotoxicosis
- Prostatic hypertrophy
- Myasthenia gravis

Adult dosages

Atropine must be given in the correct dose, and must be given quickly: underdosing, or slow administration, may cause paradoxical slowing of the heart rate.

- ACP: Bradycardia
 - 0.6 mg IV push to maximum dose of 0.04 mg/kg (~3 mg in most patients)
- ACP: Organophosphate toxicity
 - Mandatory: Contact ClinCall to discuss treatment plan
 - 1-2 mg IM/IV, repeated every 5-60 minutes until symptoms resolve
- ACP: Secretion control in palliative care
 - 0.6 mg IM

Pediatric Considerations And Dosing

Atropine must be given in the correct dose, and must be given quickly: underdosing, or slow administration, may cause paradoxical slowing of the heart rate.

[Follow weight-based dosing.](#)

- ACP: Bradycardia
 - 0.02 mg/kg IV push. Minimum dose is 0.1 mg. Maximum dose of 0.04 mg/kg.
- ACP: Organophosphate toxicity
 - Mandatory: Contact ClinCall to discuss treatment plan.
 - 0.02-0.05 mg IV every 10-20 minutes until atropine effects are seen

Mechanism Of Action

Atropine competitively antagonizes acetylcholine at muscarinic receptors, producing parasympatholytic and vagolytic effects.

Pharmacokinetics

Following intravenous administration:

- Onset: 2-4 minutes
- Peak: 2-4 minutes
- Half-life: 13-40 hours
- Duration: 4-6 hours

Adverse Effects

Common adverse effects include tachycardia, dry mouth, headaches, blurred vision, and dysphagia.

Overdose

Signs and symptoms of overdose are similar to adverse effects.

Warning And Precautions

Atropine produces pupillary dilation. Assessment of pupils may be unreliable.

Calcium Chloride

Classification

Electrolyte

Indications

- ACP: Cardiac arrest due to suspected hyperkalemia (e.g., renal failure, diabetic ketoacidosis)
- ACP: Suspected hyperkalemia with cardiovascular toxicity (e.g., wide QRS complexes, peaked T waves, or hemodynamic instability)
- ACP: Calcium channel blocker overdose with symptomatic bradycardia or hemodynamic instability

CALCIUM SHALL NOT BE ROUTINELY GIVEN IN CARDIAC ARREST IN THE ABSENCE OF EVIDENCE OF HYPERKALEMIA

Contraindications

- Hypersensitivity to calcium chloride
- Primary or secondary hypercalcemia

Adult dosages

- ACP: All indications
- 1 g IV over 3 minutes
- May repeat once in 10 minutes if indications are still present

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- ACP: Cardiac arrest
- 20 mg/kg IV over 3 minutes. Maximum single dose 1 g
- May repeat once in 10 minutes if indications are still present
- ACP: All other causes
- 10 mg/kg IV over 15 minutes. Maximum single dose 1 g
- May repeat once in 10 minutes if indications are still present

Mechanism Of Action

Calcium is essential for a wide range of biological processes, including nerve conduction, muscle contraction, renal function, and coagulation. Administration of calcium in prehospital contexts is intended to improve myocardial contractility and ventricular automaticity.

Pharmacokinetics

Intravenous administration of calcium is completely absorbed by the body. It is rapidly incorporated into skeletal muscle and distributed evenly between intra- and extracellular fluids.

Adverse Effects

Tissue irritation is the most common side effect of calcium administration. Hypotension, cardiac arrhythmias, and

cardiac arrest may occur if calcium is given too quickly. Calcium chloride may precipitate or worsen acidosis, cor pulmonale, or renal and respiratory diseases.

Warning And Precautions

Do not administer calcium IM or SC. Extravasation of calcium can cause tissue necrosis.

Drug Interactions

Flush IV lines well prior to or following sodium bicarbonate administration to avoid development of calcium carbonate precipitate.

Patients taking digoxin and receiving calcium are at elevated risk for the development of arrhythmias.

Dexamethasone

Classification

Anti-inflammatory agent, systemic corticosteroid

Indications

■ CCP: Adjunctive treatment for anaphylaxis, croup, and bronchospasm secondary to asthma or chronic obstructive pulmonary disease

Contraindications

Systemic fungal infections

Hypersensitivity to dexamethasone or other corticosteroids

Adult dosages

■ All indications: 8 mg IV/IO/IM/PO

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

■ All indications: 0.15-0.3 mg/kg IV/IO/IM/PO

Mechanism Of Action

Suppresses neutrophil migration, decreasing production of inflammatory mediators, and reversing increased capillary permeability.

Pharmacokinetics

Following intravenous administration:

- Onset of action: rapid
- Duration: short
- Half-life, pediatrics: 4-8 hours
- Half-life, adults: 4-5 hours

Adverse Effects

Cardiovascular: Bradycardia, cardiac arrhythmia, cardiac failure, cardiomegaly, circulatory shock, edema, embolism (fat), hypertension, hypertrophic cardiomyopathy (premature infants), myocardial rupture (post-MI), syncope, tachycardia, thromboembolism, thrombophlebitis, vasculitis

Central nervous system: Depression, emotional lability, euphoria, headache, increased intracranial pressure, insomnia, malaise, myasthenia, neuritis, neuropathy, paresthesia, personality changes, pseudotumor cerebri (usually following discontinuation), psychic disorder, seizure, vertigo

Dermatologic: Acne vulgaris, allergic dermatitis, alopecia, atrophic striae, diaphoresis, ecchymoses, erythema, facial

erythema, fragile skin, hyperpigmentation, hypertrichosis, hypopigmentation, perianal skin irritation (itching, burning, tingling; following IV injection), petechiae, skin atrophy, skin rash, subcutaneous atrophy, suppression of skin test reaction, urticaria, xeroderma

Endocrine & metabolic: Adrenal suppression, carbohydrate intolerance, Cushing syndrome, decreased glucose tolerance, decreased serum potassium, diabetes mellitus, fluid retention, glycosuria, growth suppression (children), hirsutism, HPA-axis suppression, hyperglycemia, hypokalemic alkalosis, menstrual disease, moon face, negative nitrogen balance, protein catabolism, redistribution of body fat, sodium retention, weight gain

Gastrointestinal: Abdominal distention, gastrointestinal hemorrhage, gastrointestinal perforation, hiccups, increased appetite, nausea, pancreatitis, peptic ulcer, pruritus ani (following IV injection), ulcerative esophagitis

Genitourinary: Defective (increased or decreased) spermatogenesis

Hematologic & oncologic: Kaposi sarcoma, petechial, tumor lysis syndrome

Hepatic: Hepatomegaly, increased serum transaminases

Hypersensitivity: Anaphylactoid reaction, anaphylaxis, angioedema, hypersensitivity

Infection: Infection, sterile abscess

Local: Postinjection flare (intra-articular use)

Neuromuscular & skeletal: Amyotrophy, aseptic necrosis of bones (femoral and humeral heads), bone fractures, Charcot-like arthropathy, myasthenia, myopathy (particularly in conjunction with neuromuscular disease or neuromuscular-blocking agents), osteoporosis, rupture of tendon, steroid myopathy, vertebral compression fracture

Ophthalmic: Exophthalmos, glaucoma, increased intraocular pressure, subcapsular posterior cataract

Respiratory: Pulmonary edema

Miscellaneous: Wound healing impairment

Source: Dexamethasone. In: Lexicomp Online, UpToDate, Waltham, MA. (Accessed November 20, 2020.)

Warning And Precautions

May cause hypercortisolism, particularly in younger children or when used for long periods of time at higher doses.

Dexamethasone should not generally be used for adrenal insufficiency, as it does not provide any mineralocorticoid activity.

Use with caution in patients with heart failure or hypertension: dexamethasone has been associated with fluid retention and electrolyte disturbance.

Corticosteroids have been associated with myocardial rupture when used in acute myocardial infarction.

Dexamethasone crosses the placenta. Some studies have found an association between corticosteroid use in the first trimester and oral clefts and decreased birth weights.

Drug Interactions

Corticosteroids may enhance the adverse or toxic effects of non-steroidal anti-inflammatory agents and salicylates (including gastrointestinal ulceration and bleeding). They may also reduce the serum concentration of salicylates.

May decrease the serum concentration of phenytoin.

May enhance the anticoagulant properties of warfarin.

Dextrose

Classification

Carbohydrate substrate

Indications

■ PCP: Suspected or known hypoglycemia

Contraindications

None noted

Adult dosages

■ PCP: Suspected or known hypoglycemia

- 10-25 g IV (equivalent to 100-250 mL of D10W solution)

Pediatric Considerations And Dosing

[Follow weight-based dosing.](#)

■ PCP: Suspected or known hypoglycemia

- 5 mL/kg D10W IV
- May repeat once

Mechanism Of Action

Provides an immediate source of glucose and water to nutrient-deficient cells. Causes transient osmotic diuresis.

Pharmacokinetics

Intravenous administration:

- Onset: immediate
- Peak: immediate
- Half-life: unknown and variable
- Duration: unknown and variable

Adverse Effects

Extravasation of glucose solutions can cause tissue necrosis.

Warning And Precautions

Consider consultation with ClinicaCall if intracerebral hemorrhage is suspected.

DiazePAM

Classification

 **HIGH ALERT MEDICATION**

CONTROLLED AND TARGETED SUBSTANCE

Benzodiazepine anticonvulsant, sedative, anxiolytic, and amnesic

Indications

- CCP: Treatment of prolonged seizures (> 5 minutes) or recurrent seizures
- CCP: Sedation prior to electrical therapies (e.g., synchronized cardioversion, external cardiac pacing)

Contraindications

- Allergy or known hypersensitivity to benzodiazepines
- Acute narrow-angle glaucoma
- Myasthenia gravis
- Hypoglycemic seizures

Adult dosages

- CCP: Status seizures
 - 5 mg IV over 5 minutes
 - May repeat once if needed for ongoing seizures
- CCP: Sedation
 - 2-5 mg IV, in increments. Give slowly to a maximum total dose of 30 mg

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- CCP: All indications
 - 2 mg/kg IV, PR, or IO
 - Maximum total dose 20 mg

Mechanism Of Action

Binds to receptor sites in the central nervous system, promoting interaction between gamma aminobutyric acid (GABA) and its receptors on neurons, which become permeable to chloride. An influx of chloride makes the interior of the cell more negative, and the cell takes longer to depolarize, suppressing the spread of seizure activity and raising the seizure threshold.

Pharmacokinetics

Intravenous:

- Onset: 1-5 minutes
- Peak: 15 minutes
- Half-life: 20-50 hours

- Duration: 15-60 minutes

Adverse Effects

May cause hypotension. Benzodiazepines as a class inhibit neuronal uptake of adenosine, which may result in peripheral vasodilation.

DiazePAM may depress respirations.

Overdose

Overdose management generally requires supportive care only. Provide appropriate airway management, ensure adequate oxygenation and ventilation, and support blood pressure as required.

Warning And Precautions

May precipitate when diluted with other solutions. Do not dilute or mix with any other material, including saline.

Exercise caution in patients who have consumed alcohol or other intoxicants.

Drug Interactions

There is an increased risk of toxicity in patients taking cimetidine, siulfiram, and oral contraceptives. Diazepam's effectiveness is decreased when given to patients taking ranitidine or theophylline.

Diltiazem

Classification

Antianginal, antiarrhythmic, antihypertensive, nondihydropyridine calcium channel blocker

Indications

- CCP: Atrial fibrillation or atrial flutter

Contraindications

- Hypersensitivity to diltiazem or any component
- Sick sinus syndrome (except in patients with a functioning artificial pacemaker)
- Second- or third-degree AV block (except in patients with a functioning artificial pacemaker)
- Severe hypotension or cardiogenic shock
- Atrial fibrillation or atrial flutter associated with accessory conduction pathway (e.g., Wolff-Parkinson-White)
- Ventricular tachycardia
- Severe bradycardia
- Pregnancy
- Concurrent use with intravenous dantrolene

Adult dosages

- CCP: 0.25 mg/kg IV/IO to single maximum dose of 20 mg
- Administer over 2 minutes undiluted, or in 5-10 mL normal saline

Pediatric Considerations And Dosing

Contact CliniCall / EPOS for dosing guidance

- Atrial tachyarrhythmias: 0.25 mg/kg over 5 minutes (maximum 20 mg) followed by infusion of 0.05-0.15 mg/kg/hour.

Mechanism Of Action

Inhibits entry of calcium ions into "slow channels" of vascular smooth muscle and myocardium during depolarization, producing relaxation of coronary vasculature. Improves myocardial oxygen delivery in patients with vasospastic angina.

Pharmacokinetics

Intravenous:

- Onset: 3 minutes
- Duration: 1-3 hours following bolus; 0.5-1 hour after discontinuation of infusion

- Metabolism: hepatic
- Half-life: 3-4 hours following bolus; 4-5 hours following infusion

Adverse Effects

Common: Peripheral edema

Less common:

Cardiovascular: Bradycardia (3% to 4%), bundle branch block (<2%), cardiac arrhythmia (1%), cardiac failure (<2%), complete atrioventricular block (<2%), ECG abnormality (<2%), edema (2% to 3%), extrasystoles (2%), first-degree atrioventricular block (3% to 4%), hypotension (3% to 4%), lower extremity edema (5% to 8%), palpitations (1% to 2%), second degree atrioventricular block (<2%), syncope (<2%), vasodilation (2% to 3%)

Dermatologic: Pruritus (<2%), skin photosensitivity (<2%) (Ramirez 2007), skin rash (1% to 2%) (Tuchinda 2014)

Endocrine & metabolic: Albuminuria (<2%), gout (1% to 2%), gynecomastia (<2%), hyperglycemia (<2%), hyperuricemia (<2%), increased lactate dehydrogenase (<2%), increased thirst (<2%), weight gain (<2%)

Gastrointestinal: Abdominal swelling (2%), anorexia (<2%), constipation (<2%), diarrhea (1% to 2%), dysgeusia (<2%), dyspepsia (1% to 6%), nausea (2%), vomiting (<2%), xerostomia (<2%)

Genitourinary: Crystalluria (<2%), impotence (2%), nocturia (<2%), sexual difficulty (<2%)

Hematologic & oncologic: Petechia (<2%)

Hepatic: Increased serum alanine aminotransferase (<2%), increased serum alkaline phosphatase (<2%), increased serum aspartate transaminase (<2%)

Hypersensitivity: Hypersensitivity reaction (<2%)

Infection: Infection (1% to 6%)

Local: Burning sensation at injection site (\leq 4%), itching at injection site (\leq 4%)

Nervous system: Abnormal dreams (<2%), abnormal gait (<2%), amnesia (<2%), depression (<2%), dizziness (2% to 10%), drowsiness (<2%), fatigue (5%), hallucination (<2%), headache (2% to 8%), insomnia (<2%), nervousness (2%), pain (6%), paresthesia (<2%), personality changes (<2%)

Neuromuscular & skeletal: Asthenia (1% to 4%), increased creatine phosphokinase in blood specimen (<2%), muscle cramps (<2%), myalgia (2%), neck stiffness (<2%), osteoarthritis (<2%), tremor (<2%)

Ophthalmic: Amblyopia (<2%), conjunctivitis (2%), eye irritation (<2%)

Otic: Tinnitus (<2%)

Renal: Polyuria (<2%)

Respiratory: Bronchitis (1% to 4%), cough (1% to 2%), dyspnea (1% to 6%), epistaxis (<2%), flu-like symptoms (2%), paranasal sinus congestion (1% to 2%), pharyngitis (6%), rhinitis (<2%)

Source: Diltiazem. In: Lexicomp Online, UpToDate, Waltham, MA. (Accessed November 20, 2020.)

Warning And Precautions

May cause first-, second-, and third-degree AV block or sinus bradycardia.

Use with caution in patients with left ventricular dysfunction: due to negative inotropic effects, cardiac output may be adversely affected.

Drug Interactions

Avoid co-administration with beta blockers -- a significant decrease in myocardial contractility may develop, as well as significant bradycardia or AV block.

DimenhyDRINATE

Classification

- Antiemetic
- Antihistamine
- Anticholinergic
- Anti-vertigo

Indications

- PCP: Prevention or control of nausea caused by motion sickness
- PCP: Relief of moderate to severe nausea and vomiting
- ACP: Prevention or control of nausea caused by narcotic administration

Contraindications

Known sensitivity to dimenhydrinate, diphenhydramine, or caffeine derivatives.

Adult dosages

- PCP: Nausea relief
- 25-50 mg IV/IM
- 12.5 mg IV/IM in elderly or frail patients
- May repeat dose once if required
- Give IM dose as direct injection. IV dose should be diluted with saline. Administer medication at rate of 25 mg/min.

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- PCP: Nausea relief
- 1.25 mg/kg IV/IM. Maximum single dose of 25 mg
- Maximum total daily dose 5 mg/kg/day
- Note: not authorized for patients under 12 years by PCP

Mechanism Of Action

Inhibits cholinergic vestibular and reticular stimulation from motion

Pharmacokinetics

Intravenous:

- Onset: nearly immediate
- Peak: uncertain
- Duration: 3-6 hours

Intramuscular:

- Onset: 20-30 minutes
- Peak: uncertain
- Duration: 3-6 hours

Adverse Effects

Drowsiness and dizziness are the most frequently reported adverse effects. Most side effects are dose-related.

Overdose

Symptoms of overdose are similar to those of atropine toxicity, and can include flushing, dilated pupils, hallucinations, confusion, ataxia, seizures, and loss of consciousness. Treatment is primarily supportive.

Warning And Precautions

Older adults may be particularly susceptible to dimenhyDRINATE's effects. Use with caution in patients with increased ocular pressure or glaucoma, prostatic hypertrophy or urinary obstruction, cardiovascular disease, and asthma or chronic obstructive pulmonary disease. The benefits of dimenhyDRINATE for pregnant women must be weighed against the potential oxytocic effect in these patients.

Drug Interactions

DimenhyDRINATE may potentiate the effects of alcohol, benzodiazepines, or other CNS depressants. Drugs with anticholinergic properties, including tricyclic antidepressants, monoamine oxidase inhibitors, or other antihistamines, may also act synergistically.

DiphenhydrAMINE

Classification

Antihistamine

Indications

- ACP: Adjunct treatment of allergic reaction

Contraindications

- Hypersensitivity to antihistamines
- Neonates
- Premature infants

Adult dosages

- ACP: Allergic reaction
- 50 mg IV or 1 mg/kg to maximum of 50 mg

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- ACP: Allergic reaction
- 1 mg/kg IM/IV to maximum of 50 mg

Mechanism Of Action

Antihistamine with anticholinergic and sedating side effects. Appears to compete with histamine for receptors on effector cells.

Pharmacokinetics

Intramuscular:

- Onset: rapid
- Peak: unknown
- Half-life: 1-4 hours
- Duration: 4-6 hours

Adverse Effects

Most adverse effects are similar to other anticholinergic and antihistamine medications: mucosal membrane dryness, nervousness, irritability, and fatigue. Effects are dose-dependent.

Overdose

Symptoms of overdose are similar to those of atropine toxicity, and can include flushing, dilated pupils, hallucinations, confusion, ataxia, seizures, and loss of consciousness. Treatment is primarily supportive.

Warning And Precautions

DiphenhydrAMINE will not abort or terminate an allergic reaction that is progressing to anaphylaxis. It must not be used in place of EPINEPHrine in these patients.

DiphenhydrAMINE should be used with caution in patients with narrow-angle glaucoma, stenosing peptic ulcer, pyloroduodenal obstruction, symptomatic prostatic hypertrophy, or bladder neck obstruction.

Drug Interactions

DiphenhydrAMINE can potentiate the effects of alcohol, benzodiazepines, and other CNS depressants. Drugs with anticholinergic properties, including tricyclic antidepressants, monoamineoxidase inhibitors, or other antihistamines, may also act synergistically.

DOPamine

Classification

Sympathomimetic alpha- and beta-agonist

Dopaminergic agonist

Indications

- CCP: Symptomatic hypotension in the absence of hypovolemia (e.g., cardiogenic shock, bradycardia, sepsis, renal failure)
- CCP: Post-cardiac arrest hypotension

Contraindications

- Known or suspected pheochromocytoma
- Tachydysrhythmias
- Patients taking mono-amine oxidase inhibitors (extreme caution required)

Adult dosages

- CCP: All indications
- 2 mcg/kg/min IV: dopaminergic effects
- 5-10 mcg/kg/min IV: beta effects
- 10-20 mcg/kg/min IV: alpha effects
- For the treatment of hemodynamically unstable patients, the dose range is 5-20 mcg/kg/min
- Titrate DOPamine in increments of 2-5 mcg/kg/min every 2-5 minutes to effect

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- CCP: All indications
- 2 mcg/kg/min IV: dopaminergic effects
- 5-10 mcg/kg/min IV: beta effects
- 10-20 mcg/kg/min IV: alpha effects
- For the treatment of hemodynamically unstable patients, the dose range is 5-20 mcg/kg/min
- Titrate DOPamine in increments of 2-5 mcg/kg/min every 2-5 minutes to effect

Mechanism Of Action

DOPamine's activity is dose-dependent: low doses result in renal, mesenteric, and cerebral vasodilation, improving urine output (and are very unlikely to be used in prehospital care). Medium doses provoke beta stimulation, increasing heart rate and contractility. At high doses, alpha effects dominate, producing systemic vasoconstriction.

Pharmacokinetics

Intravenous:

- Onset: 2-5 minutes
- Peak: Unknown
- Half-life: 2 minutes

- Duration: less than 10 minutes

Adverse Effects

The most serious adverse effects of DOPamine are ventricular arrhythmias and atrial fibrillation.

Extravasation is a significant risk: sloughing and tissue necrosis has been reported from these events. Ensure the IV line is patent and secure prior to administering DOPamine.

Overdose

Overdosage of DOPamine is associated with excessively elevated blood pressures. Reduce the rate of administration, or temporarily discontinue infusion until the patient's condition is stable. DOPamine's duration of action is relatively short; it is unlikely additional management measures will be required. For protracted overdose situations, consider the use of alpha-adrenergic antagonist agent (phentolamine) for management of hypertension.

Warning And Precautions

Do not administer DOPamine to patients with uncorrected tachydysrhythmias or ventricular fibrillation. DOPamine must not be diluted with alkaline solutions. Use with extreme caution in patients taking monoamine oxidase inhibitor medications; substantially smaller doses will be required to achieve the same clinical effects.

Drug Interactions

See Warnings and Precautions for details on co-administration with monoamine oxidase inhibitors.

EPINEPHrine

Classification

 **HIGH ALERT MEDICATION**

Catecholamine

Sympathomimetic

Indications

- PCP: Anaphylaxis
- PCP: Severe bronchospasm
- PCP: Severe croup
- ACP: Cardiac arrest
- ACP: Peri-arrest hypotension
- ACP: Significant bradycardia

Contraindications

There are no absolute contraindications to EPINEPHrine use in life-threatening situations such as anaphylaxis. Caution should be used in patients with significant tachydysrhythmias, or in the context of hypothermia.

Adult dosages

- PCP: Anaphylaxis
 - 0.5 mg IM every 5 minutes. May repeat up to 3 times.
- PCP: Severe bronchospasm with impending respiratory arrest
 - **MANDATORY CLINICAL CONSULTATION (1-833-829-4099) PRIOR TO ADMINISTRATION.**
 - 0.5 mg IM every 5-20 minutes.
- ACP: Pre-arrest anaphylaxis or bronchospasm
 - 50-100 mcg IV/IO. May repeat as necessary.
- ACP: Cardiac arrest
 - 1 mg IV/IO every 3-5 minutes. Suggested maximum dose of 3-4 mg.
- ACP: Peri-arrest hypotension
 - 10 mcg IV/IO slow push every 2-3 minutes as required.
- ACP: Significant bradycardia
 - 2-10 mcg/minute IV/IO infusion.

Pediatric Considerations And Dosing

[Follow weight-based dosing.](#)

- PCP: Anaphylaxis
 - 0.01 mg/kg IM to maximum of 0.5 mg. May repeat up to 3 times.
- PCP: Severe bronchospasm with impending respiratory arrest

- MANDATORY CLINICAL CONSULTATION (1-833-829-4099) PRIOR TO ADMINISTRATION
- 0.01 mg/kg IM to maximum of 0.5 mg

■ PCP: Severe croup

- 5 mg by nebulizer mask
 - MANDATORY CLINICAL CONSULTATION (1-833-829-4099) PRIOR TO ADMINISTRATION
 - If under 1 year of age: 0.5 mg/kg to maximum of 5 mg
 - Total volume of fluid in nebulizer mask should be 5 mL
 - Requires additional training

■ ACP: Cardiac arrest

- 0.01 mg/kg IV/IO

■ ACP: Pre-arrest anaphylaxis

- 5 mcg/kg IV/IO

■ ACP: Peri-intubation resuscitation

- 1 mcg/kg slow push IV/IO every 2-3 minutes

Mechanism Of Action

EPINEPHrine acts on alpha- and beta-adrenergic receptors. Alpha-adrenergic activity produces vasoconstriction and reduces vascular permeability; beta-adrenergic activity results in bronchial smooth muscle relaxation, increased heart rate, and increased force of cardiac contraction. EPINEPHrine also inhibits histamine release.

Pharmacokinetics

When given intramuscularly or intravenously, EPINEPHrine has a very rapid time of onset, and a relatively short duration of action, which may necessitate repeat doses.

Adverse Effects

Common reactions to systemically administered EPINEPHrine include anxiety, tremor, dizziness, sweating, palpitations, headache, and nausea. Rapid increases in blood pressure and heart rate can occur.

Accidental injection of epinephrine into a digit, hands, or feet may result in a loss of blood flow to the area.

Overdose

EPINEPHrine overdose may produce significantly elevated blood pressures and heart rates, which may in turn cause cerebral hemorrhage.

Warning And Precautions

WARNING: EPINEPHrine VIALS **MUST** BE STORED IN SPECIALLY-MARKED CONTAINERS AND **NEVER** CO-MINGLED WITH OTHER MEDICATIONS IN KITS OR BINS. INADVERTENT ADMINISTRATION OF EPINEPHrine TO PATIENTS HAS THE POTENTIAL TO CAUSE SERIOUS HARM OR DEATH.

Patients with underlying coronary artery disease may develop signs and symptoms of angina or myocardial ischemia. Caution should be exercised in these cases.

Drug Interactions

Arrhythmias can develop in patients taking antiarrhythmic medications. Beta-adrenergic blocking drugs can limit the

effectiveness of EPINEPHrine's bronchodilating and inotropic effects.

FentaNYL

Classification

 **HIGH ALERT MEDICATION**

CONTROLLED AND TARGETED SUBSTANCE

Synthetic opioid analgesic

Indications

- ACP: Moderate to severe pain
- ACP: Adjunct for awake intubation
- CCP: Adjunct for rapid sequence intubation

Contraindications

- Known hypersensitivity or allergy to opioids (including morphine)
- Myasthenia gravis
- Pre-existing respiratory depression
- Acute asthma
- Upper airway obstruction

Adult dosages

- ACP: Moderate to severe pain
- Loading dose: 0.5-1.0 mcg/kg IM/IV/IO. Maximum single dose 100 mcg. May repeat every 5 minutes to a total dose of 300 mcg.
- Loading dose: 1.5-2.0 mcg/kg IN. Maximum single dose 100 mcg. May repeat every 5 minutes to a total dose of 300 mcg.
- Maintenance dose in long transports: 50 mcg IM/IV/IO every 10 minutes. Maximum total dose of 250 mcg/hour.
- Maintenance dose in long transports: 50-100 mcg IN every 10 minutes as required. Maximum total dose of 250 mcg/hour.

Consider reducing doses by ½ in patients over 65 years of age. If pain is insufficiently relieved after a total of 1-3 mcg/kg of fentaNYL, consider use of ketamine. Contact ClinicaCall if higher doses of fentaNYL are required.

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

NB: If vascular access is unavailable, the preferred route of administration for fentaNYL is intranasal – intramuscular absorption rates are inconsistent in children.

- ACP: Moderate to severe pain
- Loading dose: 1.5-2.0 mcg/kg IN. Maximum single dose 100 mcg.
- Loading dose: 1-2 mcg/kg IV/IO. Maximum single dose 50 mcg every 5 minutes as required. Total maximum dose 200 mcg.
- Maintenance dose in long transports: 0.75-1.5 mcg/kg IN every 10 minutes as required, to a maximum of 150 mcg/hour.
- Maintenance dose in long transports: 0.5 mcg/kg IV/IO every 10 minutes as required, to a maximum of 150 mcg/hour.

FentaNYL is preferred for pain management over ketamine or methoxyflurane.

Mechanism Of Action

Inhibits ascending pain pathways in the central nervous system, altering pain perception by binding to opiate receptors, producing analgesia and euphoria.

Pharmacokinetics

Intravenous:

- Onset: immediate to 2 minutes
- Peak: 3 to 5 minutes
- Half life: 3.6 hours
- Duration: 30 to 60 minutes

Adverse Effects

- Lightheadedness, dizziness, sedation, agitation, fear, delirium, drowsiness, disorientation.
- Nausea and/or vomiting.
- Respiratory depression
- Laryngospasm
- Chest wall rigidity

Overdose

Provide airway management and ventilatory support. Consider the use of naloxone to reverse opioid intoxication. Naloxone should be used judiciously in patients on long-term opioid therapy to avoid precipitating acute withdrawal syndrome.

Warning And Precautions

FentaNYL is a potent opioid analgesic and carries the risk of respiratory depression whenever it is used.

Drug Interactions

Concomitant use of benzodiazepines or other central nervous system depressants can lead to significant sedation and respiratory depression.

Furosemide

Classification

Antihypertensive, loop diuretic

Indications

■ CCP: Cardiogenic pulmonary edema

Contraindications

- Systolic blood pressure < 100 mmHg
- Hypersensitivity to furosemide or sulfonamide-derived drugs
- Complete renal shutdown
- Hepatic coma or precoma
- Known or suspected electrolyte imbalance, hypovolemia, dehydration, or hypotension
- Jaundice in newborn infants or infants with diseases capable of causing hyperbilirubinemia
- Pregnancy or breast-feeding

Adult dosages

■ CCP: Acutely decompensated cardiogenic pulmonary edema

- For patients with intact renal function: 40-80 mg IV/IO, or double the patient's usual daily dose
- For patients with known or suspected renal impairment (eGFR < 30 mL/minute/1.73 m²): higher doses may be required to achieve diuretic responses; single doses > 160-200 mg IV are unlikely to produce additional diuresis.

Pediatric Considerations And Dosing

Caution: Limited data available. Consultation with CiniCall is required.

Mechanism Of Action

Furosemide inhibits the reabsorption of sodium and chloride in the ascending loop of Henle, as well as the proximal and distal tubules.

Adverse Effects

Cardiovascular: Necrotizing angitis, orthostatic hypotension, thrombophlebitis

Dermatologic: Acute generalized exanthematous pustulosis, bulla (hemorrhagic), bullous pemphigoid, erythema multiforme, exfoliative dermatitis, lichenoid eruption, pruritus, skin photosensitivity, skin rash, Stevens-Johnson syndrome, toxic epidermal necrolysis, urticaria.

Endocrine & metabolic: Glycosuria, hyperglycemia, hyperuricemia, hypocalcemia, hypochloremic alkalosis, hypokalemia, hypomagnesemia, hypovolemia, increased serum cholesterol, increased serum triglycerides

Gastrointestinal: Abdominal cramps, anorexia, constipation, diarrhea, gastric irritation, nausea, oral irritation, pancreatitis, vomiting

Genitourinary: Bladder spasm

Hematologic & oncologic: Agranulocytosis, anemia, aplastic anemia, hemolytic anemia, leukopenia, purpuric disease, thrombocytopenia

Hepatic: Hepatic encephalopathy, increased liver enzymes, intrahepatic cholestatic jaundice

Hypersensitivity: Anaphylactic shock, anaphylaxis, angioedema, nonimmune anaphylaxis

Immunologic: Drug reaction with eosinophilia and systemic symptoms

Nervous system: Dizziness, headache, paresthesia, restlessness, vertigo

Neuromuscular & skeletal: Asthenia, muscle spasm

Ophthalmic: Blurred vision, xanthopsia

Otic: Deafness, tinnitus

Renal: Acute kidney injury, calcium nephrolithiasis (pediatric patients), interstitial nephritis (allergic) (Jennings 1986), nephrolithiasis (pediatric patients)

Miscellaneous: Fever

Source: Furosemide. In: Lexicomp Online, UpToDate, Waltham, MA. (Accessed November 20, 2020.)

Warning And Precautions

- If given in excessive amounts, furosemide can lead to profound diuresis, causing fluid and electrolyte depletion. Supervise therapy closely.
- Monitor fluid status and renal function to prevent oliguria, azotemia, and increases in BUN and creatinine.

Drug Interactions

May enhance the hypotensive effect of angiotensin-converting enzyme inhibitors.

Beta-2 adrenergic agonists may enhance the hypokalemic effect of loop diuretics, including furosemide.

Non-steroidal anti-inflammatory agents may diminish the effectiveness of loop diuretic.

Opioid agonists may enhance the toxic effects of diuretics, and diminish their therapeutic effectiveness.

Glucagon

Classification

Pancreatic hormone and insulin antagonist

Indications

- PCP: Suspected or confirmed hypoglycemia where IV access is unavailable
- ACP: Suspected beta- or calcium channel-blocker overdose

Contraindications

Allergy or hypersensitivity
Pheochromocytoma

Adult dosages

- PCP: Suspected or confirmed hypoglycemia where IV access is unavailable
 - 5-1.0 mg IM/SC
- ACP: Suspected beta- or calcium channel-blocker overdose
 - Contact CliniCall to discuss dosing strategies

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- PCP: Suspected or confirmed hypoglycemia where IV access is unavailable
 - If < 25 kg: 0.5 mg IM/SC
 - If > 25 kg: 1.0 mg IM/SC
- ACP: Suspected beta- or calcium channel-blocker overdose
 - Contact CliniCall to discuss dosing strategies

Mechanism Of Action

Glucagon accelerates the conversion of glycogen to glucose in the liver, elevating blood glucose levels. It is only effective in treating hypoglycemia if liver glycogen is available.

Pharmacokinetics

Intramuscular or subcutaneous:

- Onset: 8-10 minutes
- Peak: 20-30 minutes
- Half-life: 3-6 minutes
- Duration: 19-32 minutes

Adverse Effects

Nausea and vomiting can be common. Glucagon can also transiently increase blood pressure and heart rate.

Overdose

Excessive parenteral administration of glucagon can cause nausea, vomiting, and diarrhea. Ingestion of glucagon is unlikely to result in symptoms, as it is rapidly destroyed by the gastrointestinal tract.

Warning And Precautions

Glucagon **must** be reconstituted with the supplied diluent. Do not attempt to reconstitute or administer with normal saline.

In patients with pheochromocytoma, glucagon can cause a release of catecholamines that leads to significant hypertension and tachycardia, and may provoke an intracerebral hemorrhage.

Drug Interactions

Hypoglycemia produced by excessive alcohol consumption is unlikely to be reversible with glucagon.

Glycopyrrolate

Classification

Anticholinergic agent

Indications

- ACP: Management of excessive respiratory secretions in palliative care

Contraindications

- Known hypersensitivity to glycopyrrolate
- Glaucoma
- Obstructive uropathy
- Obstructive diseases of the gastrointestinal tract
- Paralytic ileus
- Intestinal atony
- Chronic lung diseases in elderly or debilitated patients
- Unstable cardiovascular status in acute hemorrhage
- Severe ulcerative colitis
- Toxic megacolon (as a complication of ulcerative colitis)
- Myasthenia gravis

Adult dosages

- ACP: Management of excessive respiratory secretions in palliative care
- Requires specific training and license endorsement. Collaborate with CliniCall and patient's care team before selecting a dosing strategy.
- Initial dose: 0.4 mg SC, then 0.2-0.4 mg SC every 1-4 hours as required

Pediatric Considerations And Dosing

Consultation with CliniCall is required prior to administration of glycopyrrolate to children

Mechanism Of Action

Blocks the action of acetylcholine at parasympathetic sites in secretory glands, smooth muscle, and the central nervous system, reducing the rate of salivation indirectly by preventing stimulation of acetylcholine receptors.

Pharmacokinetics

Onset via subcutaneous administration is reported within 30-60 minutes of administration.

Adverse Effects

- Dry mouth
- Urinary retention
- Visual disturbances
- Confusion

- Tachycardia

Warning And Precautions

- Use half the dose in end-stage renal failure.
- Elderly patients may be particularly susceptible to glycopyrrolate's anticholinergic action. Start with low doses.
- Glycopyrrolate may decrease sweat production, which can exacerbate fever or provoke heat exhaustion in warm environments.
- Investigate any tachycardia before administering glycopyrrolate, as it may independently raise the heart rate. Caution is advised in patients with a history of coronary artery disease, heart failure, cardiac arrhythmias, or hypertension.

Drug Interactions

Glycopyrrolate may decrease serum concentrations of haloperidol; concurrent use should be avoided if possible.

Haloperidol

Classification

Antipsychotic

Indications

- CCP: Emergency sedation of severely agitated or delirious patients

Contraindications

- Hypersensitivity to haloperidol or any component of its formulation.
- Parkinson's disease
- Severe CNS depression or coma

Adult dosages

- CCP: Emergency sedation of severely agitated or delirious patients

- 5-10 mg IM
- 2-5 mg IV incrementally to effect

Pediatric Considerations And Dosing

The safety and efficacy of haloperidol has not been established in children.

Mechanism Of Action

Haloperidol blocks post-synaptic mesolimbic dopaminergic receptors in the brain, depressing the release of hypothalamic and hypophyseal hormones, which is believed to depress the reticular activating system and thus basal metabolism, body temperature, wakefulness, vasomotor tones, and emesis sites.

Pharmacokinetics

Onset of action:

- IM/IV: 30-60 minutes

Adverse Effects

Extrapyramidal reactions, such as Parkinson-like symptoms, akathisia, or dystonia, can occur with haloperidol use. These reactions are reported to occur more frequently when haloperidol is given intravenously. Manage dystonic reactions with diphenhydramine (25-50 mg IV).

Warning And Precautions

Haloperidol is associated with increased mortality in geriatric patients with dementia-related psychosis. Higher doses, as well as intravenous administration, have been associated with an increased risk of QT interval prolongation and the development of torsades de pointes.

HydrALAzine

Classification

Antihypertensive, vasodilator

Indications

- CCP: Hypertensive emergency
- CCP: Hypertensive emergency in pregnancy or postpartum

Contraindications

- Hypersensitivity to hydralazine
- Coronary artery disease
- Mitral valve rheumatic heart disease
- Severe tachycardia and heart failure with high cardiac output
- Myocardial insufficiency due to mechanical obstruction (aortic or mitral stenosis, constrictive pericarditis)
- Isolated right ventricular heart failure due to pulmonary hypertension
- Acute dissecting aortic aneurysm
- Porphyria

Adult dosages

- CCP: Hypertensive emergency
 - 10-20 mg IV/IM every 4-6 hours as required.
- CCP: Hypertensive emergency in pregnancy or postpartum
 - 5-10 mg IV, may repeat 5-10 mg doses every 20 minutes if blood pressure continues to exceed thresholds. Consider alternative agent if blood pressure remains elevated after a total of 20-30 mg.

Caution: significant drug interactions exist. Consult drug interaction database for additional information.

Pediatric Considerations And Dosing

- CCP: Hypertensive emergency
 - 0.1-0.2 mg/kg/dose every 4-6 hours, titrated as required. Usual dose range: 0.2-0.6 mg/kg/dose

Caution: significant drug interactions exist. Consult drug interaction database for additional information.

Mechanism Of Action

Causes direct vasodilation of arterioles, decreasing systemic resistance. May occur due to inhibition of calcium release from sarcoplasmic reticulum and inhibition of myosin phosphorylation in arterial smooth muscle cells.

Pharmacokinetics

Following intravenous administration:

- Onset: 10-80 minutes
- Duration: up to 12 hours
- Metabolism: hepatic
- Half-life: 3-7 hours

Adverse Effects

Cardiovascular: Acute myocardial infarction, angina pectoris, edema, flushing, hypotension, myocardial stimulation, palpitations, paradoxical response to antihypertensive, tachycardia

Dermatologic: Pruritus, skin rash (including eczema), urticaria

Gastrointestinal: Anorexia, constipation, diarrhea, nausea, paralytic ileus, vomiting

Genitourinary: Difficulty in micturition

Hematologic & oncologic: Agranulocytosis, decreased hemoglobin, decreased red blood cells, eosinophilia, leukopenia, lymphadenopathy, purpuric disease, splenomegaly

Hepatic: Hepatitis

Nervous system: Chills, dizziness, headache, peripheral neuritis, psychotic reaction (including anxiety, depression, disorientation, euphoria, hypomania, nervousness)

Neuromuscular & skeletal: Arthralgia, muscle cramps, tremor

Ophthalmic: Conjunctivitis, lacrimation

Respiratory: Dyspnea, nasal congestion

Miscellaneous: Fever

Source: HydrALazine. In: Lexicomp Online, UpToDate, Waltham, MA. (Accessed November 20, 2020.)

Warning And Precautions

Consider concurrent use of beta blocker: hydrALazine is associated with reflex tachycardia.

Drug Interactions

Caution: significant drug interactions exist. Consult drug interaction database for additional information.

Hydrocortisone

Classification

Systemic corticosteroid

Indications

- CCP: Severe septic shock unresponsive to fluid and vasopressor therapy

Contraindications

- Hypersensitivity to hydrocortisone or other corticosteroids
- Systemic fungal infections

Adult dosages

- CCP: Severe septic shock unresponsive to fluid and vasopressor therapy

- 100 mg IV/IO. Do not repeat dose.

Pediatric Considerations And Dosing

Caution: Limited data available. Consultation with CiniCall is required.

Mechanism Of Action

Decreases inflammation by suppressing migration of polymorphonuclear leukocytes and reversing increased capillary membrane permeability.

Pharmacokinetics

Following intravenous administration:

- Onset: 1 hour
- Half-life: 2-3 hours
- Metabolism: hepatic
- Excretion: urine

Adverse Effects

Cardiovascular: Atheromatous embolism, bradycardia, cardiac arrhythmia, cardiac failure (especially in susceptible patients), cardiomegaly, circulatory shock, hypertension, hypertrophic cardiomyopathy (premature infants), myocardial rupture (post-myocardial infarction), syncope, tachycardia, thromboembolism, thrombophlebitis, vasculitis

Central nervous system: Arachnoiditis (intrathecal administration), depression, emotional lability, euphoria, headache, increased intracranial pressure (with pseudotumor cerebri; usually following discontinuation), insomnia, malaise, meningitis (intrathecal administration), myasthenia, neuritis, neuropathy, paraplegia (intrathecal administration), paresthesia, personality changes, psychic disorder, seizure, sensory disturbance (intrathecal administration), tingling of skin (especially in the perineal area after IV injection), vertigo

Dermatologic: Acne vulgaris, allergic dermatitis, alopecia, atrophic striae, burning sensation of skin (especially in the perineal area after IV injection), diaphoresis, ecchymosis, erythema (including facial), exfoliation of skin, hyperpigmentation, hypertrichosis, hypopigmentation, skin atrophy, skin rash, suppression of skin test reaction, urticaria, xeroderma

Endocrine & metabolic: Adrenal suppression, Cushing syndrome, diabetes mellitus (latent), fluid retention, glycosuria, growth suppression, hirsutism, HPA-axis suppression, hypercalcemia (associated with cancers), hyperglycemia (including increased requirements for insulin or oral hypoglycemic agents in diabetes mellitus), hypokalemia, hypokalemic alkalosis, impaired glucose tolerance, lipodystrophy, lipomatosis (epidural), menstrual disease (menstrual irregularities), moon face, negative nitrogen balance, protein catabolism, sodium retention, weight gain

Gastrointestinal: Abdominal distention, carbohydrate intolerance, dyspepsia, gastrointestinal disease (intrathecal administration), gastrointestinal perforation (small and large intestine, particularly in patients with inflammatory bowel disease), hiccups, increased appetite, nausea, pancreatitis, peptic ulcer (with possible perforation and hemorrhage), ulcerative esophagitis, vomiting

Genitourinary: Asthenospermia, bladder dysfunction (intrathecal administration)

Hematologic & oncologic: Leukocytosis, petechia

Hepatic: Hepatomegaly, increased serum transaminases (usually mild elevations and reversible on discontinuation)

Hypersensitivity: Anaphylaxis, angioedema, hypersensitivity reaction

Infection: Increased susceptibility to infection, infection, sterile abscess

Local: Atrophy at injection site (cutaneous and subcutaneous), postinjection flare (intra-articular use), skin edema

Neuromuscular & skeletal: Amyotrophy, Charcot-like arthropathy, lower extremity weakness (intrathecal administration), osteonecrosis (aseptic necrosis of femoral and humeral heads), osteoporosis, pathological fracture (long bones), rupture of tendon (particularly Achilles tendon), steroid myopathy, vertebral compression fracture

Ophthalmic: Cataract (posterior subcapsular), exophthalmos, glaucoma, increased intraocular pressure, retinopathy (central serous chorioretinopathy)

Respiratory: Pulmonary edema

Miscellaneous: Wound healing impairment

Source: Hydrocortisone. In: Lexicomp Online, UpToDate, Waltham, MA. (Accessed November 20, 2020.)

Warning And Precautions

May cause hypercortisolism, particularly in younger children or when used for long periods of time at higher doses.

Use with caution in patients with heart failure or hypertension: corticosteroids has been associated with fluid retention and electrolyte disturbance.

Corticosteroids have been associated with myocardial rupture when used in acute myocardial infarction.

Corticosteroids should not be administered for sepsis in the absence of shock.

Drug Interactions

Corticosteroids may enhance the adverse or toxic effects of non-steroidal anti-inflammatory agents and salicylates (including gastrointestinal ulceration and bleeding). They may also reduce the serum concentration of salicylates.

May decrease the serum concentration of phenytoin.

May enhance the anticoagulant properties of warfarin.

Hydroxocobalamin

Classification

Vitamin (form of vitamin B12)

Indications

- CCP: Patients with known cyanide ingestion
- CCP: Patients from enclosed space fires with altered levels of consciousness

Contraindications

Allergy to hydroxocobalamin

Adult dosages

- CCP: All indications
- 70 mg/kg IV. Typical adult dose is 5 g for a 71 kg person.
- Second half-dose may be given depending on the severity of the poisoning, or the clinical response to treatment

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- CCP: All indications
- 70 mg/kg IV.
- Second half-dose may be given depending on the severity of the poisoning, or the clinical response to treatment

Mechanism Of Action

Hydroxocobalamin binds directly with cyanide molecules, which prevents cyanide binding to cellular mitochondria

Pharmacokinetics

Following IV administration:

- Onset: Immediate
- Half-life: 24-48 hours

Excretion is in the urine

Adverse Effects

Hydroxocobalamin may cause a temporary reddish discoloration of the skin, plasma, urine, and mucous membranes. These changes last for approximately two to three days.

Overdose

Single doses of hydroxocobalamin are safe in all patients not allergic to vitamin B12.

Warning And Precautions

Hydroxocobalamin may interfere with co-oximetry measurements, complicating the assessment of victims of smoke inhalation who may suffer from both cyanide and carbon monoxide poisoning.

Ibuprofen

Classification

Analgesic

Antipyretic

Non-steroidal anti-inflammatory

Indications

■ PCP: Mild to moderate pain

■ ACP: Fever

Contraindications

Allergy to ibuprofen or other non-steroidal anti-inflammatory drugs

Active GI bleeding or ulcers

Pregnancy (first, second, or third trimesters)

Adult dosages

■ PCP: Mild to moderate pain

- 300-400 mg PO. May repeat every 4-6 hours. Maximum daily dose 1,200 mg/day.

■ ACP: Fever

- 300-400 mg PO. May repeat every 4-6 hours. Maximum daily dose 1,200 mg/day.

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

■ PCP: Mild to moderate pain

- 10 mg/kg PO. May repeat once after 6 hours. Maximum daily dose 40 mg/kg/day from all sources.

■ ACP: Fever

- For temperatures < 39°C: 5 mg/kg. May repeat every 4-6 hours.
- For temperatures > 39°C: 10 mg/kg. May repeat every 4-6 hours.
- Maximum daily dose 40 mg/kg/day from all sources.

Mechanism Of Action

Inhibits prostaglandin synthesis, reducing pain, inflammation, and fever.

Pharmacokinetics

Following oral administration:

- Analgesic effects:
 - Onset: 30 minutes
 - Peak: 1-2 hours
 - Duration: 4-6 hours

- Antipyretic effects:
 - Onset: 30 minutes to 2.5 hours
 - Peak: 2-4 hours
 - Duration: 6-8 hours

Ibuprofen is 80% absorbed through the gastrointestinal tract, metabolised in the liver, and excreted in the urine.

Adverse Effects

The most common adverse reactions involve gastrointestinal upset, ranging from abdominal discomfort to gastric ulceration, bleeding, and perforation. These events are unlikely following a single, prehospital dose of ibuprofen, but care should be exercised in patients with a recent history of NSAID use.

Overdose

The most common symptoms of NSAID overdose are gastrointestinal irritation and CNS depression. Care is primarily supportive.

Warning And Precautions

Alternative treatment options should be considered in patients with a history of gastrointestinal, renal, or significant cardiovascular disease: ibuprofen, and all NSAIDs, have the potential to cause significant adverse reactions. The risk appears to increase with dose, duration of therapy, and underlying risk factors.

Drug Interactions

As a class of medications, NSAIDs may raise blood pressure, limiting the effectiveness of antihypertensives.

Ipratropium

Classification

Anticholinergic bronchodilator

Indications

- ACP: Severe bronchospasm in asthma and chronic obstructive pulmonary disease

Contraindications

Known hypersensitivity to ipratropium or any formulation components

Adult dosages

- ACP: Severe bronchospasm in asthma or chronic obstructive pulmonary disease
 - 160 mcg via metered-dose inhaler (8 x 20 mcg sprays)
 - Spacer use recommended, but not required
 - PREVIOUS DOSING STRATEGY USING NEBULIZERS NOT AUTHORIZED DURING COVID

Pediatric Considerations And Dosing

- ACP: Severe bronchospasm in asthma or chronic obstructive pulmonary disease
 - Consultation with CliniCall recommended to confirm dosing strategy

Mechanism Of Action

Ipratropium antagonizes the activity of acetylcholine in bronchial smooth muscle, producing bronchodilation and muscle relaxation.

Pharmacokinetics

Inhaled:

- Onset: 1-3 minutes
- Peak: 1.5-2 hours
- Duration: 4-6 hours

Adverse Effects

Adverse effects are similar to other anticholinergics and can include atrial arrhythmias, blurred vision. Coughing is common. Paradoxical bronchospasm can occur during the use of inhaled bronchodilators; this is not the same thing as an inadequate response to treatment.

Overdose

Very high doses of ipratropium (up to 1.2 mg) have been given to volunteers without the development of serious systemic side effects.

Warning And Precautions

- Ipratropium is intended to act synergistically with salbutamol as part of a management plan for bronchospasm. It is not indicated for episodes of acute bronchospasm as monotherapy.
- Avoid spraying ipratropium into the eyes of patients with narrow-angle glaucoma.

KetAMINE

Classification

 **HIGH ALERT MEDICATION**

CONTROLLED AND TARGETED SUBSTANCE

Sedative

Analgesic

General anesthetic

Indications

■ PCP: Analgesia

Adult Patients with:

- Moderate to severe pain associated with fractures and dislocations
- Moderate to severe pain associated with burns or soft tissue trauma including crush injuries
- Moderate to severe pain associated with multisystem trauma
- Palliative Patients Requiring Analgesia for pain (See Associated Palliative CPG)

CliniCall can authorize PCPs to administer IN ketamine for:

- Moderate to severe pain in pediatric patients (Aged 5 - 12 years old) due to trauma, fractures, burns or soft tissue injury
- Moderate to severe non-traumatic back pain
- Moderate to severe pain associated with abdominal pain and renal colic
- Moderate to severe obstetrical or gynecological associated pain unrelieved by nitrous oxide

■ ACP: Analgesia

■ ACP: Induction of sedation prior to intubation

■ ACP: Procedural sedation

■ ACP: Severe agitation or excited delirium syndrome

Contraindications

- Ketamine is contraindicated for the purpose of sedation at the PCP level
- Hypersensitivity or allergy to ketAMINE
- Unable to manage the adverse effects of ketAMINE
- Conditions where elevated blood pressure may be harmful
- ACP: Age < 6 months
- PCP: Age < 5 years

Adult dosages

■ PCP: Analgesia

REQUIRES ADDITIONAL TRAINING AND ENDORSEMENT

- Intranasal
 - 0.75 mg/kg ([see intranasal ketamine dosing chart](#))
 - May repeat 0.5 mg/kg after 20 minutes
 - Maximum single dose 100 mg

- Contact CliniCall for additional dosing instructions
- See [PR11: Intranasal Medication Administration](#) procedure

■ ACP: Analgesia

- Intravenous/Intraosseous
 - 0.3 mg/kg slow push
 - May repeat 0.15 mg/kg after 5 minutes
 - Maximum cumulative dose 0.6 mg/kg in 45 minutes
- Intramuscular
 - 0.5 mg/kg
 - May repeat 0.3 mg/kg after 45 minutes

■ ACP: Procedural Sedation

- Intravenous/Intraosseous
 - 0.1 - 0.5 mg/kg slow push every 60 seconds to effect
 - Consider starting at 0.5 mg/kg; use subsequent doses of 0.25 mg/kg or less as needed
 - Titrate to effect

■ ACP: Anesthesia Induction

- Intravenous/Intraosseous: 2 mg/kg if shock index < 1
- Intravenous/Intraosseous: 1 mg/kg if shock index ≥ 1

■ ACP: Maintenance of Anesthesia

- ½ of required induction dose every 10-15 minutes as required

■ ACP: Excited Delirium

- Intramuscular
 - 4-5 mg/kg bolus
 - Maximum single/cumulative dose 500 mg. If appropriate sedation is not achieved, a call to Clinica11 is required.
 - Maximum volume of administration:
 - Deltoid: 2 mL
 - Lateral thigh: 4-5 mL
 - Gluteal: 5 mL

Pediatric Considerations And Dosing

[Follow weight-based dosing \(Page for Age\)](#)

■ PCP: Analgesia (Aged 5 - 12 years)

■ ACP: Analgesia (Aged > 6 months)

- Intravenous/Intraosseous
 - 0.3 mg/kg slow push
 - Maximum single dose 20 mg
 - Repeat every 2-3 minutes to a total cumulative dose of 0.6 mg/kg
- Intramuscular
 - 0.5 mg/kg
 - May repeat 0.3 mg/kg after 45 minutes
- Intranasal
 - 1.5 mg/kg
 - May repeat 1 mg/kg at 20 minutes
 - Maximum single dose of 100 mg

- See [PR11: Intranasal Medication Administration](#) procedure

■ ACP: Procedural Sedation

- See adult dosing guidelines. **Follow weight-based dosing regimen.**

■ ACP: Excited Delirium

- **CLINICAL CONSULT REQUIRED FOR ANY PATIENT UNDER 12 YEARS OF AGE**
- See adult dosing guidelines above

Mechanism Of Action

Ketamine is a non-competitive NMDA receptor antagonist that blocks glutamate. Low doses produce analgesia and modulate central sensitization, hyperalgesia, and opioid tolerance. Reduces polysynaptic spinal reflexes.

Pharmacokinetics

Onset:

- Intravenous/Intraosseous: anesthetic effects within 30 seconds
- Intramuscular: anesthetic effects within 3-4 minutes
- Intranasal: analgesic effects within 5-10 minutes

Duration:

- Intravenous/Intraosseous: 5-10 minutes, recovery 1-2 hours
- Intramuscular: 12-15 minutes, recovery 3-4 hours
- Intranasal: up to 60 minutes of analgesic effects

Adverse Effects

- Emergence phenomenon: confusion, delirium, excitement, hallucinations
- Tachycardia and hypertension (> 10%)
- Laryngospasm (< 1%)
- Bradycardia and hypotension (1-10%)
- Anaphylaxis (< 1%)
- Hypersalivation (< 1%)
- Extreme muscle rigidity or tone (< 1%)
- Nystagmus, increased intraocular pressure
- Apnea and respiratory depression (rare; transient reaction with rapid IV bolus dose)
- Erythema, morbilliform rash, rash at injection site
- Laryngospasm is a known and rare complication of ketAMINE administration, and, when it occurs, is usually transient.

Warning And Precautions

Use with caution in:

- Severe hypertension (systolic BP > 180 mmHg)
- Subarachnoid hemorrhage or epidural hematoma with severe hypertension
- Myocardial ischemia or cardiac arrhythmias

KeTORolac

Classification

Non-opioid analgesic

Non-steroidal anti-inflammatory drug

Indications

■ CCP: Moderate to severe acute pain

Contraindications

- Hypersensitivity to keTORolac, aspirin, or other NSAIDs
- Active, or history of, peptic ulcer disease
- Recent GI bleeding or perforation
- Asthma, urticaria, or allergic-type reactions after taking aspirin or other NSAIDs
- Advanced renal disease
- Suspected or confirmed cerebrovascular bleeding
- Concurrent use with aspirin or other NSAIDs
- Labour and delivery
- Preoperative pain prophylaxis

Adult dosages

■ CCP: Moderate to severe acute pain

- 30 mg IV as a single dose. May repeat every 6 hours to maximum of 120 mg/day.
- 60 mg IM as a single dose. May also consider initial dose of 10 to 30 mg IM, then every 4-6 hours as required, to maximum of 120 mg/day.

Pediatric Considerations And Dosing

■ CCP: Moderate to severe acute pain

Limited data available.

- For children over 2 and under 16 years of age: 0.5 mg/kg/dose IM/IV every 6 hours. Maximum dose 30 mg/dose.
- For children over 16 years of age: 30 mg IM or 15 mg IV every 6 hours. Maximum daily dose 60 mg/day.

Mechanism Of Action

Reversibly inhibits cyclooxygenase-1 and 2 (COX-1 and 2) enzymes, resulting in decreased formation of prostaglandin precursors.

Pharmacokinetics

- Onset: 30 minutes
- Duration: 4-6 hours
- Peak: 1-3 minutes (IV), 30-60 minutes (IM)
- Half-life: 3-9 hours
- Excretion: urine

Adverse Effects

>10%:

Central nervous system: Headache (17%)

Gastrointestinal: Gastrointestinal pain (13%), dyspepsia (12%), nausea (12%)

>1% to 10%:

Cardiovascular: Edema (4%), hypertension

Central nervous system: Dizziness (7%), drowsiness (6%)

Dermatologic: Diaphoresis, pruritus, skin rash

Gastrointestinal: Diarrhea (7%), constipation, flatulence, gastrointestinal fullness, gastrointestinal hemorrhage, gastrointestinal perforation, gastrointestinal ulcer, heartburn, stomatitis, vomiting

Hematologic & oncologic: Anemia, prolonged bleeding time, purpura

Hepatic: Increased liver enzymes

Local: Pain at injection site (2%)

Otic: Tinnitus

Renal: Renal function abnormality

Warning And Precautions

- Inhibits platelet functions. Contraindicated in patients with cerebrovascular bleeding, hemorrhagic diathesis, incomplete hemostasis, and patients at high risk of bleeding.
- NSAIDs have an increased risk of serious and potentially fatal adverse cardiovascular thrombotic events.
- KeTORolac can cause peptic ulcers, GI bleeding, and/or perforation of the stomach or intestines.
- May increase the risk of hyperkalemia, particularly in the elderly, diabetics, patients with renal disease, or concomitant use of other agents that may induce hyperkalemia (e.g., ACE inhibitors).

LABETalol

Classification

Selective alpha- and non-selected beta-adrenergic blocker

Indications

■ CCP: Severe hypertension or hypertensive crisis

Contraindications

- Bronchospastic airway disease
- Obvious congestive heart failure
- Second- or third-degree heart block
- Cardiogenic shock
- Severe bradycardia
- Other conditions associated with severe and prolonged hypotension
- Known hypersensitivity to labetalol or any ingredient in the formulation

Adult dosages

■ CCP: Severe hypertension or hypertensive crisis

- Initial goal of IV therapy is to reduce mean arterial BP by no more than 25% within minutes to 1 hour, followed by further reduction *if stable* toward 160/100 to 110 mm Hg within the next 2–6 hours, avoiding excessive declines in pressure that could precipitate renal, cerebral, or coronary insufficiency. If this BP is well tolerated and the patient is clinically stable, further gradual reductions toward normal can be implemented in the next 24–48 hours.
- Intravenous bolus dosing:
 - 20–80 mg slow IV push
 - Higher initial doses (1–2 mg/kg) are available, but 20 mg is recommended to minimize adverse events and risks associated with a rapid fall in blood pressure.
 - Additional doses can be given (20–80 mg) at 10 minute intervals until the desired supine blood pressure is reached, or to a total cumulative dose of 300 mg
- Intravenous infusion dosing:
 - 0.5–2 mg/min via continuous infusion. Adjust the flow rate based on blood pressure response.
 - Progressive, incremental IV infusion regimen (i.e., infusing 20, 40, 80, and 160 mg/hour for 1 hour at each dose level, or until the desired BP is achieved) has been used, and may result in more gradual BP reduction, minimizing adverse effects compared with repeated IV injections of the drug. Controlled comparisons of various IV administration methods are not available.
 - Maximum cumulative dose of 300 mg
- Adjust dosage according to the severity of hypertension and the patient's supine BP response and tolerance
- Patients with aortic dissection should have systolic pressure reduced to <100 mm Hg if tolerated

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

Mechanism Of Action

Competitively blocks adrenergic stimulation of β -receptors within the myocardium (β_1 -receptors) and within bronchial and vascular

smooth muscle (β_2 -receptors) and α_1 -receptors within vascular smooth muscle.

Pharmacokinetics

- Onset
 - Following slow, direct IV injection, hypotensive effect is apparent within 2–5 minutes and usually maximal within 5–15 minutes
- Duration
 - Following slow, direct IV injection, the hypotensive effect generally persists for about 2–4 hours, although a longer duration of effect (i.e., up to 24 hours) has been reported in some patients

Adverse Effects

- Symptomatic orthostatic hypotension
- Dizziness or light headedness
- Fatigue
- Nausea or dyspepsia

Overdose

Management of overdose is consistent with the management of beta blocker toxicity. See [CPG J07: Beta Blockers](#) for additional information.

Warning And Precautions

Use of LABETalol carries the risk of precipitating congestive heart failure. LABETalol may be used cautiously in patients with well-compensated heart failure (i.e., those whose heart failure is controlled with cardiac glycosides or diuretics).

Lidocaine

Classification

Class IB antiarrhythmic

Local anesthetic

Indications

- ACP: Control of ventricular arrhythmias (including ectopy, brief or sustained ventricular tachycardia, and ventricular fibrillation)
- ACP: Local anesthesia during intraosseous cannulation
- ACP: Local anesthesia during awake intubation

Contraindications

Allergy or hypersensitivity to lidocaine

For systemic (IV/IO) administration, including rhythm control and IO anesthesia:

- Third-degree AV block
- Ventricular escape rhythms
- Wolff-Parkinson-White syndrome

Consider alternative agents in patients with congestive heart failure. Consultation with CliniCall is recommended in these cases.

NB: some sources report that lidocaine use is contraindicated in second-degree AV blocks. These rhythms are functionally supraventricular, and in the post-arrest context, the benefits of lidocaine would be likely to outweigh the theoretical risks.

Adult dosages

- ACP: Ventricular rhythm control
 - 1.0-1.5 mg/kg IV bolus
 - May repeat at 0.5-1.0 mg/kg to a total maximum dose of 3 mg/kg
- ACP: Local anesthesia during intraosseous cannulation (in conscious patients)
 - Initial dose 40 mg, administered over 120 seconds
 - Allow the lidocaine to "dwell" in the marrow space for 1-2 minutes before flushing the cannula and infusing an additional dose of 1/2 the initial amount over 60 seconds, then flushing briskly with normal saline
 - Total amount for local anesthesia is 80 mg
 - See [PR12: Intraosseous Cannulation](#) for additional information
- ACP: Local anesthesia for awake intubation
 - Attach lidocaine preload to mucosal atomizer device and directly spray the surface of the tongue, soft palate, posterior pharynx, and tonsillar pillars.
 - Employ a "spray as you go" technique and assess for degree of anesthesia.
 - There is no consensus on a maximum permissible dose: avoid exceeding 5 mg/kg topically where possible.

Pediatric Considerations And Dosing

[Follow weight-based dosing.](#)

■ ACP: Ventricular rhythm control

- 1.0-1.5 mg/kg IV bolus
- May repeat at 0.5-1.0 mg/kg to a total maximum dose of 3 mg/kg

■ ACP: Local anesthesia during intraosseous cannulation (in conscious patients)

- 0.5 mg/kg, to a maximum of 40 mg, slowly infused over 120 seconds.
- Allow the lidocaine to "dwell" in the marrow space for 1-2 minutes before flushing the cannula and infusing an additional dose of 1/2 the initial amount over 60 seconds, then flushing briskly with normal saline
- Total maximum amount for local anesthesia is 80 mg
- See [PR12: Intraosseous Cannulation](#) for additional information.

■ ACP: Local anesthesia for awake intubation

- Attach lidocaine preload to mucosal atomizer device and directly spray the surface of the tongue, soft palate, posterior pharynx, and tonsillar pillars.
- Employ a "spray as you go" technique and assess for degree of anesthesia.
- There is no consensus on a maximum permissible dose: avoid exceeding 5 mg/kg topically where possible.

Mechanism Of Action

As a sodium channel blocker, lidocaine decreases the duration of the action potential by shortening the period of repolarization.

Pharmacokinetics

Intravenous:

- Onset: 2 minutes
- Peak: uncertain
- Half-life: 1-2 hours
- Duration: 20 minutes

Adverse Effects

- Dizziness, lightheadedness, drowsiness, slurred speech
- Hypotension
- Muscle twitching
- Paresthesia (particularly in fingers or lips)
- Tinnitus
- Nausea or vomiting
- Cardiac arrhythmias

Overdose

Care for lidocaine overdoses is primarily supportive, although some in-hospital therapies are available.

Drug Interactions

The risk of lidocaine toxicity is increased in patients taking cimetidine, ranitidine, or beta blockers. Lidocaine use in patients taking disopyramide may precipitate bradycardia that can progress to cardiac arrest.

Magnesium Sulfate

Classification

Antiarrhythmic

Smooth muscle relaxant

Indications

- ACP: Treatment of ventricular fibrillation and ventricular tachycardia refractory to first-line antiarrhythmics
- ACP: Recurrent, intermittent episodes of wide-complex tachycardia
- ACP: Treatment of Torsades de Pointes
- ACP: Bronchospasm refractory to bronchodilation in acute asthma
- ACP: Management of seizures in pregnancy associated with hypertension

Contraindications

- Hypersensitivity to magnesium sulfate
- Second or third-degree AV block

Adult dosages

- ACP: Control of ventricular arrhythmias (including Torsades de Pointes)
 - For perfusing rhythms: 2 g IV over 15 minutes
 - In cardiac arrest: 4 g IV push
- ACP: Bronchospasm refractory to bronchodilation
 - 2 g IV over 20 minutes
- ACP: Management of seizures in pregnancy associated with hypertension

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- ACP: All indications
 - In cardiac arrest: 50 mg/kg IV/IO push to maximum of 2 g
 - All other causes: 50 mg/kg IV/IO [infused over 15 minutes](#)

Mechanism Of Action

The precise mechanism of action of magnesium sulfate is not entirely clear. It appears to alter membrane potential, slowing conduction and relaxing smooth muscle.

Pharmacokinetics

Following intravenous administration:

- Onset: 1-2 minutes
- Peak: < 5 minutes

- Duration: uncertain in most patients

Infusions may take up to 20-30 minutes to produce significant bronchodilation

Warning And Precautions

May prolong the effects of non-depolarizing neuromuscular blockers, and may potentiate the effects of calcium channel blockers

Mannitol

Classification

Osmotic diuretic

Indications

- CCP: Reduction of intracranial pressure and cerebral edema

Contraindications

- Patients with well-established anuria as a result of severe renal disease, and who do not respond to two test doses
- Severe pulmonary congestion or frank pulmonary edema
- Severe congestive heart failure
- Dehydration states
- Metabolic edema associated with capillary fragility or membrane permeability
- Progressive renal disease

Adult dosages

- CCP: Reduction of intracranial pressure and cerebral edema
- 1.5-2 g/kg IV infused as a 15%, 20%, or 25% solution
- 0.25 g/kg IV not more frequently than every 6-8 hours

Pediatric Considerations And Dosing

- CCP: Reduction of intracranial pressure and cerebral edema
- 2 g/kg IV infused as a 15% or 20% solution

Mechanism Of Action

Mannitol increases extracellular fluid volume and dilutes extracellular stores of sodium, drawing water out of the cells into the plasma. Fluid shifts result in the reduction of cerebral edema and lowering of cerebrospinal fluid pressure.

Pharmacokinetics

Intravenous:

- CSF pressure is reduced within 15 minutes
- Diuresis generally develops after 1-3 hours
- Intraocular pressure reduces within 30-60 minutes

Adverse Effects

Mannitol use may disturb other fluid and electrolyte balances.

Overdose

Accumulation of mannitol caused by inadequate urinary output, or rapid administration of large volumes, may result

in the overexpansion of extracellular fluid and circulatory overload causing signs and symptoms of water intoxication. Overhydration may be corrected by hemodialysis, or administration of a diuretic.

Warning And Precautions

There is a risk of serious electrolyte disturbances, which may be severe enough to alter the acid-base balance, or to depress respirations. Thiazides may be used if hypernatremia, or hyperosmolality occurs.

Methoxyflurane

Classification

Inhaled anesthetic

Indications

■ PCP: Moderate to severe pain associated with trauma or interventional medical procedures in adults

Contraindications

- Children < 18 years of age
- Inadequate patient understanding or lack of cooperation
- Decreased level of consciousness
- History of clinically significant renal impairment
- History of liver dysfunction following previous exposure to halogenated anesthetics
- Current use of tetracycline antibiotics
- Personal or familial history of malignant hyperthermia
- Muscular dystrophy
- Pregnancy, intended pregnancy, or current breast-feeding

Adult dosages

■ PCP: Moderate to severe pain associated with trauma or interventional medical procedures in adults

- 3 mL via inhaler. May provide additional 3 mL volume after 20 minutes. Maximum total volume 6 mL.

Patients must self-administer as needed under direct paramedic supervision.

Pediatric Considerations And Dosing

Not authorized for patients under 18 years of age

Mechanism Of Action

The specific mechanism of action of halogenated anesthetics is not well understood. Methoxyflurane is the only volatile anesthetic agent with significant analgesic properties at low, sub-anesthetic doses.

Pharmacokinetics

Inhaled:

- Onset: 1-3 minutes
- Duration: 1 hour

Adverse Effects

- Altered level of consciousness (chiefly drowsiness)
- Cough
- Hypotension and bradycardia (rare)

Overdose

Doses of methoxyflurane that exceed therapeutic doses have been shown to produce serious, irreversible nephrotoxicity. Follow dosing guidelines and do not exceed recommended amounts.

Although unlikely in prehospital settings, patients should not receive more than 6 mL in any 48 hour period, and no more than 15 mL over one week.

Warning And Precautions

Methoxyflurane carries unique risks for paramedics, particularly given chronic exposure. As such, limit administration of methoxyflurane inside ambulances to a single 3 mL dose; where possible, ensure adequate ventilation through the use of exhaust fans, and set ambulance heater or AC to any position but "Max AC" (as this is a recirculating mode).

Ensure that patients exhale through the carbon filter.

No single employee should administer more than three doses of methoxyflurane per shift.

Metoclopramide

Classification

Antiemetic, dopamine antagonist

Indications

■ CCP: Nausea and vomiting

Contraindications

- Hypersensitivity to metoclopramide
- Bowel perforation
- Seizure disorders
- Extrapyrimal reactions
- Monoamine oxidase inhibitor therapy within the past 14 days

Adult dosages

■ CCP: Nausea and vomiting

- 0.1 mg/kg IV/IO/IM to a single maximum dose of 10 mg
- May repeat every 6 hours as required. Total daily dose limit 0.5 mg/kg.

Pediatric Considerations And Dosing

Caution: Limited data available. Consultation with CiniCall is required.

Not authorized for infants < 1 year of age.

Mechanism Of Action

Blocks dopamine receptors in the chemoreceptor trigger zone of the central nervous system. Enhances up GI tract motility and accelerates gastric emptying.

Pharmacokinetics

Following intravenous administration:

- Onset: 1-3 minutes
- Duration: 1-2 hours
- Half-life: 5-6 hours
- Metabolism: hepatic
- Excretion: urine

Adverse Effects

>10%:

Gastrointestinal: Dysgeusia (nasal spray: 15%)

Nervous system: Drowsiness (~10% to 70%; dose related), dystonic reaction ($\leq 25\%$; dose and age related)

1% to 10%: Nervous system: Fatigue (~10%; dose related), lassitude (~10%; dose related), restlessness (~10%; dose related)

Frequency not always defined:

Cardiovascular: Atrioventricular block, bradycardia, cardiac failure, flushing (following high IV doses), hypertension, hypotension, supraventricular tachycardia

Dermatologic: Skin rash, urticaria

Endocrine & metabolic: Amenorrhea, endocrine disease (elevation of aldosterone), fluid retention, galactorrhea not associated with childbirth, gynecomastia, hyperprolactinemia, porphyria

Gastrointestinal: Change in bowel habits, diarrhea, nausea

Genitourinary: Urinary frequency, urinary incontinence

Hematologic & oncologic: Agranulocytosis, leukopenia, methemoglobinemia, neutropenia, sulfhemoglobinemia

Hypersensitivity: Angioedema, hypersensitivity reaction, tongue edema

Nervous system: Akathisia, confusion, depression, dizziness, drug-induced extrapyramidal reaction, hallucination, headache, insomnia, neuroleptic malignant syndrome, parkinsonism, seizure, suicidal ideation, tardive dyskinesia (total cumulative dose and duration of treatment related)

Neuromuscular & skeletal: Laryngospasm (rare)

Ophthalmic: Visual disturbance

Respiratory: Bronchospasm, laryngeal edema

Source: Metoclopramide. In: Lexicomp Online, UpToDate, Waltham, MA. (Accessed November 20, 2020.)

Warning And Precautions

May cause CNS depression.

May cause extrapyramidal symptoms, typically acute dystonic reactions. Higher doses increase these risks.

High doses and long term therapy (> 12 weeks) may cause tardive dyskinesia.

May prolong QT interval in some patients (particularly heart failure with renal impairment).

MetoproLOL

Classification

Beta 1 selective beta blocker

Anti-anginal agent

Antihypertensive

Indications

- CCP: Symptomatic atrial fibrillation or flutter with rapid ventricular response

Contraindications

- Hypersensitivity to metoproLOL or its constituents
- Second- or third-degree AV block
- Sick sinus syndrome or sinus bradycardia
- Cardiogenic shock
- Relatively contraindicated in patients with a history of bronchospastic diseases: generally beta blockers should not be used in individuals with a history of bronchospasm, however due to metoproLOL's beta-1 selectivity, it may be used with caution and close monitoring.

Adult dosages

- CCP: Symptomatic atrial fibrillation or flutter with rapid ventricular response

- 5 mg IV slow push
- May repeat every five minutes to a maximum of 15 mg, or a heart rate < 110/min, or a blood pressure < 100 mmHg

Mechanism Of Action

MetoproLOL has a preferential inhibitory effect on beta-1 adrenoreceptors, located primarily in the cardiac muscle. At higher doses, metoproLOL can exert some inhibition on beta-2 receptors in bronchial and vascular tissues.

Pharmacokinetics

Intravenous:

- Onset: rapid
- Duration: dose-dependent.

Adverse Effects

Secondary effects of decreased cardiac output, which can include headache, weakness, dizziness, and lightheadedness. Respiratory symptoms, including shortness of breath, wheezing and bronchospasm, rhinitis, and exertional dyspnea can also occur.

Overdose

Provide supportive care. [Review J07: Beta Blockers](#) for specific guidance.

Warning And Precautions

MetopROLOL should be used with caution in compensated heart failure, and patients must be closely monitored for worsening of their condition.

MIDAZOLam

Classification

 **HIGH ALERT MEDICATION**

CONTROLLED AND TARGETED SUBSTANCE

Short-acting benzodiazepine

Indications

- ACP: Sedation of agitated patients
- ACP: Control of seizures
- ACP: Maintenance of anesthesia in intubated patients

Contraindications

- Hypersensitivity to MIDAZOLam or other benzodiazepines
- Acute narrow-angle glaucoma
- Shock
- Decreased level of consciousness
- Hypotension

Adult dosages

- ACP: All indications
 - 2-5 mg IV/IO in increments to effect
 - 5-10 mg IM
 - May repeat as required in small increments
 - Maximum dose from all sources is 30 mg
 - Contact CliniCall if higher doses or additional sedation is required

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- ACP: All indications
 - 0.2 mg/kg IN, *OR*
 - Maximum dose 10 mg
 - Intranasal drug administration is recommended over intramuscular because of a more consistent absorption
 - Administer 1/2 the dose in each nare
 - Consult A07: Oxygen and Medication Administration for additional information on the use of intranasal atomizer devices.
 - 0.1 mg/kg IV/IO, *OR*
 - Maximum dose 5 mg
 - 0.2 mg/kg IM

Mechanism Of Action

Like other benzodiazepines, MIDAZOLam intensifies the activity of gamma aminobutyric acid, the major inhibitory neurotransmitter in the central nervous system. This action is believed to result in hyperpolarization of neuronal cells, which then take longer to reach threshold and depolarize.

Pharmacokinetics

Intravenous:

- Onset: 1-5 minutes (intramuscular onset is 5-15 minutes)
- Peak: uncertain
- Half-life: 1.5-3 hours
- Duration: 2-6 hours (dose-related)

Adverse Effects

- Sedation, headache, blurred vision
- Hypotension
- Nausea and vomiting
- Pain and tenderness if given IM
- Respiratory depression

Overdose

Benzodiazepine overdoses should be managed supportively, with oxygenation and ventilation supported as necessary, and fluids given to maintain an adequate blood pressure. Reversal agents are available in-hospital.

Warning And Precautions

Use with caution when administering other central nervous system depressants or narcotic analgesics.

Drug Interactions

Erythromycin, diltiazem, verapamil, ketoconazole, fluconazole, and itraconazole can significantly increase the bioavailability of MIDAZOLam, and may produce prolonged sedation.

Ritonavir and nelfinavir may cause deep and prolonged sedation that may progress to respiratory depression.

Rifampin, carbamazepine, and phenytoin may markedly reduce the effectiveness of MIDAZOLam.

MORPHine

Classification

 **HIGH ALERT MEDICATION**

CONTROLLED AND TARGETED SUBSTANCE

Opioid analgesic

Indications

■ ACP: Symptom relief in palliative or end-of-life patients with pain or shortness of breath

Contraindications

- Known hypersensitivity to mORPHine or other opioid analgesics
- Use with caution in patients with asthma, bronchospasm, or chronic obstructive pulmonary disease

Adult dosages

■ ACP: All indications

- Requires specific training and license endorsement. Consult with palliative care team or CliniCall before selecting a dosing strategy.
- 0.1 mg/kg SC or
- 2.5-5 mg SC
- May repeat every 10-30 minutes as required based on blood pressure (>100 mmHg) or as per CliniCall/palliative care team plan

Pediatric Considerations And Dosing

Not authorized

Mechanism Of Action

Acts on opioid receptors (primarily mu receptors) in the central nervous system to produce analgesia, euphoria, and sedation. Interaction with receptors in the spinal cord depresses pain transmission. Produces venodilation, reducing cardiac preload.

Pharmacokinetics

Intravenous:

- Onset: rapid
- Peak: 20 minutes
- Half-life: 2-3 hours
- Duration: 4-5 hours

Adverse Effects

- Lightheadedness, dizziness, sedation, agitation
- Respiratory depression and apnea

- Profound hypotension
- Nausea and vomiting

Naloxone

Classification

Narcotic antagonist

Indications

■ FR: Reversal of respiratory depression caused by suspected narcotic intoxication

Contraindications

Allergy or known hypersensitivity to naloxone

Adult dosages

■ FR: Reversal of respiratory depression caused by suspected narcotic intoxication

- 0.4 mg IM every 3 minutes as required, to maximum of 3 total doses

■ EMR: Reversal of respiratory depression caused by suspected narcotic intoxication

- 0.4 mg IM every 3 minutes as required, to a maximum of 4 total doses
 - Second dose: 0.4 mg IM if required
 - Third dose: 0.8 mg IM if required
 - Fourth dose: 2 mg IM if required

■ PCP: Reversal of respiratory depression caused by suspected narcotic intoxication

- 0.4 mg IM/IV every 3 minutes as required, to a maximum of 3 total doses
 - Second dose: 0.4 mg IM/IV if required
 - Third dose: 0.8 mg IM/IV if required
 - Fourth dose: 2 mg IM/IV if required (IV preferred)

■ ACP: Reversal of respiratory depression caused by suspected narcotic intoxication

- As per PCP schedule
- May also consider, in order:
 1. 4 mg IV
 2. 10 mg IV Requires ClinCall consultation -- 1-833-829-4099

Titrate doses to improve spontaneous respiratory effort. It is not necessary to administer sufficient naloxone to completely reverse the opioid effects.

Pediatric Considerations And Dosing

Never administer naloxone to neonates.

[Follow weight-based dosing](#)

■ FR: Not authorized

■ EMR: Reversal of respiratory depression caused by suspected narcotic intoxication

- 0.1 mg/kg (to maximum of 2 mg per dose), repeated every 3 minutes, to maximum of 4 total doses
 - Higher dose for pediatric patients as they are unlikely to experience withdrawal

Mechanism Of Action

Competitively antagonizes opioids bound to receptors in the central nervous system.

Pharmacokinetics

- Onset: 1 minute (intravenous); 3-5 minutes (intramuscular)
- Peak: unknown
- Half-life: 1-3 hours
- Duration: 45 minutes

Adverse Effects

- Sudden reversal of narcotic intoxication may provoke combativeness
- May produce withdrawal signs and symptoms
- Hypotension or hypertension
- Nausea and vomiting, sweating, tachycardia

Nitroglycerin

Classification

Antianginal

Indications

- EMR: Relief from chest pain suggestive of acute coronary syndrome
- ACP: Reduction of blood pressure in acute cardiogenic pulmonary edema

Contraindications

- Known allergy or hypersensitivity to nitroglycerin
- Use of Viagra (sildenafil) or Levitra (vardenafil) within the previous 24 hours
- Use of Cialis (tadalafil) within the previous 48 hours
- Hypotension or uncorrected hypovolemia
- Severe anemia
- Restrictive pericarditis or pericardial tamponade
- Documented right sided acute myocardial infarction

Adult dosages

- EMR: Relief from chest pain suggestive of acute coronary syndrome
 - Requires ClinCall consultation if the patient has no prior prescription for nitroglycerin, or if more than 3 doses are needed
 - 0.4 mg SL every 3-5 minutes
 - Verify systolic blood pressure prior to administering each dose. Systolic blood pressure must be > 110 mmHg.
- ACP: Reduction of blood pressure in acute cardiogenic pulmonary edema
 - 0.4 mg SL every 3-5 minutes
- CCP: All indications
 - 10-200 mcg/min IV infusion

Pediatric Considerations And Dosing

Not authorized

Mechanism Of Action

Relaxes smooth muscle in vasculature. Nitroglycerin works primarily as a venodilator, but can also produce coronary and systemic arterial vasodilation, decreasing preload and lowering myocardial oxygen consumption.

Pharmacokinetics

Sublingual

- Onset: 1-3 minutes

- Peak: uncertain
- Half-life: 1-4 minutes
- Duration: 30 minutes

Adverse Effects

- Hypotension
- Headache
- Nausea

Warning And Precautions

Do not administer to patients whose blood pressure is < 110 mmHg, or who are exhibiting signs of significant hypoperfusion.

Use with caution in patients with hepatic or renal insufficiency.

Exercise caution (and rule out right-sided involvement) in patients with documented inferior ischemia on 12-lead ECG.

Drug Interactions

Antihypertensive agents may act synergistically with nitroglycerin.

Nitrous Oxide

Classification

Inhaled anesthetic

Indications

■ EMR: Relief from moderate to severe pain

- Includes pain caused by extremity injuries, burns, or other injuries or clinical conditions not including inhalation injuries

Contraindications

- Traumatic or spontaneous pneumothorax
- Air embolism or decompression sickness following a recent SCUBA dive
- Bullous emphysema
- Gross abdominal distension
- Altered mental status or an inability to comply with instructions
- Inhalation injury (i.e., smoke or chemicals)
- Nitroglycerin use within five minutes prior to administration of nitrous oxide

Consider the use of the mnemonic **CDCPAIN**:

- Ability to **C**omply
- **D**ecompression sickness
- Altered level of **C**onsciousness
- **P**neumothorax
- **A**ir embolism
- **I**nhalation injury
- **N**itroglycerin use within five minutes

Adult dosages

■ EMR: All indications

- Self-administered to effect

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

■ EMR: All indications

- Self-administered to effect

Mechanism Of Action

As used in BCEHS, nitrous oxide is supplied as a 50/50 mixture with oxygen and known as Entonox. Nitrous oxide is a sweet-smelling, colorless gas that is a potent analgesic and a weak anesthetic, whose specific mechanism of action is not well understood. It is believed that endorphin release is likely involved in the analgesic effects of nitrous oxide.

Pharmacokinetics

When administered by inhalation:

- Onset: rapid
- Peak: immediate
- Duration: requires continuous use

Nitrous oxide is excreted unchanged from the body through the lungs.

Adverse Effects

- Lightheadedness, dizziness, numbness in lips, sedation, drowsiness, disorientation
- Nausea and/or vomiting

Warning And Precautions

- Nitrous oxide's blood/gas partition coefficient at body temperature is significantly higher than that of nitrogen's. It will therefore expand into internal gas spaces in the body, and must not be used in cases where additional gas loading would be dangerous (e.g., decompression sickness or air embolisms, abdominal distension, pneumothorax); this phenomenon accounts for the majority of nitrous oxide's contraindications.
- Do not use nitrous oxide in confined spaces that cannot be adequately ventilated. When using nitrous oxide inside an ambulance, ensure exhaust fans are running or windows are open to provide for sufficient ventilation of the patient compartment.
- Do not use nitrous oxide aboard aircraft due to the risk of flight crew exposure.
- Nitrous oxide must be used with caution in patients who are hypotensive or in shock, have ingested or are suffering from the effects of depressant drugs, have a history of chronic obstructive pulmonary disease, or have suffered facial injuries.

Drug Interactions

The depressant effects of nitrous oxide can be potentiated by the presence of other CNS depressants such as alcohol, sedatives, antihistaminics, or psychotropic medications.

NOREpinephrine

Classification

Alpha- and beta-agonist

Indications

- CCP: Symptomatic bradycardia
- CCP: Shock with hypotension refractory to fluid resuscitation
- CCP: Cardiogenic shock with refractory hypotension

Contraindications

- Mesenteric or peripheral vascular thrombosis
- Pregnancy
- Profound hypoxia
- Hypovolemia

Adult dosages

- CCP: All indications
- 0.1 mcg/kg/minute IV/IO
- Titrate upwards to a maximum of 1 mcg/kg/minute.

NOREpinephrine														
Concentration: 4 mg in 250 mL D5W or normal saline yields 16 mcg/mL														
Dose (mcg/kg/min)	Weight (kg)													
	40 kg	45 kg	50 kg	55 kg	60 kg	65 kg	70 kg	75 kg	80 kg	85 kg	90 kg	100 kg	110 kg	120 kg
0.1	15	16.9	18.8	20.6	23	24.4	26.3	28.1	30	31.9	33.8	37.5	41.3	45
0.15	22.5	25.3	28.1	30.9	34	36.6	39.4	42.2	45	47.8	50.6	56.3	61.9	67.5
0.2	30	33.8	37.5	41.3	45	48.8	52.5	56.3	60	63.8	67.5	75	82.5	90
0.25	37.5	42.2	46.9	51.6	56	60.9	65.6	70.3	75	79.7	84.4	93.8	103.1	112.5
0.3	45	50.6	56.3	61.9	68	73.1	78.8	84.4	90	95.6	101.3	112.5	123.8	135
0.35	52.5	59.1	65.6	72.2	79	85.3	91.9	98.4	105	111.6	118.1	131.3	144.4	157.5
0.4	60	67.5	75	82.5	90	97.5	105	112.5	120	127.5	135	150	165	180
0.45	67.5	75.9	84.4	92.8	101	109.7	118.1	126.6	135	143.4	151.9	168.8	185.6	202.5
0.5	75	84.4	93.8	103.1	113	121.9	131.3	140.6	150	159.4	168.8	187.5	206.3	225
0.55	82.5	92.8	103.1	113.4	124	134.1	144.4	154.7	165	175.3	185.6	206.3	226.9	247.5
0.6	90	101.3	112.5	123.8	135	146.3	157.5	168.8	180	191.3	202.5	225	247.5	270
0.65	97.5	109.7	121.9	134.1	146	158.4	170.6	182.8	195	207.2	219.4	243.8	268.1	292.5
0.7	105	118.1	131.3	144.4	158	170.6	183.8	196.9	210	223.1	236.3	262.5	288.8	315
0.75	112.5	126.6	140.6	154.7	169	182.8	196.9	210.9	225	239.1	253.1	281.3	309.4	337.5
0.8	120	135	150	165	180	195	210	225	240	255	270	300	330	360
0.85	127.5	143.4	159.4	175.3	191	207.2	223.1	239.1	255	270.9	286.9	318.8	350.6	382.5
0.9	135	151.9	168.8	185.6	203	219.4	236.3	253.1	270	286.9	303.8	337.5	371.3	405
0.95	142.5	160.3	178.1	195.9	214	231.6	249.4	267.2	285	302.8	320.6	356.3	391.9	427.5
1	150	168.8	187.5	206.3	225	243.8	262.5	281.3	300	318.8	337.5	375	412.5	450
Infusion rate (mL/hr)														

Pediatric Considerations And Dosing

Follow weight-based dosing.

■ CCP: All indications

- 0.1 mcg/kg/minute IV/IO
- Titrate upwards to a maximum of 1 mcg/kg/minute.

Mechanism Of Action

Stimulates alpha and beta-1 adrenergic receptors causing increased contractility, heart rate, and vasoconstriction.

Pharmacokinetics

Following intravenous administration:

- Onset: very rapid
- Duration: 1-2 minutes
- Half-life: 2-3 minutes

Adverse Effects

Cardiovascular: Bradycardia, cardiac arrhythmia, cardiomyopathy (stress), peripheral vascular insufficiency

Central nervous system: Anxiety, transient headache

Respiratory: Dyspnea

Source: Norepinephrine. In: Lexicomp Online, UpToDate, Waltham, MA. (Accessed November 20, 2020.)

Warning And Precautions

- Correct hypovolemia prior to administering NORepinephrine.
- Hypoxia or hypercarbia may produce ventricular tachycardia or ventricular fibrillation.
- Avoid extravasation of NORepinephrine. Administer into a large vein whenever possible. Monitor catheter and line patency before and during administration.

Ondansetron

Classification

Antiemetic

Indications

- ACP: Relief of moderate to severe nausea and vomiting

Contraindications

- Known allergy or hypersensitivity to ondansetron
- Congenital long QT syndrome

Adult dosages

- ACP: Relief of moderate to severe nausea and vomiting
- Requires specific training and license endorsement. **For use in palliative care only.**
- 4 mg SC as a single dose
- Do not repeat administration

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- ACP: Relief of moderate to severe nausea and vomiting
- Requires specific training and license endorsement. For use in palliative care only.
- 2 mg PO for 6 months - 4 years
- 4 mg PO for age 4 and up
- Do not repeat dose

Mechanism Of Action

Selectively inhibits type 3 serotonergic receptors, suppressing nausea.

Pharmacokinetics

Onset, parenteral: 15 minutes

Duration: >5 hours

Adverse Effects

- Hypotension
- Depression or agitation

Warning And Precautions

Carefully assess patients prior to administering ondansetron. Evaluate the type and intensity of the nausea, as well as the efficacy of relief following administration. Closely monitor patients for signs of respiratory depression or CNS effects (particularly in elderly patients, or those with hepatic or renal impairment).

Oxytocin

Classification

 **HIGH ALERT MEDICATION**

Oxytocic agent

Indications

- CCP: Promote uterine contractions following normal delivery
- CCP: Post-partum hemorrhage not responsive to fundal massage

Contraindications

- Hypersensitivity
- Uterine inversion
- Placenta previa
- Abruptio placentae
- Predisposition to uterine rupture (e.g., grand multiparity, overdistention of the uterus, prior caesarian delivery, other uterine surgery)

Adult dosages

- CCP: Promote uterine contractions following normal delivery
 - 10 U IM at the time of delivery of anterior shoulder
- CCP: Post-partum hemorrhage not responsive to fundal massage
 - 20 U into 1,000 mL normal saline
 - Infuse 500 mL as bolus, then maintain rate at up to 500 mL/hour, titrated to maintain uterine contraction and control atony

Pediatric Considerations And Dosing

Not indicated in pediatrics

Mechanism Of Action

Stimulates uterine contraction by activating G-protein receptors, and increases local prostaglandin production.

Pharmacokinetics

- Onset of uterine contractions: 3-5 minutes (IM), 1 minute (IV)
- Duration: 2-3 hours (IM); 1 hour (IV)
- Half-life: 1-6 minutes

- Excretion: urine

Adverse Effects

Cardiovascular: Cardiac arrhythmia, hypertensive crisis, hypotension, subarachnoid hemorrhage, tachycardia, ventricular premature contractions

Endocrine & metabolic: Water intoxication (severe water intoxication with seizure and coma is associated with a slow oxytocin infusion over 24 hours)

Gastrointestinal: Nausea, vomiting

Genitourinary: Postpartum hemorrhage, uterine rupture

Hematologic & oncologic: Pelvic hematoma

Hypersensitivity: Anaphylaxis

Warning And Precautions

HIGH ALERT MEDICATION

WOMEN WORKING WITH OXYTOCIN, AND WHO ARE IN THE SECOND OR THIRD TRIMESTER OF PREGNANCY, MUST BE AWARE THAT OXYTOCIN MAY INDUCE UTERINE CONTRACTIONS AND LABOUR THROUGH CONTACT. USE PROPER PERSONAL PROTECTIVE EQUIPMENT WHEN HANDLING.

- In multiparous situations, do not administer until all babies have been delivered.
- May produce intrinsic antidiuretic effects.
- Use with extreme caution in hemodynamically unstable patients: arrhythmias, hypotension, myocardial ischemia, peripheral vasodilation, and tachycardia have been reported.

PhenyLEPHRine

Classification

Sympathomimetic

Indications

- ACP: Maintenance of blood pressure in acute hypotensive states, or shock following adequate fluid volume replacement

Contraindications

- Known hypersensitivity or allergy to phenylephrine
- Hypersensitivity to sulfites (contained in the product preparation)
- Severe hypertension or ventricular tachycardia
- Pheochromocytoma

Adult dosages

- ACP: Maintenance of blood pressure in acute hypotensive states, or shock following adequate fluid volume replacement
- 100 mcg IV slow push every 2-5 minutes to maximum of 500 mcg
- Administer dose over 20-30 seconds
- If higher doses are required, consult with ClinicaCall

Pediatric Considerations And Dosing

Not authorized. Consider the use of push-dose epinephrine in these patients.

Mechanism Of Action

Agonizes alpha-adrenergic receptors producing arterial vasoconstriction

Pharmacokinetics

Intravenous:

- Onset: rapid
- Duration: 15-20 minutes

Adverse Effects

- Headache
- Nervousness
- Reflex bradycardia
- Nausea and vomiting
- Paresthesia
- May produce significant peripheral or visceral vasoconstriction

Warning And Precautions

Exercise caution when administering phenylephrine to patients with bradycardia, incomplete AV block, or other underlying cardiovascular disease.

Phenylephrine carries a significant risk of sloughing and tissue necrosis if extravasation occurs. Ensure administration line is patent and free-flowing.

Rapid IV administration of phenylephrine may result in development of premature ventricular contractions, ventricular tachycardia, and hypertension.

PhenyTOIN

Classification

 **HIGH ALERT MEDICATION**

Anticonvulsant

Indications

■ CCP: Seizures refractory to midazolam

Contraindications

- Sinus bradycardia, sinoatrial block, 2nd or 3rd degree AV block, Adams-Stokes syndrome, QT interval prolongation, or other heart rhythm disorders
- Hypersensitivity to phenytoin or other hydantoins
- Hypersensitivity to propylene glycol or ethanol
- Concurrent poisoning or toxic ingestion (cyclic antidepressants, cocaine, etc.)

Adult dosages

■ CCP: Seizures refractory to midazolam

- 20 mg/kg IV/IO -- dilute to a concentration of 10 mg/mL or less, and infuse based on body weight:
 - For patients < 75 kg: administer over a minimum of 30 minutes
 - For patients 76-150 kg: administer over a minimum of 60 minutes
 - For patients > 151 kg: administer over a minimum of 90 minutes
- Do not repeat administration

Pediatric Considerations And Dosing

■ CCP: Seizures refractory to midazolam

- 20 mg/kg IV/IO over a minimum of 30 minutes. Dilute to a concentration of 5 mg/mL.
- Do not repeat administration

Mechanism Of Action

Stabilizes neuronal membranes and decreases seizure activity by lowering intracellular sodium levels in the motor cortex; prolongs effective refractory period and suppresses ventricular pacemaker automaticity, shortening action potential in the heart.

Pharmacokinetics

Following intravenous administration:

- Onset: 30 minutes - 1 hour
- Half-life: 10-12 hours (NB: half-life is not first-order, and increases with increasing phenytoin concentrations)
- Excretion: urine

Adverse Effects

Cardiovascular: Cardiac arrhythmia, cardiac conduction disturbance (depression), circulatory shock, hypotension, ventricular fibrillation

Central nervous system: Ataxia, cerebral atrophy (elevated serum levels and/or long-term use), cerebral dysfunction (elevated serum levels and/or long-term use), confusion, dizziness, drowsiness, headache, insomnia, nervousness, paresthesia, peripheral neuropathy (associated with chronic treatment), slurred speech, suicidal ideation, suicidal tendencies, twitching, vertigo

Dermatologic: Bullous dermatitis, exfoliative dermatitis, morbilliform rash, scarlatiniform rash, skin or other tissue necrosis, skin rash

Endocrine & metabolic: Decreased T4, increased gamma-glutamyl transferase, vitamin D deficiency (associated with chronic treatment)

Gastrointestinal: Constipation, dysgeusia, gingival hyperplasia, nausea, swelling of lips, vomiting

Genitourinary: Peyronie's disease

Hematologic & oncologic: Macrocytosis, megaloblastic anemia, pseudolymphoma, purpuric dermatitis

Hepatic: Acute hepatic failure, hepatic injury, hepatitis, increased serum alkaline phosphatase, toxic hepatitis

Local: Injection site reaction ("purple glove syndrome;" edema, discoloration, and pain distal to injection site), local inflammation, local irritation, localized tenderness, local tissue necrosis

Neuromuscular & skeletal: Osteomalacia

Ophthalmic: Nystagmus

Miscellaneous: Fever, tissue sloughing

Warning And Precautions

HIGH ALERT MEDICATION

Phenytoin must be infused slowly. Do not exceed an infusion rate in adults of 50 mg/minute, and 1-3 mg/kg/minute (or 50 mg/minute, whichever is greater). Hypotension and severe cardiac arrhythmias may occur with rapid administration, and have been reported even when infused below recommended rate. Cardiovascular monitoring is mandatory during and after phenytoin administration.

Phenytoin is a vesicant and can cause significant tissue damage if extravasation occurs. Ensure line patency during infusion.

Ensure that an in-line micron filter is used during administration of diluted solution to prevent infusion of phenytoin crystals.

Phenytoin is **incompatible** with **dextrose solutions** and will precipitate very rapidly.

Do not attempt to administer phenytoin through PICC lines.

Rocuronium

Classification

HIGH ALERT MEDICATION

Nondepolarizing neuromuscular blocking agent

Indications

- CCP: Areflexia for rapid sequence intubation

Contraindications

Known hypersensitivity or allergy to rocuronium bromide or any component of the formulation

Adult dosages

- CCP: Areflexia for rapid sequence intubation

- 0.6-1.2 mg/kg IV
 - Based on actual body weight

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- CCP: Areflexia for rapid sequence intubation

- For patients between 3 months and 14 years of age
- 0.6 mg/kg IV

Mechanism Of Action

Produces skeletal muscle relaxation by inhibiting the activity of acetylcholine at the neuromuscular junction. Does not alter the resting electrical potential of the motor end plate, or cause muscular contraction.

Pharmacokinetics

Intravenous:

- Onset: 1-1.5 minutes for clinically sufficient neuromuscular blockade
- Peak: 3-4 minutes
- Duration:
 - Doses of 0.6 mg/kg: 30 minutes
 - Doses of 1.2 mg/kg: 67 minutes
 - Doses of 2 mg/kg: 110 minutes

Adverse Effects

Skeletal muscle weakness

Warning And Precautions

WARNING

Administration of rocuronium produces paralysis and compromises respiratory function. Rocuronium must only be used by paramedics trained and experienced in its use, and where effective oxygenation and ventilation can be maintained.

Drug Interactions

Succinylcholine: administer rocuronium only after the patient has recovered from succinylcholine-induced neuromuscular blockade

Magnesium sulfate: increases duration of neuromuscular blockade from rocuronium

Salbutamol

Classification

Bronchodilator

Sympathomimetic

Indications

■ PCP: Bronchospasm

■ ACP: Adjunctive management of hyperkalemia

Contraindications

- Known hypersensitivity to salbutamol
- Hemodynamically significant tachycardia

Adult dosages

■ PCP: Bronchospasm

- 5 mg nebulized. Repeat doses back to back as necessary.
- **NB: nebulized medication therapy not authorized during Covid.**
- 4 x 100 mcg via metered dose inhaler. Repeat as required.

■ ACP: Adjunctive management of hyperkalemia

- 10-20 mg via nebulizer. May require multiple doses back-to-back to reach total dose.
- **NB: nebulized medication therapy not authorized during Covid.**

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

■ PCP: Bronchospasm

- Via nebulizer
 - Age < 1 year: 2.5 mg
 - Age > 1 year: 5 mg
 - **NB: nebulized medication therapy not authorized during Covid**
- Via metered dose inhaler:
 - < 10 kg: not indicated
 - < 20 kg: 5 x 100 mcg per round. May repeat up to 3 times.
 - > 20 kg: 10 x 100 mcg per round. May repeat up to 3 times.

How Supplied

test

Mechanism Of Action

Salbutamol is a selective beta-2 adrenergic agonist that produces bronchodilation and some degree of vasodilation. Some beta-1 effects can be seen, particularly at higher doses.

Pharmacokinetics

Inhaled:

- Onset: 5 minutes
- Peak: 1.5-2 hours
- Half-life: 3.8 hours
- Duration: 3-8 hours

Adverse Effects

- Restlessness, weakness, vertigo, apprehensiveness
- Nausea and vomiting
- Tachycardia or other dysrhythmias
- Paradoxical worsening of respiratory distress
- Cough
- Pulmonary edema
- Sweating, pallor, flushing
- Tremors

Overdose

Discontinue administration if signs of toxicity are developing: heart rates > 150/minute in adults (> 200/minute in children), or if severe tremors, or ventricular arrhythmias develop.

Sodium Bicarbonate

Classification

Electrolyte

Alkalinizing agent / buffer

Indications

- ACP: Known or suspected hyperkalemia
- ACP: Tricyclic or salicylate overdoses
- ACP: Suspected or confirmed metabolic acidosis
- ACP: Pre-treatment prior to weight release in crush injury

Contraindications

Suspected metabolic alkalosis

History of excessive vomiting (i.e., evidence of chloride loss)

Adult dosages

- ACP: All indications
 - 1 mEq/kg IV/IO slow push.
 - May repeat 0.5 mEq/kg IV/IO slow push every 10-15 minutes as required
 - Tricyclic overdoses may require doses as high as 2-3 mEq/kg IV/IO

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

- ACP: All indications
 - Infant: 1-2 mEq/kg very slow IV/IO. May repeat 0.5 mEq/kg every 10-15 minutes as required
 - Use 4.2% solution for infants
 - Child: 1-3 mEq/kg slow IV/IO. May repeat 0.5 mEq/kg every 10-15 minutes as required

Mechanism Of Action

Buffers or neutralizes excess acid (specifically, excess hydrogen ions), raising overall pH.

Pharmacokinetics

Intravenous:

- Onset: 2 minutes
- Peak: 30 minutes
- Half-life: uncertain

- Duration: 1-3 hours

Adverse Effects

- Metabolic alkalosis may produce hypoxia due to the leftward/upward shift of the oxyhemoglobin dissociation curve
- Muscle tetany
- Seizures

Warning And Precautions

Administration of sodium bicarbonate may paradoxically worsen metabolic acidosis if minute ventilation is insufficient. Consider overall physiological state when selecting ventilation strategy.

Succinylcholine

Classification

 **HIGH ALERT MEDICATION**

Depolarizing neuromuscular blocking agent

Indications

■ CCP: Paralysis to facilitate intubation

Contraindications

- Known or suspected hyperkalemia
- Hypersensitivity
- Family history of malignant hyperthermia
- Myopathies associated with elevated creatine kinase
- Use following the acute phase of injury following major burns, multitrauma, crush injuries, denervation of skeletal muscle, or upper motor neuron injury.

Adult dosages

■ CCP: Paralysis to facilitate intubation

- 1.5 mg/kg rapid IV/IO push (based on actual body weight)
- Do not repeat dose

Pediatric Considerations And Dosing

■ CCP: Paralysis to facilitate intubation

- 2 mg/kg rapid IV/IO push (based on actual body weight)
- Do not repeat dose

How Supplied

test

Mechanism Of Action

Depolarizes motor endplate by binding to acetylcholine receptors.

Pharmacokinetics

Following IV administration:

- Onset of paralysis: 60 seconds
- Duration: 4-6 minutes (shorter in children)
- Metabolism: plasma pseudocholinesterase
- Excretion: urine

Adverse Effects

Cardiovascular: Bradycardia (higher with second dose; more frequent in children), cardiac arrhythmia, hypertension, hypotension, malignant hyperthermia, tachycardia

Dermatologic: Skin rash

Endocrine & metabolic: Hyperkalemia

Gastrointestinal: Sialorrhea

Hypersensitivity: Anaphylaxis

Neuromuscular & skeletal: Fasciculations, jaw tightness, myalgia (postoperative), rhabdomyolysis (with possible myoglobinuric acute renal failure)

Ophthalmic: Increased intraocular pressure

Respiratory: Apnea, respiratory depression (prolonged)

Warning And Precautions

Use caution in children and adolescents. Acute rhabdomyolysis with hyperkalemia, ventricular arrhythmias and cardiac arrest have been reported (rarely) in children with undiagnosed skeletal muscle myopathy (eg, Duchenne muscular dystrophy); occurs soon after administration and requires immediate treatment of hyperkalemia. Prolonged resuscitation may be required. Use in children should be reserved for emergency intubation when immediate airway control is necessary (eg, laryngospasm, difficult airway, full stomach), or IM use when a suitable vein is inaccessible.

- Anaphylaxis: Severe anaphylactic reactions (some life-threatening and fatal) have been reported; immediate treatment (including epinephrine 1 mg/mL) for anaphylactoid and/or hypersensitivity reactions should be available during use. Use caution in patients with previous anaphylactic reactions to other neuromuscular blocking agents.
- Bradycardia: Risk of bradycardia may be increased with second dose and may occur more in children. Occurrence may be reduced by pretreating with anticholinergic agents (eg, atropine).
- Increased intraocular pressure (IOP): May increase IOP; avoid use in patients in which an increase in IOP is undesirable (eg, narrow-angle glaucoma, penetrating eye injuries).
- Intracranial pressure: May cause a transient increase in intracranial pressure (adequate anesthetic induction prior to administration of succinylcholine will minimize this effect).
- Intra gastric pressure: May increase intra gastric pressure, which could result in regurgitation and possible aspiration of stomach contents.
- Malignant hyperthermia: Use may be associated with acute onset of malignant hyperthermia; risk may be increased with concomitant administration of volatile anesthetics.
- Neuromuscular cross-sensitivity: Cross-sensitivity with other neuromuscular-blocking agents may occur; use extreme caution in patients with previous anaphylactic reactions to other neuromuscular-blocking agents.
- Vagal tone: May increase vagal tone.

Ticagrelor

Classification

Antiplatelet agent

Indications

- CCP: Adjunctive antiplatelet therapy for STEMI

Contraindications

- Hypersensitivity to ticagrelor or any component
- Active pathological bleeding (e.g., peptic ulcer, intracranial hemorrhage) or history of intracranial hemorrhage
- Moderate to severe hepatic impairment
- Concurrent use of strong CYP3A4 inhibitors (e.g., ketoconazole, clarithromycin, ritonavir, atazanavir, nefazodone)

Adult dosages

- CCP: Adjunctive antiplatelet therapy for STEMI
- 180 mg PO as soon as possible after diagnosis in combination with aspirin

Mechanism Of Action

Reversibly binds ADP P2Y₁₂ receptor on the platelet surface, preventing activation of the GPIIb/IIIa complex, reducing platelet aggregation.

Pharmacokinetics

Following oral administration:

- Onset: within 30 minutes
- Peak: 2 hours
- Duration: 2-8 hours
- Half-life: 7 hours (9 hours for active metabolite)
- Elimination: feces and urine

Adverse Effects

>10%: Respiratory: Dyspnea (14% to 21%)

1% to 10%:

Cardiovascular: ECG abnormality (ventricular pause; 2% to 6%)

Endocrine & metabolic: Gout ($\leq 2\%$)

Gastrointestinal: Nausea (4%)

Hematologic & oncologic: Major hemorrhage (4%), minor hemorrhage (4%)

Nervous system: Dizziness (5%)

Renal: Increased serum creatinine (7%; transient; mechanism undetermined)

Frequency not defined: Endocrine & metabolic: Increased uric acid

Warning And Precautions

Ticagrelor increases the risk of bleeding including significant and sometimes fatal bleeding. Use is contraindicated in patients with active pathological bleeding (eg, peptic ulcer bleeding, intracranial hemorrhage) or history of intracranial hemorrhage. Additional risk factors for bleeding include propensity to bleed (eg, recent trauma or surgery, recent or recurrent GI bleeding, active peptic ulcer disease (PUD), moderate to severe hepatic impairment), coronary artery bypass graft (CABG) or other surgical procedure, concomitant use of medications that increase risk of bleeding (eg, warfarin, nonsteroidal anti-inflammatory drugs), and advanced age. Bleeding should be suspected if patient becomes hypotensive after undergoing recent coronary angiography, percutaneous coronary intervention, CABG, or other surgical procedure even if overt signs of bleeding do not exist.

Tranexamic Acid

Classification

Hemostatic and antifibrinolytic agent

Indications

■ PCP: Signs of shock or hypoperfusion in association with an injury suggestive of occult or ongoing bleeding

Contraindications

- Hypersensitivity to tranexamic acid
- Time since injury to administration > 3 hours
- Age < 12 years (PCP) or < 1 year (ACP)

Adult dosages

■ PCP: Signs of shock or hypoperfusion in association with an injury suggestive of occult or ongoing bleeding

- 1 g IV over 10 minutes (via infusion).

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

■ ACP: Signs of shock or hypoperfusion in association with an injury suggestive of occult or ongoing bleeding

- < 12 years of age: 15 mg/kg IV over 10 minutes (via infusion)
- > 12 years of age: 1 g IV over 10 minutes (via infusion).

Mechanism Of Action

Prevents clot degradation by competing for TPA receptor sites

Pharmacokinetics

Intravenous:

- Onset: immediate

Adverse Effects

May potentiate hypotension if administered too quickly

Warning And Precautions

For intravenous infusion use only. Do not administer as a push dose, or intramuscularly or subcutaneously.

Vasopressin

Classification

Antidiuretic hormone analog

Indications

■ CCP: Vasodilatory shock

Contraindications

Hypersensitivity to vasopressin or any component

Adult dosages

■ CCP: Vasodilatory shock

- ≤ 0.03 units/minute IV. Titrate up by 0.005 units/minute at 10- to 15-minute intervals, to a maximum dose of 0.1 unit/minute, if target blood pressure is not reached.

Pediatric Considerations And Dosing

Not recommended.

Mechanism Of Action

Vasopressin stimulates a family of arginine vasopressin (AVP) receptors, oxytocin receptors, and purinergic receptors (Russell 2011). Vasopressin, at therapeutic doses used for vasodilatory shock, stimulates the AVPR1a (or V1) receptor and increases systemic vascular resistance and mean arterial blood pressure; in response to these effects, a decrease in heart rate and cardiac output may be seen.

Pharmacokinetics

- Onset: within 15 minutes
- Duration: for duration of infusion and ~20 minutes after discontinuation
- Half-life: 10-20 minutes
- Excretion: urine

Adverse Effects

Cardiovascular: Atrial fibrillation, bradycardia, ischemic heart disease, limb ischemia (distal), low cardiac output, right heart failure, shock (hemorrhagic)

Dermatologic: Skin lesion (ischemic)

Endocrine & metabolic: Hyponatremia

Gastrointestinal: Mesenteric ischemia

Hematologic & oncologic: Decreased platelet count, hemorrhage (intractable)

Hepatic: Increased serum bilirubin

Renal: Renal insufficiency

Warning And Precautions

Vasopressin is a vesicant. Ensure patency of infusion line and device to prevent extravasation.

Use with caution in cardiovascular disease -- may worsen cardiac output.

Vitamin K

Classification

Fat-soluble vitamin

Indications

■ CCP: Major, life-threatening bleeding in patients with an INR > 1.5, on warfarin therapy, or with vitamin K deficiency

Contraindications

Hypersensitivity to vitamin K (phytonadione) or any component of the formulation

Adult dosages

■ CCP: Major, life-threatening bleeding in patients with an INR > 1.5, on warfarin therapy, or with vitamin K deficiency

- 10 mg IV/IO, **no faster than 1 mg/minute**.
- Do not repeat dose.

Pediatric Considerations And Dosing

■ CCP: Major, life-threatening bleeding in patients with an INR > 1.5, on warfarin therapy, or with vitamin K deficiency

- Significant bleeding: 0.5-2 mg IV. Do not repeat.
- Life-threatening bleeding: 5 mg IV. Do not repeat.

Mechanism Of Action

Promotes liver synthesis of clotting factors (II, VII, IX, X); however, the exact mechanism as to this stimulation is unknown.

Pharmacokinetics

- Onset: 1-2 hours
- Peak: 12-14 hours
- Metabolism: hepatic
- Excretion: urine and feces

Adverse Effects

Cardiovascular: Chest pain, flushing, hypotension, tachycardia, weak pulse

Central nervous system: Dizziness

Dermatologic: Diaphoresis, eczematous rash, erythema, erythematous rash, pruritic plaques of the skin, urticaria

Gastrointestinal: Dysgeusia

Hepatic: Hyperbilirubinemia

Hypersensitivity: Anaphylactoid reaction, anaphylaxis, hypersensitivity reaction

Local: Injection site reaction (including pain, swelling, tenderness)

Respiratory: Cyanosis, dyspnea

Miscellaneous: Lesion (scleroderma-like)

Warning And Precautions

Fatal hypersensitivity reactions, including anaphylaxis, have occurred with parenteral use; onset may occur during or immediately after intravenous (IV) or intramuscular (IM) administration. Reactions have occurred despite dilution to avoid rapid IV infusion and with the first dose.

Infusion Drip Rate Formula

□

Given a certain amount of liquid, a time period, and a drop factor (gtts/mL), what is the necessary IV flow rate in gtts/min?

This measurement is used when the IV is regulated manually. Because it is not possible to give a patient a fraction of a drop, it is typical to round answers for these problems up or down to the nearest whole number.

Formula:

<u>Volume (mL)</u>	x Drop Factor (gtts/mL) = Y (Flow Rate in gtts/min)
Time (min)	

Example: Calculate the IV flow rate for 1200 mL of NS to be infused in 6 hours. The infusion set is calibrated for a drop factor of 15 gtts/mL.

<u>Volume (mL)</u>	x Drop Factor (gtts/mL) = Y (Flow Rate in gtts/min)
Time (min)	

Convert 6 hours to minutes.

- min ← hr (x by 60)
- 6 hr x 60 = 360 min

<u>1200 mL</u>	x 15 gtts/mL = 50 gtts/min
360 min	

Example: Calculate the IV flow rate for 200 mL of 0.9% NaCl IV over 120 minutes. Infusion set has drop factor of 20 gtts/mL.

<u>Volume (mL)</u>	x Drop Factor (gtts/mL) = Y (Flow Rate in gtts/min)
Time (min)	

<u>200 mL</u>	x 20 gtts/mL = 33 gtts/min
120 min	

Amiodarone Infusion

150 mg over 10 minutes

Saline Bag	50 mL	250 mL
Drip Set	10 gtts	10 gtts
Add Drug	150 mg	150 mg
Drip Rate	1 gtt/s	5 gtts/s (open)

Epinephrine Infusions

Saline Bag	250 mL	500 mL	1000 mL
Drip Set	60 gtts	10 gtts	10 gtts
Add Drug	1.0 mg Epinephrine	0.5 mg Epinephrine	1.0 mg Epinephrine
Result	4 mcg/mL	1 mcg/mL	1 mcg/mL
1 mcg/min	15 gtts/min (1 gt/4s)	10 gtts/min (1 gt/6s)	10 gtts/min (1 gt/6s)
2 mcg/min	30 gtts/min (1 gt/2s)	20 gtts/min (1 gt/3s)	20 gtts/min (1 gt/3s)
4 mcg/min	60 gtts/min (1 gt/1s)		
6 mcg/min		60 gtts/min (1 gt/1s)	60 gtts/min (1 gt/1s)
8 mcg/min	120 gt/min (2 gt/1s)		
12 mcg/min		120 gt/min (2 gt/1s)	120 gt/min (2 gt/1s)

Magnesium Sulfate Infusion

2 g over 20 minutes

Saline Bag	50 mL	250 mL
Drip Set	10 gtts	10gtts
Drip Rate	1 gt/2s	2-3 gtts/s

Tranexemic Acid (TXA) Infusion

1 g over 10 minutes

Saline Bag	50 mL	250 mL
Drip Set	10 gtts	10 gtts
Drip Rate	1 gt/1s	5 gtts/s (open)

