INTRODUCTION:
The Emergency Medical Services (EMS) Program at Regions Hospital has developed these policies and guidelines. All statements contained in this manual are informative only and represent that which is believed to be the highest standard of care relating to any particular set of circumstances.

It is the intention of the Regions Hospital EMS medical director(s) that this manual be used as consultative material in striving for optimal patient care. It is recognized that any specific procedure is always subject to modification depending upon the circumstances of a particular case. Further, the medical control physician may deviate from these guidelines based on medical judgment.

This edition replaces all previous editions and becomes effective on March 1, 2016.

REGIONS HOSPITAL EMERGENCY MEDICAL SERVICES:
Regions Hospital Emergency Medical Services is a program of Regions Hospital. Our services encompass the full spectrum of out-of-hospital emergency care oversight including:

- Medical direction and consultation
- Quality management
- Education
- Research
- Legislative advocacy

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Visit us at www.regionsems.com or on Facebook at Regions EMS

These guidelines and policies have been approved by:

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March 1, 2016

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March 1, 2016

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March 1, 2016

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SCOPE OF PRACTICE

The Critical Care Emergency Medical Technician - Paramedic (CCP) will render care to critically ill or injured patients who are being transported to a facility that provides an equal or higher level of care, for continued treatment. In addition to standard ALS equipment utilized routinely by paramedics, the CCP may be required to manage special equipment and/or medications being used on a patient provided by the transferring hospital. The CCP may need to perform advanced procedures, as well as monitor and administer medications not routinely used by ALS Paramedics. When called for (should be considered when manual ventilations are being performed, non-standard ventilator settings are necessary, or more than 2 titratable drips are in use), additional critical care personnel such as a respiratory therapist, ICU nurse, physician, or another paramedic may accompany patient to assist in providing care. The CCP will be the team member in charge but will recognize and respect the expertise of the other care givers on board. The decision to transfer a patient rests with the transferring physician. This physician bears responsibility for the transfer decisions, and must:

1) Determine whether the benefits of transfer outweigh the risks.
2) Ensure that the patient is properly stabilized prior to departure.
3) Be responsible for complying with currently accepted community standards of practice regarding interfacility transfer.

For the purposes of these guidelines, MRCC stands for Medical Resource Control Center, which refers to on-line medical control. This can be obtained by hailing East Metro MRCC on the 800mhz Minnesota ARMER radio system using talkgroup “MRCC-E”, by phone at (651)-254-2990, or by contacting the hospital designated as medical control for either the transporting agency or for the specific patient encounter.

Any medication given via intravenous infusion that must be infused at a defined rate, or titrated based on specific parameters, must be infused via an infusion pump. “Estimating” drip rates is not authorized.

Any medication authorized for intravenous delivery may also be administered via an intraosseous line.
## Treatment Guidelines

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This document is a supplement to the Regions Hospital EMS patient care guidelines. If at any point the patient’s status should change, address any emergency medical conditions according to the standard Regions Hospital EMS patient care guidelines.

**General Considerations**

- If the patient is felt to be not stable for transport, coordinate with the transferring facility to stabilize the patient to the extent of that facility’s capabilities prior to departure. Consider the need for definitive care vs the risk of transport in an unstable condition. If any disagreement exists, contact MRCC for recommendations.
- Obtain contact information for family members or caregivers in case the patient’s status changes en route.
- Verify that the receiving facility has accepted the patient and is ready for the transfer.
- Collect all available documentation including EMS run sheets, demographics face sheet, lab/imaging results (and images on a CD if appropriate), provider/nursing notes, and if applicable any documentation provided by the patient’s residential facility.
- If patient is unstable or requires time-sensitive interventions at the receiving facility, do not delay transport to collect the documentation. This should be faxed by the transferring facility directly to the receiving unit.
- Provide an update to MRCC with the patient’s status and ETA prior to arrival at the receiving facility.
- In the unlikely situation when medical control is unreachable and intervention is necessary outside of the scope of standing orders, the transport team will divert to the nearest appropriate medical facility.
- If infusing medication concentrations do not match the library in the IV pump, either exchange the medication for its equivalent from the critical care medication pack (if available) or override the pump programming to match the concentration. Verify all medications with the RN prior to transfer. Contact MRCC for an IV pharmacy consult if needed for assistance with pump programming.

**Additional Personnel**

When the EMS provider anticipates that they will require more assistance to appropriately care for the patient during transfer, they shall request the transferring physician/health care provider to provide appropriately trained hospital staff to accompany the patient and assist. The EMS provider must contact Medical Control for medical direction in all situations where they are not comfortable with the circumstances of the transfer. The transfer will not occur unless the EMS provider and medical control are confident the personnel and equipment are appropriate for transfer.

**Requirements of CCP**

- Current State Paramedic Licensure
- Successful completion & maintenance of an approved Critical Care EMT-P (or equivalent) course.
- Complete annual CME and skills testing requirements as determined by the Medical Director
Anaphylaxis

Interventions
- Frequent airway evaluation
- Be prepared for advanced airway intervention
- Have surgical airway kit readily available

Medications
- Diphenhydramine
- Methylprednisolone
- Epinephrine

Adult Medications
- The following medications are authorized on standing order:
  - **Diphenhydramine**: 25-50 mg IV or 50 mg IM. May repeat x 1 two hours after initial dose. Contact Medical Control for further authorization if needed.
  - **Methylprednisolone**: 125 mg IV x 1 dose if not given by transferring facility. (Note: Peak effect will not be seen for up to 6 hours)
  - **Epinephrine 1:1,000**: 0.3 mg IM. May repeat every 20 minutes for persistent hypotension and/or airway compromise.
  - **Epinephrine 1:10,000**: 0.1 mg to 0.5 mg slow IV push every 5 minutes as needed (max 3 mg in 30 minutes) for impending respiratory/cardiac arrest.
- **Medical control authorization required**:
  - **Epinephrine drip**: Mix 1 mg of epinephrine in 250 mL of normal saline (concentration will be 4 µg/mL). Titrate at 2 – 10 µg/min. Drip rate: 1 – 5 gtt/sec with micro drip set (60 gtt/mL).

Pediatric Medications
- The following medications are authorized on standing order:
  - **Diphenhydramine**: 1 mg/kg IV (max 25 mg) or 2 mg/kg IM (max 50 mg). May repeat x 1 two hours after initial dose. Contact Medical Control for further authorization if needed.
  - **Methylprednisolone**: 2 mg/kg IV (max 125 mg) x 1 dose if not given by sending facility. (Peak effect will not be seen for up to 6 hours)
  - **Epinephrine 1:1,000**: 0.01 mg/kg IM (max 0.3 mg). May repeat every 20 minutes for persistent hypotension and/or airway compromise.
  - **Epinephrine 1:10,000**: 0.01 mg/kg (0.1 mL/kg, max 0.5 mg per dose) slow IV push every 5 minutes as needed (max 1 mg in 30 minutes) for impending respiratory/cardiac arrest.
- **Medical control authorization required**:
  - **Epinephrine drip**: Mix 1 mg of epinephrine in 250 mL of normal saline (concentration will be 4 µg/mL). Titrate at 0.1 – 1 µg/min. Drip rate: 1 drip every 40 secs (0.1 µg/min) to 1 drip every 4 secs (1 µg/min) with micro drip set (60 gtt/mL).

- **Epinephrine 1:1,000 should NEVER be given IV!!**
  - Although the dose may be the same, epinephrine 1:1,000 is 10x more concentrated than epinephrine 1:10,000. This can cause significant cardiac ischemia, arrhythmias, or even sudden cardiac arrest if given IV.
  - If patient develops chest pain following administration of epinephrine, obtain a 12-lead EKG and treat according to the standard Chest Pain treatment guideline.

**Pearls**
- Airway management is the most important consideration.
- Atypical anaphylaxis may present with hypotension, altered mental status, or abdominal pain with or without facial or airway edema or skin findings.
- For individuals over 50 or those with a history of coronary artery disease, epinephrine should be reserved for severe reactions or evidence of airway involvement.
Symptom Severity Classification

Mild symptoms:
- Flushing, hives, itching, erythema with normal blood pressure and perfusion.

Moderate symptoms:
- Flushing, hives, itching, erythema plus mild respiratory (wheezing, dyspnea, hypoxia) or gastrointestinal symptoms (nausea, vomiting, abdominal pain) with normal blood pressure and perfusion.

Severe symptoms:
- Skin symptoms may or may not be present, depending on perfusion. Possible itching, erythema plus severe respiratory (wheezing, dyspnea, hypoxia) or gastrointestinal symptoms (nausea, vomiting, abdominal pain) with hypotension and poor perfusion.
Aortic Emergencies

Interventions
- Treatment is generally similar to major trauma patients
- Ensure adequate vascular access (2 large-bore IV’s)
- Emergent transport unless otherwise instructed
- Blood pressure control is the primary focus.

Medications
- Labetalol
- Esmolol
- Nitroprusside

Aortic Rupture, Transection, or Tear
- Maintain systolic BP 90 – 110 mmHg or MAP 65 – 80 mmHg
- If systolic BP < 90 mmHg or MAP < 65 mmHg, follow the Hypovolemic Shock guideline to transfuse blood products (preferred) or infuse IV fluids.
- If systolic BP > 110 mmHg or MAP > 80 mmHg:
  - Labetalol: 5 – 10 mg slow IV push over 2 minutes. If SBP remains above target, repeat 10 – 20 mg slow IV push (over 2 minutes) every 10 minutes.
  - Esmolol: 500 µg/kg slow IV push over 1 minute. Then start drip at 50 µg/kg/min. Titrate up to max of 300 µg/kg/min, to keep SBP 90 – 110 mmHg, MAP 65 – 80 mmHg, or heart rate no less than 20% of initial rate.

Abdominal Aortic Aneurysm
- Maintain systolic BP 90 – 110 mmHg or MAP 65 – 80 mmHg
- If systolic BP < 90 mmHg or MAP < 65 mmHg, follow the Hypovolemic Shock guideline to transfuse blood products (preferred) or infuse IV fluids.
- If systolic BP > 110 mmHg or MAP > 80 mmHg:
  - Labetalol: 5 – 10 mg slow IV push over 2 minutes. If SBP remains above target, repeat 10 – 20 mg slow IV push (over 2 minutes) every 10 minutes.
  - Esmolol: 500 µg/kg slow IV push over 1 minute. Then start drip at 50 µg/kg/min. Titrate up to max of 300 µg/kg/min, to keep SBP 90 – 110 mmHg, MAP 65 – 80 mmHg, or heart rate no less than 20% of initial rate.

Thoracic Aortic Aneurysm / Dissection
- Maintain systolic BP < 110 mmHg
- If systolic BP > 110 mmHg or MAP > 80 mmHg:
  - Labetalol: 20 mg slow IV push (over 2 minutes) every 10 minutes until SBP < 110 mmHg.
  - Esmolol: 500 µg/kg slow IV push over 1 minute. Then start drip at 50 µg/kg/min. Titrate up to max of 300 µg/kg/min, to keep SBP 90 – 110 mmHg, MAP 65 – 80 mmHg, or heart rate no less than 20% of initial rate.

If patient becomes bradycardic (HR < 60 or drop of more than 20% from initial HR):
- Stop (or titrate down) current drip rate
- Sodium nitroprusside drip: Start at 0.25 µg/kg/min, increase by 0.25 – 0.5 µg/kg/min every 5 minutes until target BP goal reached (max 10 µg/kg/min).

Pearls
- An aortic rupture, transection, or tear can cause rapid life-threatening hemorrhage. Treatment includes emergent surgery or endovascular repair in a cath lab.
- An aneurysm is a weakened or bulging area of the aorta. These can leak or rupture, causing life-threatening hemorrhage. Treatment depends on the size and location of the aneurysm but may involve emergent surgery.
- A dissection is a flap between layers of the wall of the aorta. This flap can cause occlusion of branches off the aorta, leading to stroke symptoms, kidney failure, intestinal damage, or even coronary artery occlusion. Occasionally the dissection flap can extend back to the heart, causing hemorrhage into the pericardium (tamponade). Treatment depends on the location and may include surgical or non-surgical management. The primary management focus is controlling the blood pressure to reduce shearing and prevent further dissection damage.
Blood Product Transfusions

Interventions
- Critical Care Paramedics may initiate the administration of blood products
- All blood products must be obtained from the transferring facility
- Monitor for transfusion reactions or anaphylaxis

Indications
- Documented anemia with hemodynamic instability, symptoms (dyspnea, light-headedness), or indicated due to medical comorbidities
- Persistent hypotension or sustained tachycardia despite adequate IV crystalloid fluid challenge (2 L for adults, total of 40 mL/kg for pediatric patients), and concern exists for blood loss
- Suspected ongoing hemorrhage with symptoms of anemia

Preparation
- Determine the source of blood loss if possible, and perform hemorrhage control interventions (including tourniquet use if indicated)
- Ensure large bore IV access, 2 sites if possible. (Blood products can be transfused through an IO line although the rate will be limited)
- Ensure IV crystalloid fluid challenge has been given
- Document physician order for initiating blood product transfusion (referral physician or on-line medical control physician)

Transfusion Procedure
- Both paramedics should match the patient’s name and wristband with the blood product unit’s information tag (blood type, Rh factor, unit #, expiration date). This information should be documented in the PCR.
- If any inconsistencies exist in matching the patient’s information to the blood product, DO NOT TRANSFUSE!
- Obtain baseline vitals (including temperature) prior to transfusion
- Transfuse via dedicated IV line using blood tubing and filter set primed with normal saline
- Adult patients will receive the entire unit, pediatric patients should receive 10 mL/kg
- Discuss infusion rate with transferring provider
- Reassess vital signs (including temperature) every 5 minutes during transfusion
- Monitor for acute hemolytic reactions or allergic reactions – see red box for information
- Monitor for signs of fluid overload (respiratory issues), slow transfusion rate or provide positive-pressure ventilation or CPAP as indicated
- Retain all tubing and used blood product bags for receiving facility analysis

Medications
- Packed Red Blood Cells (PRBC)
- Fresh Frozen Plasma (FFP)
- Platelets
- Cryoprecipitate

Pearls
- Type-specific and cross-matched blood products are preferred if time permits to reduce the risk of reactions
- Universal donor O-negative (or occasionally O-positive) PRBCs (universal FFP is type AB) may be ordered by a physician in emergent situations
# Cardiac Arrhythmias

## Interventions
- Patients should be NPO unless they have passed a bedside nursing swallow evaluation
- Maintain head of bed at 30 degrees
- Monitor and document the following every 10 minutes:

## Medications
- Metoprolol
- Esmolol
- Diltiazem
- Amiodarone
- Lidocaine
- Procainamide

## Bradycardia
- Follow the standard Adult Bradycardia guideline, consider toxicology-related causes
- Be prepared to pace 2nd degree type 2 and 3rd degree A-V blocks

## Supraventricular Tachycardia (SVT) or Wide Complex Tachycardia
- Follow the standard Adult Tachycardia Narrow/Wide Complex guideline
- If SVT persists despite cardioversion attempts AND patient remains symptomatic or unstable, contact MRCC for physician authorization for the following:
  - **Amiodarone**: 150 mg diluted in 100 mL NS, infuse over 10 minutes. Peds: 5 mg/kg (max 150 mg).
  - Re-attempt cardioversion
  - If successful, start amiodarone drip at 1 mg/min (Peds: contact MRCC)

## Atrial Fibrillation/Flutter
- Follow the standard Adult Tachycardia Narrow Complex guideline
- If at any point the patient becomes unstable (altered mental status, hypotension, respiratory distress, chest pain), attempt cardioversion
  - **The following medications require physician authorization**, either by transferring facility or MRCC (target heart rate is < 100):
    - **Metoprolol**: 5 mg slow IV push over 2 minutes, may repeat every 5 minutes for 3 doses total. HOLD if SBP < 100.
    - **Esmolol**: 500 µg/kg slow IV push over 1 minute. Then start drip at 50 µg/kg/min. Titrate up to max of 300 µg/kg/min. HOLD if SBP < 90.
    - **Diltiazem**: 0.25 mg/kg (20 mg for avg adult) slow IV push over 2 minutes. After 15 minutes may repeat at 0.35 mg/kg (25 mg for avg adult) slow IV push over 2 minutes. After 15 additional minutes, may start Diltiazem drip at 5 – 15 mg/hour. HOLD if SBP < 90.
    - **Amiodarone**: 150 mg diluted in 100 mL NS, infuse over 10 minutes. Then start amiodarone drip at 1 mg/min. HOLD if SBP < 90.

## Frequent PVCs or Other Atrio-Ventricular Arrhythmias
- Typically do not require treatment. If symptomatic or unstable, obtain order from transferring facility or MRCC:
  - **Amiodarone**: 150 mg diluted in 100 mL NS, infuse over 10 minutes. Then start amiodarone drip at 1 mg/min. HOLD if SBP < 90.
  - **Procainamide**: 1 – 4 mg/min
  - **Lidocaine**: 1 – 1.5 mg/kg slow IV push over 2 minutes. May repeat 0.5 – 0.75 mg/kg every 10 minutes, max 3 mg/kg.
  - **Lidocaine drip**: 1 – 4 mg/min

If at any point the patient loses pulses, refer to the Cardiac Arrest guidelines.

## Pearls
- *Treat the patient, not the number!* Asymptomatic arrhythmias do not necessarily need treatment.
Acute Coronary Syndrome

- **Aspirin**: 324 mg chewed orally if not already given. OK to give even if patient is on warfarin – the benefits outweigh the risks for a single dose in the setting of cardiac ischemia.

- **Pain control**:
  - **Nitroglycerin**: 0.4 mg sublingual. May repeat every 5 minutes for 3 doses. If still having pain, start a nitroglycerin drip at 50 µg/min IV. Increase by 5 – 10 µg/min every 5 – 10 minutes to alleviate pain, hold if SBP < 90 mmHg. **Avoid if patient has used a phosphodiesterase inhibitor (Viagra, Levitra, Cialis) in the past 48 hours. Use cautiously in the setting of an inferior MI.**
  - May also use the Pain Management guideline if nitroglycerin is not effective

- **If ordered by transferring physician**:
  - **Heparin**: 60 units/kg IV (max 4,000 units) bolus, followed by heparin drip at 12 units/kg/hour IV (max 1,000 units/hour). Do not give if Lovenox has been given in past 6 hours.
  - **Eptifibatide (Integrilin)**: 180 µg/kg IV bolus, followed by eptifibatide drip at 2 µg/kg/min IV (if renal function is impaired – creatinine clearance < 50 mL/min – dose should be reduced to 1 µg/kg/min)

STEMI

- Ensure 2 IV’s are available, defibrillator pads are placed
- Ensure the following medications have been given by transferring facility:
  - **Aspirin**: 324 mg (chewed or rectal)
  - **Clopidogrel (Plavix)**: 600 mg PO -OR- **Ticagrelor (Brilinta)**: 180 mg PO
  - **Treat per the “Acute Coronary Syndrome” treatment section above**
- If thrombolitics (TPA) were given or started by transferring facility, discuss plan with provider:
  - TPA should be infused through a dedicated line. DO NOT infuse any other medications through this line.
  - **Tenecteplase (TNKase)** is given as a single IV bolus dose.
  - **Alteplase (Activase)** is given as a bolus, followed by an IV infusion
  - Verify total dose of TPA to be infused, time of administration (if completed prior to transfer), or anticipated time of completion (if still infusing)
  - If TPA infusion will continue during transfer, verify with sending facility that excess TPA has been withdrawn from the TPA bottle and wasted. The bottle should be labeled by the sending hospital with the total dose/volume that was in the bottle initially to be administered.
  - When pump alarms that the bottle is empty, switch the IV tubing to a fresh bag of saline to infuse the remaining medication left in the tubing. The pump will stop when the preset volume has been infused.
  - If SBP increases above 180 mmHg or DBP above 105 mmHg, follow the “Hypertensive Crisis” treatment section (on back)

**Medications**

- **Aspirin**
- **Heparin**
- **Nitroglycerin**
- **Ticagrelor**
- **Clopidogrel**
- **Eptifibatide**
- **Alteplase**

**Pearls**

- Emergent transport – encourage transferring facility to expedite transfer of care to your vehicle
- Be prepared for life-threatening arrhythmias in the setting of acute cardiac ischemia
- Reference “CHF/Pulmonary Edema” on back and “Cardiogenic Shock” guideline as needed
Interventions
- Maintain continuous cardiac monitoring
- Monitor respiratory status and mental status closely during transport
- A rapid decrease in blood pressure can precipitate cerebral ischemia. Target goal is generally a 20% reduction.

Hypertensive Crisis
Maintain BP within parameters given by sending facility. A reasonable target should be a 20% decrease in systolic BP from initial value. *The following standing orders may be used for blood pressure control:*
- Hold anti-hypertensives if SBP < 140, DBP < 80, or decrease in SBP of more than 20% from baseline.
- Restart drips if SBP > 180 or DBP > 105, decrease previous dose by 2 titration steps.
- For BP control the following medications are authorized on standing order to maintain parameters given by transferring facility (contact MRCC for further orders):
  - **Labetalol:** 10mg slow IV push over 2 minutes. May repeat x1 in 10 minutes if no response. Hold if HR < 60.
  - **Metoprolol:** 5mg IV push. May repeat every 5 mins (total max 20 mg). Hold if HR < 60.
  - **Hydralazine:** 10 mg slow IV push over 2 minutes. May repeat x 1 in 10 minutes if no response.
  - **Esmolol drip:** 500 µg/kg slow IV push over 1 minute. Then start drip at 50 µg/kg/min. Increase by 25 µg/kg/min every 5 minutes (Max 300 µg/kg/min). Hold or titrate down if HR < 60.
  - **Nicardipine drip:** Start at 5 mg/hr. Increase by 2.5 mg/hr every 5-10 minutes (Max 15 mg/hr).
  - **Sodium Nitroprusside drip:** Start at 0.25 µg/kg/min, increase by 0.25 – 0.5 µg/kg/min every 5 minutes (max 10 µg/kg/min).

CHF / Pulmonary Edema
- If patient becomes hemodynamically unstable, include treatments from “Cardiogenic Shock” guideline.
- Treatment goal is alleviation of respiratory symptoms. Prepare for RSI and closely monitor respiratory status.
- Consider the “Pain/Sedation Management” guideline cautiously as needed.
- If central venous access is available, a CVP of < 12 mmHg would argue against cardiogenic pulmonary edema.
- **Standing orders for respiratory distress:**
  - **CPAP/BiPAP:** Refer to the Ventilator/BiPAP/CPAP device management guideline.
  - **Mechanical Ventilation:** Refer to Ventilator/BiPAP/CPAP device management guideline. Patients with pulmonary edema generally need assistance with oxygenation (PEEP, FiO₂) rather than ventilation (rate, tidal volume).
  - **Nitroglycerin:** 0.4 – 0.8 mg sublingual. May repeat every 5 minutes for 3 doses if able to tolerate oral medications. Then start a nitroglycerin drip at 50 µg/min IV. Increase by 5 – 10 µg/min every 5 – 10 minutes to alleviate respiratory distress, hold if SBP < 90 mmHg. *Use with caution if patient has used a phosphodiesterase inhibitor (Viagra, Levitra, Cialis) in the past 48 hours.*
  - **If ordered by transferring physician:**
    - **Furosemide (Lasix) drip:** Continue infusion at rate set by transferring facility (typically 20 -160 mg/hr). No titration needed.
    - **Bumetanide (Bumex) drip:** Continue infusion at rate set by transferring facility (typically 0.1 – 1 mg/hr). No titration needed.

Pearls
- Discontinue CPAP/BiPAP and consider intubation if patient becomes hypotensive or mental status deteriorates.
- CPAP/BiPAP is contraindicated in trauma and those with high risk of aspiration.
# Cardiogenic Shock

## Pearls
- Cardiogenic shock is caused by poor cardiac output. This leads to low BP, venous congestion, and often pulmonary edema.
- Consider reversible causes of cardiogenic shock, such as medications which can lower blood pressure or reduce cardiac output.

## Interventions
- Support respiratory efforts if evidence of pulmonary edema
- Support end-organ perfusion by maintaining adequate intravascular volume and cardiac output
- Continuous cardiac monitoring

## Medications
- Dobutamine
- Dopamine
- Norepinephrine

## General Considerations
- Consider defibrillation pad placement in critically ill patients
- Titrate down or stop any vasodilators that may be infusing (beta-blockers, calcium channel blockers, sodium nitroprusside, nitroglycerin, sedatives)
- Monitor for arrhythmias and treat/cardiovert as indicated
- Follow the “Cardiac Emergencies” guideline, “CHF/Pulmonary Edema” treatment section for respiratory symptoms

## Normotensive
- Follow the “Cardiac Emergencies” guideline, “CHF/Pulmonary Edema” treatment section for respiratory symptoms as needed

## Hypotensive (SBP < 100) without symptoms
- Closely monitor, contact MRCC with any questions or concerns

## Hypotensive (SBP < 100) with signs/symptoms of shock
- Refer to the appropriate “Cardiac Arrhythmia” guideline as indicated
- If no evidence of pulmonary edema or respiratory distress:
  - Normal Saline: 250 – 500 mL IV bolus. Use caution in elderly or known history of CHF.
- Discuss the following order with the transferring physician:
  - Dobutamine: Start at 10 µg/kg/min, titrate up by 2.5 µg/kg/min every 5 minutes to keep SBP > 100 mmHg (max 20 µg/kg/min).
  - If no response to dobutamine, add Dopamine: Start at 10 µg/kg/min, titrate up by 2.5 µg/kg/min every 5 minutes to keep SBP > 100 mmHg (max 20 µg/kg/min). Hold if new arrhythmia noted or HR > 100.
  - Contact MRCC for further orders as needed.

## Advanced Interventions
- Arterial lines – May be used in place of intermittent blood pressure cuff readings for purposes of titrating medications. Verify with transferring facility that invasive pressures correlate with non-invasive pressures.
- Swan-Ganz Catheter / Central Venous Catheter – Discuss placement and depth with transferring provider, Swan-Ganz catheters can be used for CVP measurements at the appropriate depth. Refer to the “CVC Lines” guideline prior to use. Do not manipulate during transport.
- Intra-Aortic Balloon Pump – must have a trained technician accompany during transport.
- Extra-Corporeal Membrane Oxygenation (ECMO) – must have a trained perfusionist accompany during transport
- Transvenous Pacer – refer to the “Transvenous Pacing” guideline

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If at any point the patient loses pulses, refer to the Cardiac Arrest guidelines.
CVA (Stroke)

Interventions
- Patients should be NPO unless they have passed a bedside nursing swallow evaluation
- Maintain head of bed at 30 degrees
- Monitor and document the following every 10 minutes:
  - Vital signs
  - Neurologic exam
  - If TPA was/is infusing, evaluate for bleeding (IV sites, catheter, mouth/gums, sites of recent trauma)

Medications
- TPA
- Labetalol
- Metoprolol
- Esmolol
- Hydralazine
- Nicardipine
- Nitroprusside

TPA
- Document vitals prior to departure, ensure that SBP < 180 and DBP < 105. If outside of these parameters, transferring hospital should stabilize further or stop the TPA infusion.
- Document a thorough baseline neuro exam prior to departure
- TPA should be infused through a dedicated line. DO NOT administer any other medications through this line.
- Verify total dose of TPA to be infused, time of administration (if completed prior to transfer), or anticipated time of completion (if still infusing at time of transfer)
- If TPA infusion will continue during transfer, verify with sending facility that excess TPA has been withdrawn from the TPA bottle and wasted. The bottle should be labeled by the sending hospital with the total dose/volume that was in the bottle initially to be administered.
- When pump alarms that the bottle is empty, switch the IV tubing from the TPA bottle to a fresh bag of saline to infuse the remaining medication left in the tubing. This should remain on the IV pump, and the pump will stop when the preset volume has been infused.
- When TPA infusion is complete, infuse normal saline at TKO.

Blood Pressure Control
Maintain BP within parameters given by sending facility, using medications ordered by sending facility.

The following standing orders may be used for blood pressure control:
- Hold anti-hypertensives and/or stop anti-hypertensive drips if SBP < 140, DBP < 80, or HR < 60.
- Restart drips if SBP > 180 or DBP > 105, decrease previous dose by 2 titration steps.
- If SBP > 180 or DBP > 105, the following medications are authorized on standing order:
  - **Labetalol**: 10mg slow IV push over 2 minutes. May repeat x1 in 10 minutes if no response.
  - **Metoprolol**: 5mg IV push. May repeat every 5 mins (total max 20 mg).
  - **Hydralazine**: 10 mg slow IV push over 2 minutes. May repeat x 1 in 10 minutes if no response.
  - **Esmolol drip**: 500 µg/kg slow IV push over 1 minute. Then start drip at 50 µg/kg/min. Increase by 25 µg/kg/min every 5 minutes (Max 300 µg/kg/min). Hold or titrate down if HR < 60.
  - **Nicardipine drip**: Start at 5 mg/hr. Increase by 2.5 mg/hr every 5-10 minutes (Max 15 mg/hr).
  - **Sodium Nitroprusside drip**: Start at 0.25 µg/kg/min, increase by 0.25 – 0.5 µg/kg/min every 5 minutes (max 10 µg/kg/min).

Pearls
- Blood pressure control is important with neurologic emergencies, as the brain loses its ability to auto-regulate.
- Cerebral hemorrhage patients may require tight blood pressure control to prevent further bleeding.
- Ischemic stroke patients, however, should be allowed to run hypertensive which helps to maintain perfusion throughout the brain.
- TPA has the potential to cause life-threatening bleeding at any time during and following the infusion.
Hypoglycemia

- Follow the standard Diabetic treatment guideline for symptomatic patients
- Dextrose as a continuous infusion (any concentration – commonly 5% or 10%) may be continued and titrated per transferring provider’s orders.
- Continuous infusions at concentrations of 20% or higher should be given through a central line

Diabetic Ketoacidosis (DKA)

- **Verify pediatric orders with transferring provider, or contact MRCC**
- Patient should remain NPO
- Ensure home insulin pump is stopped, if present
- Document amount of fluid infused prior to transfer
- Obtain and review current lab values (glucose, sodium, potassium, serum bicarbonate, pH, creatinine)
- If iStat is available, recheck serum electrolytes every hour
- Recheck finger-stick glucose every 30 minutes during transport
- **The following adult orders should be verified by the transferring provider:**
  - **IV Fluids** (after initial 2,000 mL bolus of 0.9% NS)
    - Switch to 0.45% NS unless otherwise specified
    - Infuse at 500 mL/hr for 2 hours, then maintain at 200 mL/hr
    - When glucose drops below 250 mg/dL, switch to D5 0.45% NS at current rate.
  - **Potassium Chloride**
    - If serum potassium is < 3.0, HOLD insulin and administer potassium chloride 10 mEq over 1 hour with IV fluids
    - If serum potassium is between 3.5 – 5.0, administer insulin infusion as below and add potassium chloride 10 mEq over 1 hour x 2 doses
    - If serum potassium is > 5.0, administer insulin infusion as below and HOLD potassium chloride
  - **Insulin**
    - **Regular insulin** (1 U/mL in 0.9% NS) – infuse at 0.1 U/kg/hr (typically between 6 – 10 U/hr), titrate per table below every 30 minutes per finger-stick glucose readings:

<table>
<thead>
<tr>
<th>Glucose</th>
<th>Change in glucose from previous</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 250 mg/dL</td>
<td>↑ by ≥ 50 mg/dL</td>
<td>Verify insulin infusion is infusing appropriately</td>
</tr>
<tr>
<td>≥ 250 mg/dL</td>
<td>↑ by &lt; 50 mg/dL or ↓ by any amount</td>
<td>No change</td>
</tr>
<tr>
<td>&lt; 250 mg/dL</td>
<td>↓ by &lt; 100 mg/dL or ↑ by any amount</td>
<td>Change IV fluid to D5 0.45% NS No change in insulin</td>
</tr>
<tr>
<td>&lt; 200 mg/dL</td>
<td>↓ by ≥ 60 mg/dL over prior 2 hours</td>
<td>Change IV fluid to D5 0.45% NS Decrease insulin infusion rate by 50%, call MRCC</td>
</tr>
<tr>
<td>&lt; 200 mg/dL</td>
<td>↓ by &lt; 60 mg/dL over prior 2 hours or ↑ by any amount</td>
<td>Change IV fluid to D5 0.45% NS No change in insulin</td>
</tr>
<tr>
<td>&lt; 100 mg/dL</td>
<td></td>
<td>Decrease insulin infusion rate by 50%, call MRCC</td>
</tr>
</tbody>
</table>

**Pearls**

- Insulin should not be started until potassium is > 3.5
- Patients are often profoundly dehydrated when in DKA
- Kussmaul breathing (deep rapid breathing) is a normal response to severe acidosis, such as with DKA
### Diabetic Emergencies

#### Interventions
- Ensure adequate hydration
- Ensure potassium levels are adequate
- Administer insulin to prevent further ketone production
- Consider an acute medical event as the underlying cause (infection, cardiac ischemia, insulin non-compliance)

#### Medications
- Dextrose
- Insulin
- Potassium chloride
- 0.45% NS
- D5 0.45% NS

<table>
<thead>
<tr>
<th></th>
<th>DKA</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>HHS</th>
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</thead>
<tbody>
<tr>
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<tr>
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<td>&gt;7.30</td>
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<tr>
<td>Serum bicarbonate (mEq/L)</td>
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<td>10 to &lt;15</td>
<td>&lt;10</td>
<td>&gt;18</td>
<td></td>
</tr>
<tr>
<td>Urine ketones*</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Small</td>
<td></td>
</tr>
<tr>
<td>Serum ketones*</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Small</td>
<td></td>
</tr>
<tr>
<td>Effective serum osmolality (mOsm/kg)</td>
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<td>Variable</td>
<td>Variable</td>
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</tr>
<tr>
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<td>&gt;10</td>
<td>&gt;12</td>
<td>&gt;12</td>
<td>Variable</td>
<td></td>
</tr>
<tr>
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<td>Alert</td>
<td>Alert/drowsy</td>
<td>Stupor/coma</td>
<td>Stupor/coma</td>
<td></td>
</tr>
</tbody>
</table>

#### Pearls
- DKA is caused by lack of insulin in the body, which is uncommon in type 2 diabetics
- HHS, or Hyperosmolar Hyperglycemic State, can happen with either type of diabetes and is characterized by altered mental status, remarkably high glucose levels (often > 1,000 mg/dL), and lack of concomitant acidosis.
Electrolyte Abnormalities

Interventions
- Maintain continuous cardiac monitoring
- Obtain lab values, ensure treatment decisions are based on recent values

Medications
- Potassium
- Calcium
- Magnesium
- Hypertonic saline

Hypokalemia
- Monitor for cardiac rhythm changes, treat per appropriate guideline
- Assess for low magnesium levels and treat accordingly, as potassium levels cannot be restored if magnesium levels are also low.
- **The following orders should be verified by transferring provider:**
  - **Potassium Chloride** - concentrations no greater than 20mEq/50ml D5W (or NS) for central lines and 10mEq/100ml D5W (or NS) for peripheral lines
    - **Central Lines:**
      - **Serum K+**
      - **Dose**
      - **Total Dose**
      - < 2.5: 20mEq KCL q1hr x 5
      - 2.6 – 3.0: 20mEq KCL q1hr x 4
      - 3.1 – 3.5: 20mEq KCL q1hr x 3
    - **Peripheral Lines:**
      - **Serum K+**
      - **Dose**
      - **Total Dose**
      - < 2.5: 10mEq KCL q1hr x 10
      - 2.6- 3.0: 10mEq KCL q1hr x 8
      - 3.1 – 3.5: 10mEq KCL q1hr x 6
- If patient’s creatinine is > 1.4, discuss with transferring provider or contact MRCC before administering potassium chloride.

Hyperkalemia
- Confirm any potassium level > 5.5 prior to treatment unless patient is hemodynamically unstable.
- If iStat is available, recheck serum potassium every 30 minutes after treatment.
- Monitor for cardiac rhythm changes, treat per appropriate guideline
- **The following orders should be verified by transferring provider:**
  - **Moderate (6.0-7.0) without EKG changes:**
    - **Sodium bicarbonate:** 1 mEq/kg IV (max 100 mEq)
    - **Insulin:** 10 U IV (Peds: 0.1 U/kg, max 10 U) - AND - **Dextrose:** 25 g IV (Peds: 0.5 - 1 g/kg, max 25 g)
  - **Severe (>7.0) or Moderate (6.0-7.0) with EKG changes:**
    - Same as above plus:
    - **Calcium gluconate:** 1 g IV over 10 minutes (Peds: 100 mg/kg, max 1,000 mg). *Calcium chloride may be given if diluted.*
    - **Albuterol:** 10 mg nebulized over 15 minutes (Peds: 2.5 mg if < 25 kg; 5.0 mg if > 25 kg)
  - **Severe (>7.0) with EKG changes & instability or cardiac arrest**
    - Immediately give calcium chloride
    - Treat as above

Pearls
- Electrolyte imbalances can cause life-threatening arrhythmias
- **Never administer potassium as IV push!** It can cause life-threatening arrhythmias.
- Hyperkalemia in the setting of acute renal failure often requires emergent dialysis
Critical Care Guidelines

Electrolyte Abnormalities

**Interventions**
- Maintain continuous cardiac monitoring
- Obtain lab values, ensure treatment decisions are based on recent values

**Medications**
- Potassium
- Calcium
- Magnesium
- Hypertonic saline

**Hyponatremia**
- Rapidly raising the serum sodium levels can be dangerous. Treatment should be gradual (over days), or more aggressive only if significant symptoms are present.
- Brain tissue can swell with severely low or acutely low sodium levels, with the risk of stroke-like symptoms, altered mental status, brain herniation, or seizures.
- In most cases, the only treatment needed is to restrict the patient’s water intake.

**Hypomagnesemia**
- If patient’s creatinine is > 1.4, discuss with transferring provider or contact MRCC before administering magnesium.

**Hyponatremia**
- Confirm with the transferring provider if treatment is indicated and obtain orders for medications. The following adult treatments are commonly used:
  - 3% Saline – 50-100 mL over 10 minutes. Central line preferred, may give through a reliable peripheral IV
  - 3% Saline continuous infusion – Confirm infusion rate and pump settings with transferring provider

**Hypocalcemia**
- Verify with the provider that treatment is indicated. Total serum calcium levels (reported as part of a standard basic metabolic panel) should not be used as indications for replacement. The actual active ion is in the form of ionized calcium which is a separate lab test, and should be used as the basis for calcium replacement.
- Patients receiving transfusions of multiple units of blood products may also need calcium replacement, as preservatives in the blood products may bind to free calcium ions.

**Pearls**
- Avoid calcium if digoxin toxicity is suspected. Magnesium Sulfate (2gm over 5 min) may be used instead.
Gastrointestinal Bleeding

Interventions
- Monitor airway status
- Treat nausea and pain as needed
- Utilize Hypovolemic Shock guideline as indicated

Medications
- Octreotide
- Pantoprazole
- Esomeprazole
- Vasopressin
- Antibiotics

Lower GI Bleeding
- Treat pain and nausea per the Pain Management guideline
- If hemodynamically unstable, treat per the Hypovolemic Shock guideline

Upper GI Bleeding
- Closely monitor airway, consider advanced intervention as indicated
- Treat pain and nausea per the Pain Management guideline
- If hemodynamically unstable, treat per the Hypovolemic Shock guideline
- Obtain current labs and review (Hgb, INR)
- If INR is elevated (> 1.4), discuss the following interventions with transferring provider (Patients may not receive all of these, some may not be appropriate such as those who are hemodynamically stable, liver failure, or who have had a heart valve replaced):
  - Vitamin K – 10mg IV slow push/infusion over 20 minutes
  - Kcentra Prothrombin Complex Concentrate – should be administered by transferring facility
  - Recombinant Factor Vlla – should be administered by transferring facility
  - Fresh Frozen Plasma (FFP) transfusion – 20 mL/kg
- Regardless of INR, discuss the following interventions with transferring provider:
  - Octreotide – 50 µg IV bolus, then infuse at 25-50 µg/hr
    - OR -
  - Vasopressin – 0.2 - 0.8 U/min IV infusion
  - Pantoprazole – 80 mg IV bolus over 5 minutes, then infuse at 8 mg/hr
    - OR -
  - Esomeprazole – 80 mg IV bolus over 30 minutes, then infuse at 8 mg/hr
  - Antibiotics – in the setting of cirrhosis, antibiotics may be indicated due to the high incidence of infection

Sengstaken-Blakemore Tube (Minnesota Tube)
- If indicated, will be placed by the transferring provider
- Patient should be intubated while device is in place
- Ensure you have appropriate syringes to deflate the balloons if necessary, should complications arise during transport
- Maintain 1kg traction on the end of the tube to keep the gastric balloon compressing the gastro-esophageal junction. This should be established at the transferring facility following device placement.
- Contact MRCC with any changes or concerns

Pearls
- Upper GI bleeding can be life-threatening and may require emergent intervention
- Patients with liver failure or those on blood thinners are higher risk for life-threatening bleeding
- Consider obtaining additional blood products for longer transports
Head Trauma

**Interventions**
- Prevent secondary brain injury
  - Maintain SBP > 90
  - Maintain SpO2 > 93%
  - Elevate head
  - Maintain adequate sedation and pain control

**Head Trauma**
- **Airway**
  - Ensure airway is patent, secure if needed
  - Apply oxygen to maintain SpO2 > 93%, avoid hypoxia
- **Breathing**
  - Ventilate to maintain EtCO2 at 35-40 mmHg
  - If signs of imminent herniation develop, consider slight hyperventilation to EtCO2 30-35 mmHg
- **Circulation**
  - Control any obvious external hemorrhage
  - Infuse normal saline to maintain SBP > 90 mmHg
  - Treat per the Hypovolemic Shock guideline if bleeding concerns exist
- **Disability**
  - Monitor pupils and neurologic status throughout transport
  - Avoid long-acting paralytics (vecuronium) unless absolutely necessary for patient safety or compliance with ventilator
  - Whenever possible, keep head of cot or backboard elevated 15-20 degrees
  - **Monitor for signs of imminent herniation:**
    - Unilateral pupillary dilation (with altered LOC)
    - Rapidly decreasing LOC
    - Decorticate/decerebrate posturing
    - Cushing’s Triad (hypertension, bradycardia, irregular breathing pattern)
  - **Consider neuroprotective interventions if signs of herniation develop:**
    - Ensure patient is adequately sedated and pain is well controlled
    - Raise head of cot to 30 degrees if possible
    - Consider 3% Hypertonic Saline – 150 mL IV bolus over 15 minutes
    - Alternatively, if isolated head trauma, may consider Mannitol 20% – 0.25-1.0 g/kg IV bolus over 20 minutes
- **If INR is elevated (> 1.4) and intracranial hemorrhage is identified on imaging, discuss the following interventions with transferring provider (may not be appropriate for all patients):**
  - Vitamin K – 10mg IV slow push/infusion over 20 minutes
  - Kcentra Prothrombin Complex Concentrate – should be administered by transferring facility
  - Recombinant Factor VIIIa – should be administered by transferring facility
  - Fresh Frozen Plasma (FFP) transfusion – 20 mL/kg

**Pearls**
- Maintain EtCO2 as close to 35 mmHg as possible. This will maximize fluid extraction from brain tissue (reducing swelling) while minimizing arterial vasoconstriction and decreased cerebral perfusion due to low blood CO2 levels.
- Mannitol is a diuretic and will enhance the urinary output. This should be avoided in patients with hypovolemic or hemorrhagic shock, thus hypertonic saline is preferred if imminent herniation is identified.
Hypovolemic Shock

**Interventions**
- Control the source of volume loss
- Perform hemorrhage control measures, use tourniquets if indicated
- Treat symptoms of nausea and vomiting
- *Initiate fluid replacement initially with 0.9% Normal Saline, up to 2,000 mL (30 mL/kg for peds)*
- Obtain orders from transferring provider for fluid resuscitation. Generally, hemodynamic goals would include SBP > 90 and/or MAP 60-65 mmHg.
- If the underlying cause is blood loss:
  - Refer to the Blood Product Transfusion guideline
  - Transfuse packed red blood cells as indicated and ordered by transferring provider. Type-specific is preferred, although in emergency situations O-negative blood can be given to anyone (males may also receive O-positive blood).
  - *For massive transfusions, transfuse 2 units of FFP after the first 4 units of packed RBC’s. Following that, the ration of FFP to packed RBC units transfused should be 1:1.*
- If the underlying cause is excessive fluid loss or inadequate fluid intake (dehydration):
  - Bolus 0.9% Normal Saline – 500 mL (10 mL/kg for peds) per dose. Repeat as needed to achieve hemodynamic goals, HOLD if signs of volume overload develop (respiratory distress, increasing oxygen requirements, wet lung sounds).
- If patient remains inadequately perfused despite attempts to replace volume:
  - Consider norepinephrine – start at 0.1 µg/kg/min, titrate up by 0.05 – 0.2 µg/kg/min every 5 minutes as needed (Max: 1 µg/kg/min)
  - Contact MRCC for further orders

**Medications**
- Normal Saline
- Blood Products
- Norepinephrine

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**Pearls**
- Vasopressors will not be effective until adequate volume has been restored.
- Use caution with excessive fluid boluses in patients with CHF or renal failure. Infusions would still be indicated, but monitor very closely for signs of fluid overload.
General Considerations

- Request that transferring provider check the patient’s cervix within 30 minutes of transport to estimate likelihood of imminent delivery.
- Request that the transferring provider document whether or not patient is in active labor.
- If fetal monitoring is necessary during transport, qualified staff must accompany the patient to interpret and manage the monitoring devices.
- If the patient is in active labor, it may be more appropriate to request a NICU transport team and plan to deliver the patient or perform an emergent C-section at the transferring facility.

Pre-Eclampsia / Eclampsia

- The only definitive treatment is delivery of the fetus. Risks/benefits of premature delivery must be considered and may require delaying delivery until fetal lungs have matured.
- **Verify the following orders with the transferring provider:**
  - **Magnesium Sulfate** – Mix 4g in 50mL of NS, administer over 20 minutes. Then infuse at 2 g/hr (4g in 100mL of NS – 50 mL/hr). *Monitor for magnesium toxicity (see back)!!*
  - **Lorazepam** – 1-2 mg slow IV push, repeat every 5 minutes as needed (Max: 20mg)
  - **If patient seizes:**
    - **Magnesium Sulfate** – 2g bolus over 10 minutes
    - If seizure activity persists, give Lorazepam – 1-2 mg slow IV push, repeat every 5 minutes as needed (Max: 20mg)
  - **For severe hypertension (SBP > 160mmHg, DBP > 110mmHg):**
    - **Labetalol** – 10-20mg slow IV push over 2 minutes, may repeat every 10 minutes as needed. HOLD if maternal HR < 60.

Pre-Term Labor

- Continue antibiotic infusions if initiated by transferring facility
- Keep patient in comfortable left lateral recumbent position
- Apply oxygen to maintain SpO₂ > 95% (higher due to fetal needs)
- **Verify the following orders with the transferring provider:**
  - **0.9% Normal Saline** – infuse at 125 mL/hr
  - **Terbutaline** – Start at 2.5 – 5 µg/min, titrate by 2.5 µg/min every 20 – 30 minutes if persistent contractions remain (max 20 µg/min).
  - **Magnesium Sulfate** – Mix 4g in 50mL of NS, administer over 20 minutes. Then infuse at 2 g/hr (4g in 100mL of NS – 50 mL/hr). Increase by 1 g/hr every 60 minutes if persistent contractions remain. *Monitor for magnesium toxicity (see back)!!*

Pears

- Pre-eclampsia is defined as BP greater than 140/90, or a 30mmHg rise in SBP or 15mmHg rise in DBP from baseline, after the 20th week of pregnancy.
- Any changes in condition should be closely communicated to receiving facility, in case the need arises for emergent C-section upon arrival.

It is against federal law (EMTALA) for a facility to transfer a patient in active labor until that facility has provided stabilization to the full extent of their capabilities.

No matter how sick the mother or baby may be, it is always better to deliver in a hospital rather than the back of an ambulance, especially when complications are anticipated.

If you feel uncomfortable with the situation, REJECT the transfer, contact the on-call medical director via MRCC IMMEDIATELY, and have the transferring provider discuss the situation with the EMS medical director.
Critical Care Guidelines

Other Ob/Gyn Emergencies
- Vaginal bleeding, placental emergencies, ruptured ectopic pregnancies, post-partum hemorrhage, trauma
- Follow the Hypovolemic Shock guideline as indicated
- Continue treatments initiated by transferring facility
- For post-partum hemorrhage, discuss the following order with the transferring provider:
  - Oxytocin – 10-40 U in 1,000mL NS, start at 125 mL/hr, titrate to maintain uterine contraction

Indications for medical control consultation prior to transport
- Coagulopathy (disseminated intravascular coagulation)
- Fetal distress (as evidenced by fetal heart rhythm strips or ultrasound findings)
- Excessive maternal hemorrhage
- Regular contractions < 5 minutes apart (active labor)
- Hemodynamic instability
- Severe abdominal pain
- Seizures or other abnormal neurologic findings
- Pulmonary edema
- Severe hypertension (SBP > 160 mmHg), not present prior to pregnancy
- Cervical dilation > 4 cm

Magnesium Toxicity
- Magnesium can rise to toxic levels when infused continuously
- Signs/symptoms include:
  - Loss of deep tendon reflexes (patellar reflexes)
  - Altered mental status
  - Respiratory depression
  - Cardiac depression (hypotension, bradycardia)
- Providers should check deep tendon reflexes and monitor for changes every 30 minutes while receiving continuous magnesium infusions.
- If toxicity develops, perform the following interventions:
  - STOP magnesium sulfate infusion
  - If cardiac or respiratory depression is present, give Calcium Gluconate – 1g slow IV push over 10 minutes
  - Contact MRCC for further orders

Pearls
- Magnesium Sulfate is the treatment of choice to prevent seizures due to eclampsia.
- The diagnosis of eclampsia is an indication for an emergent C-section, and the patient would not be considered stable for transfer.
Overdose Management

- Monitor airway and be prepared to intervene as needed
- **Acetaminophen overdose:**
  - If initiated by the transferring facility, maintain the following continuous IV infusion of **N-Acetyl Cysteine (NAC):**
    - 150 mg/kg over 60 minutes
    - Then 50 mg/kg over 4 hours
    - Then 100 mg/kg over 16 hours
- **Sedative overdose:**
  - Narcotic/Opiate overdose:
    - **Naloxone (Narcan):** 0.4 – 2 mg IV (Peds 0.1mg/kg, max 2 mg) every 30 minutes as needed to maintain adequate respiratory drive. May also maintain a continuous naloxone infusion if initiated by transferring facility.
  - Benzodiazepine overdose:
    - **Flumazenil:** 0.2 mg slow IV push over 1 – 2 minutes (Peds 5 µg/kg over 1 – 2 minutes, max 200 µg) every 1 minute for total of 4 doses to maintain adequate respiratory drive. *Use caution in patients who have been on long-term benzodiazepine therapy as this may precipitate seizures.*
- **Cardiovascular agent overdose (beta-blocker, calcium-channel blocker):**
  - Discuss management strategy with transferring provider. Consider involving a Toxicology consultant, either via MRCC (1-888-588-9855) or Poison Control (1-800-222-1222).
  - The following infusions may be maintained if ordered by transferring provider:
    - **High-dose Insulin infusion:** start at 1 unit/kg/hr, titrate up to 10 units/kg/hr to maintain hemodynamic parameters (SBP > 90 mmHg or MAP > 65 mmHg). This will also require a simultaneous dextrose infusion (D5 or D10). Obtain detailed management and titration parameters from transferring facility. *This requires a second ALS provider (Paramedic, CCP, or RN) to accompany the patient in the ambulance.*
    - **20% Fat Emulsion infusion (Intralipid):** 1.5 mL/kg IV bolus, then 0.25 mL/kg/min for 60 minutes. *Most patients treated with this therapy are critically ill and often too unstable for transport.*
- **Other considerations:**
  - Refer to the “Overdose/Toxic Ingestion” guideline, the “Cyanide Exposure” guideline, and the “WMD – Nerve Agent Exposure” guideline from the standard patient care guidelines for additional reference.
  - If EKG shows QRS width > 120 ms (without previously diagnosed bundle branch block):
    - Administer **Sodium Bicarbonate:** 100 mEq IV (Peds 1 mEq/kg, max 100 mEq) every 15 minutes until QRS < 120 ms.
    - May maintain **Sodium Bicarbonate infusion** – 150 mEq in 1,000 mL D5W, rate per transferring provider’s order (typical starting dose is around 25 mL/hr)
  - If EKG shows corrected QT interval > 500 ms:
    - Administer **Magnesium Sulfate:** 2 g slow IV push over 2 minutes (Peds 40 mg/kg, max 2,000 mg)

**Pearls**

- Most ingestions can be grouped into toxidromes, or clusters of symptoms. The common toxidromes involve respiratory depression, cardiovascular depression or stimulation, cardiac conduction abnormalities, and neurologic sedation or excitability (agitation, psychosis, seizures).
### Pain Management / Sedation

**Interventions**
- Assess pre-intervention pain/anxiety
- Re-assess post-intervention pain/anxiety
- Monitor respiratory status and blood pressure closely
- Consider EtCO₂ monitoring for high-risk patients or those requiring multiple doses
- Be aware of non-verbal signs of pain in non-communicative patients, such as tachycardia, hypertension, watering of the eyes, restlessness, or facial grimacing

**Medications**
- Fentanyl
- Hydromorphone
- Ketamine
- Midazolam
- Lorazepam
- Propofol
- Dexmedetomidine

### Pain Management / Anxiety

- *This guideline should supplement the Pain Control guideline from the standard patient care guidelines*
- Attempt non-pharmacologic interventions such as verbal de-escalation, positioning, ice packs, distraction
- A patient with a patient-controlled analgesia pump (PCA) may be transported with the pump, however no changes should be made to the pump during transport
- If medications are indicated, the following standing orders may be utilized for treatment of moderate to severe pain:
  - **Fentanyl** – 0.5-1 µg/kg IV every 15 minutes as needed, or 1-2 µg/kg IN every 20 minutes as needed (Peds same dose)
  - **Hydromorphone** – 0.2-1 mg IV every 30 minutes as needed (Peds 0.01 mg/kg)
  - Consider EtCO₂ monitoring if multiple doses are required or patient’s mental status is abnormal
  - Consider lower doses if SBP < 100 mmHg
- If medications are indicated, the following standing orders may be utilized for treatment of significant anxiety:
  - **Midazolam** – 1-2 mg IV every 30 minutes as needed (Peds 6 months to 5 years: 0.05 mg/kg IV, over age 6: 0.025 mg/kg IV), or 2-4 mg IN every 30 minutes as needed (Peds 0.1 mg/kg IN)
  - **Lorazepam** – 0.5-1 mg IV every 30 minutes as needed (Peds 0.02 mg/kg, max 1 mg)
  - Avoid or consider lower doses if SBP < 100 mmHg

### Overdose
- If the patient’s respiratory drive decreases after administration of analgesics or anxiolytics, consider the following standing orders:
  - For narcotic-induced symptoms, consider **Naloxone** – 0.4-2 mg IV/IM/IN (Peds 0.1 mg/kg, max 2 mg), repeat every 5-10 minutes as needed

### Pearls
- Intranasal midazolam should be given undiluted to minimize volume
- Do not hesitate to err on the lower side of dosing and titrate to effect, especially with elderly patients or those with a tenuous airway status
### Interventions
- Monitor respiratory status and blood pressure closely
- Be aware of non-verbal signs of pain in non-communicative patients, such as tachycardia, hypertension, watering of the eyes, restlessness, or facial grimacing

### Medications
- Fentanyl
- Hydromorphone
- Ketamine
- Midazolam
- Lorazepam
- Propofol

### Adult Sedation
- For behavioral sedation, refer to the Adult Behavioral guideline from the standard patient care guidelines
- **For intubated patients, the following standing orders may be utilized:**
  - May continue any infusions at rate determined by transferring facility. Obtain titration and holding parameters from provider before transport.
  - **Propofol infusion** – 5 - 80 µg/kg/minute, titrate by 5-10 µg/kg/minute every 5 minutes to maintain adequate sedation. HOLD if SBP < 90 mmHg or HR < 60.
  - **Midazolam** – 1 - 5 mg IV every 10 minutes as needed. Avoid or consider lower doses if SBP < 100 mmHg.
  - **Lorazepam** – 1 – 4 mg IV every 10 minutes as needed.
  - **Fentanyl** – 0.5 – 2.0 µg/kg every 10 minutes as needed.
  - **Hydromorphone** – 0.5 – 2.0 mg IV every 20 minutes as needed. Avoid or consider lower doses if SBP < 100 mmHg.
  - **Ketamine** – 0.5 – 1.0 mg/kg IV every 20 minutes as needed.

### Pediatric Sedation
- For intubated patients, the following standing orders may be utilized:
  - May continue any infusions at rate determined by transferring facility. Obtain titration and holding parameters from provider before transport.
  - **Propofol infusion** – 5 - 150 µg/kg/minute, titrate by 5-10 µg/kg/minute every 5 minutes to maintain adequate sedation. HOLD if SBP < (70 + (Age x 2)).
  - **Midazolam** – 0.1 mg/kg (max 10 mg) IV every 30 minutes as needed. Avoid or consider lower doses if SBP < (70 + (Age x 2)).
  - **Lorazepam** – 0.15 mg/kg (max 4 mg) IV every 30 minutes as needed.
  - **Fentanyl** – 0.5 – 2 µg/kg every 10 minutes as needed.
  - **Hydromorphone** – 0.01 – 0.02 mg/kg every 20 minutes as needed. Avoid or consider lower doses if SBP < (70 + (Age x 2)).
  - **Ketamine** – 0.5 mg/kg IV every 20 minutes as needed.

### Pearls
- Intranasal midazolam should be given undiluted to minimize volume
- Do not hesitate to err on the lower side of dosing and titrate to effect, especially with elderly patients or those with a tenuous airway status or borderline blood pressure
Respiratory Emergencies

Interventions
- Closely monitor airway status
- Do not hesitate to utilize CPAP or Bi-PAP early for significant symptoms

Bronchospasm
- Possible etiologies include COPD, asthma, anaphylaxis, angioedema, toxic fume exposure.
- Treat per the “Respiratory Distress” guideline (Adult or Peds) from the standard patient care guidelines.
- Consider treating for severe allergic reaction per the “Anaphylaxis” guideline as indicated.
- If not given by the transferring facility, give Methylprednisolone – 125 mg IV (Peds 2 mg/kg, max 125 mg) x 1 dose
- Transport in a position of comfort, typically sitting upright.
- For adult patients, consider a trial of Bi-PAP if respiratory distress or work of breathing remains elevated.

Pulmonary Edema
- Treatments should be titrated to relieve respiratory symptoms.
- Positive-pressure ventilation (invasive or non-invasive) is the preferred initial treatment to relieve respiratory symptoms.
- Consider trial of CPAP or Bi-PAP early. Prepare for intubation if mental status or respiratory status continues to decline.
- Confirm the following orders with the transferring provider:
  - Nitroglycerin – 0.4 – 0.8 mg SL every 5 minutes as needed, or start continuous infusion at 50 µg/min. Titrate up by 5 - 10 µg/min every 5 minutes as needed to relieve respiratory symptoms. HOLD if SBP < 90 mmHg.
  - Furosemide (Lasix) – 20 – 40 mg IV x one dose (should be given by transferring facility). May maintain any continuous infusion started by the transferring facility, titrate per orders from transferring provider.
  - Bumetanide (Bumex) – 0.5 – 1 mg IV x one dose (should be given by transferring facility). May maintain any continuous infusion started by the transferring facility, titrate per orders from transferring provider.

Pulmonary Embolism
- Treatment is dependent on hemodynamic stability vs instability (submassive vs massive PE).
- Diagnostic findings may or may not include right-sided heart enlargement, troponin elevation, BNP elevation (evidence of heart failure), tachycardia, hypoxia, and hypotension.
- Stable (not hypotensive), or submassive, PEs are generally treated with anticoagulation, whereas massive PEs often require thrombolytic treatment – see back for more information.
- Confirm with the transferring provider the following orders:
  - Low-molecular weight heparin (Lovenox) – 1 mg/kg SC x 1 dose (should be given by transferring facility)
  - Heparin – 80 units/kg (Max 5,000 units) IV bolus (should be given by transferring facility), then 18 units/kg/hr (Max 1,300 units/hr) continuous infusion

Pearls
- Prior to anticoagulation or thrombolytic therapy (see back), providers should review the checklist on back for any bleeding risks and discuss with the transferring provider if any concerns exist.
Respiratory Emergencies

Interventions
- Closely monitor airway status
- Do not hesitate to utilize CPAP or Bi-PAP early for significant symptoms

Medications
- Methylprednisolone
- Nitroglycerin
- Furosemide
- Bumetanide
- Low-molecular weight heparin
- Heparin
- Alteplase
- Tenecteplase

TPA (for Pulmonary Embolism)
- Document vitals prior to departure, discuss blood pressure parameters and management orders with transferring provider.
- Document a thorough baseline neuro exam prior to departure
- TPA should be infused through a dedicated line. DO NOT administer any other medications through this line.
- Verify total dose of TPA to be infused, time of administration (if completed prior to transfer), or anticipated time of completion (if still infusing at time of transfer)
- If TPA infusion will continue during transfer, verify with sending facility that excess TPA has been withdrawn from the TPA bottle and wasted. The bottle should be labeled by the sending hospital with the total dose/volume that was in the bottle initially to be administered.
- When pump alarms that the bottle is empty, switch the IV tubing from the TPA bottle to a fresh bag of saline to infuse the remaining medication left in the tubing. This should remain on the IV pump, and the pump will stop when the preset volume has been infused.
- When TPA infusion is complete, infuse normal saline at TKO.

Contraindications to thrombolytics
- Intracranial diseases
- Previous hemorrhagic stroke, ever
- Stroke within past 6 months
- Intracranial neoplasm
- Recent surgery (10-14 days)
- GI hemorrhage (3-6 mo)
- Cranial/spinal surgery/trauma (2 mo)
- Recent trauma
- Bleeding diathesis
- Post-infarction pericarditis
- Possibility of aortic dissection
- Severe uncontrolled hypertension >180/110 mmHg
- Traumatic or sustained (>10 min) CPR
- Major surgery within 3-4 wks
- Noncompressible vascular punctures
- Diabetic retinopathy
- Pregnancy

Pearls
- Prior to anticoagulation or thrombolytic therapy, providers should review the checklist for any bleeding risks and discuss with the transferring provider if any concerns exist.

Monitor for any acute change in neurologic condition (headache, acute hypertension, nausea/vomiting, new focal deficits, or change in mental status). If noted:
- Immediately stop the TPA infusion if still infusing!
- Contact medical control for further instructions, including blood pressure parameters, diversion to nearest hospital, or if patient is a direct admit consideration of further stabilization in the ED at the receiving facility
- Continue to monitor vital signs and neurologic exam every 10 minutes during infusion.
Seizure Emergencies

Interventions
- Ensure glucose level has been checked
- Benzodiazepines are the first-line treatment choice
- Fosphenytoin or Keppra is usually the second-line choice
- If still seizing, patients should be intubated and sedated with propofol

Medications
- Dextrose
- Lorazepam
- Midazolam
- Fosphenytoin
- Phenytoin
- Keppra

Status Epilepticus
- Refer to the standard Seizure patient care guideline (adult and peds) as indicated
- Most seizures are self-limited, however for the purposes of this guideline it is likely the patient has already manifested prolonged or multiple seizure episodes, thus any seizure activity in the presence of EMS should warrant treatment.
- May maintain any infusion initiated by the transferring facility
- **Confirm the following orders with the transferring provider:**
  - Benzodiazepine – first line, choose one
    - Lorazepam – 1-2 mg IV (Peds: 0.05 mg/kg IV, max 2 mg per dose), may repeat in 5 minutes for 3 doses total if needed
    - Midazolam – 2 mg IV (Peds: 0.1 mg/kg IV, max 2 mg) or 5 mg IM (Peds: 0.2 mg/kg, max 5 mg), may repeat every 5 minutes as needed, max 15 mg total
  - Anti-epileptic – second line, discuss with transferring provider or MRCC
    - Fosphenytoin – 20 mg PE/kg (Max 1,500 PE), infuse no faster than 150 PE/min
    - Phenytoin – 20 mg/kg IV (Max 1,500 mg), infuse no faster than 50 mg/min
    - Levetiracetam (Keppra) – 20 mg/kg IV over 15 minutes (Max 1,000 mg)
    - Valproic Acid (Depakote) – 20-40 mg/kg IV (Adults: infusion rate 3-6 mg/kg/min, Peds: infusion rate 1.5-3 mg/kg/min).
- As a second-line drug, fosphenytoin is preferred due to significantly lower cost, higher infusion rate, and lower risk of hypotension and other cardiovascular complications.

Peals
- Prolonged seizure activity can cause permanent neurological damage
- **Chemical paralysis does NOT stop seizure activity** – it merely masks the external evidence of seizure activity
- Do not hesitate to contact Medical Control if seizure activity is not controlled
- If patient is pregnant and in 3rd trimester, consider the diagnosis of eclampsia and treat per the OB/Gyn Emergencies guideline. Magnesium Sulfate would be the initial treatment of choice.
Sepsis

Defined as 2 or more of the following, PLUS a suspected or confirmed source of infection:

- Temperature > 100.4°F or < 96.8°F
- Heart rate > 90
- Respiratory Rate > 20
- WBCC > 12 or < 4

Severe sepsis would be diagnosed by the presence of any of the following:

- Elevated lactate
- SBP < 90 mmHg, or a drop ≥ 40 mmHg from normal
- Evidence of 2 or more organ systems failing

**Ensure that antibiotics are initiated prior to transfer**

Blood cultures should be obtained prior to initiation of antibiotics by the transferring facility

**Interventions – discuss with transferring provider:**

- Maintain any antibiotic infusions initiated by transferring facility.
- May initiate any antibiotics ordered and provided by the transferring facility
- Monitor for signs/symptoms of allergic reactions as indicated

**For elevated lactate or hypotension:**

- **Normal Saline** – 30 ml/kg (Max 2,000 mL) IV bolus
- If patient remains persistently hypotensive (mean arterial pressure < 65 mmHg):
  - Monitor respiratory status and lung exam for signs of fluid overload with repeated boluses
  - If central venous access is available, monitor CVP and administer additional IV fluid boluses to maintain CVP 8-12 mmHg: **Normal Saline** – 500 mL (Peds: 10 mL/kg) IV bolus
  - If CVP is adequate (or unavailable) and patient remains persistently hypotensive, **discuss the following with transferring provider or contact MRCC for orders** to maintain MAP > 65 mmHg:
    - **Norepinephrine** – start at 0.1 µg/kg/min, titrate by 0.05-0.2 µg/kg/min every 5 minutes as needed (Max: 1 µg/kg/min). Hold or reduce if patient becomes tachycardic.
    - **Epinephrine** – same dosing as norepinephrine.
    - **Vasopressin** – 0.03 units/min, no titration (Peds: not indicated, contact MRCC)
    - **Dopamine** – start at 10 µg/kg/min, titrate by 2.5 µg/kg/min every 5 minutes as needed (Max: 20 µg/kg/min). Hold or reduce if patient becomes tachycardic or develops a tachyarrhythmia.
    - **Phenylephrine** – **last choice if other pressors are not adequate** – start 0.5 µg/kg/min, titrate by 0.1-0.2 µg/kg/min every 10 minutes as needed (Max: 5 µg/kg/min). Peds: 0.1-0.5 µg/kg/min. Hold or reduce if heart rate < 60.
- Some patients with normal blood pressures but evidence of low cardiac output may benefit from infusion of **Dobutamine** – start at 10 µg/kg/min, titrate by 2.5 µg/kg/min every 5 minutes as needed (Max: 20 µg/kg/min).

**Pearls**

- Source control is the critical intervention – this could include surgery to remove infected organs or tissue, abscess drainage, or most commonly, antibiotics

**Interventions**

- Ensure blood cultures and urine have been collected
- Ensure antibiotics are initiated prior to transfer
- Determine duration of infusion and total dose to be given
- Maintain adequate end-organ perfusion with IV fluids and pressors if needed

**Medications**

- Normal Saline
- Antibiotics
- Norepinephrine
- Epinephrine
- Vasopressin
- Dopamine
- Phenylephrine
- Dobutamine
Critical Care Guidelines

Shock of Undifferentiated Etiology

- Attempt to assess volume status – peripheral edema, JVD, pulmonary edema, skin turgor, mucous membranes
- Assess for evidence of hemorrhage – abdominal pain, dark/tarry stools
- If evidence of hypovolemia or hemorrhage, refer to the Hypovolemic Shock guideline
- If suspicion for infection, refer to the Sepsis guideline
- If concern exists for cardiac dysfunction, refer to the Cardiogenic Shock guideline
- Consider any exposure to medications that may cause poor perfusion – antihypertensives, some antidepressants, pain medication, antiseizure medications. Discuss with transferring provider or MRCC.

- For shock without clear etiology, confirm the following orders with the transferring provider:
  - **Normal Saline** – 10 mL/kg IV bolus (Max 1,000 mL per dose), repeat as needed x 2
  - **Norepinephrine** – start at 0.1 µg/kg/min, titrate by 0.05-0.2 µg/kg/min every 5 minutes as needed (Max: 1 µg/kg/min). Hold or reduce if patient becomes tachycardic.
  - **Vasopressin** – 0.03 units/min, no titration (Peds: not indicated, contact MRCC)
  - **Dopamine** – start at 10 µg/kg/min, titrate by 2.5 µg/kg/min every 5 minutes as needed (Max: 20 µg/kg/min). Hold or reduce if patient becomes tachycardic or develops a tachyarrhythmia.

### Types of Shock

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<td>Impaired heart pump function</td>
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<td>Peripheral blood vessel vasodilation</td>
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<td>Obstructive</td>
<td>Non-cardiac obstruction to blood flow</td>
<td>Pulmonary embolus, tension pneumothorax, tamponade</td>
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### Pearls
- Hypovolemic shock is the most common type of shock
- If there is no obvious evidence of hemorrhage (i.e. normal hemoglobin level), the most likely etiology is sepsis
Pearls

- **Inter-Facility Transport** – Long backboards do not have a role in the transport of patients between hospitals **EVEN IF A SPINE INJURY IS DIAGNOSED**. Use of long boards during interfacility transport is associated with increased pain, respiratory compromise, and potential for pressure sores and ulcers. Patients should instead be managed with a cervical collar (if appropriate) and firmly secured to the EMS stretcher. If a sending facility has placed the patient on a long board or requests use of a long board, EMS providers should discuss the option of forgoing backboard use with the transferring provider. If a backboard ultimately is used, it MUST be padded adequately to maximize patient comfort.

Spinal Injury

- Cervical spinal cord injury patients often have compromised respiratory function and may deteriorate during transport. Consider pre-transport intubation in a controlled environment with the most skilled/experienced provider.
- Complete primary assessment to evaluation for critical injuries affecting airway, breathing and circulation.
- Note and document any gross neurologic deficits prior to immobilization.
- Document levels of sensory and motor function, including sensation at various levels on the torso.
- **Remove patient from long backboard prior to transport**
- Consider Foley catheter at referring institution if spinal cord injury is evident
- **If patient develops neurogenic shock:**
  - Normal Saline – 10 mL/kg IV bolus (Max 1,000 mL per dose), repeat as needed x 2
  - If HR < 100, consider **Dopamine** – start at 5 µg/kg/min, titrate by 2.5 µg/kg/min every 5 minutes as needed (Max: 20 µg/kg/min). Hold or reduce if patient becomes tachycardic or develops a tachyarrhythmia.
  - If HR > 60, consider **Phenylephrine** - start 0.5 µg/kg/min, titrate by 0.1-0.2 µg/kg/min every 5 minutes as needed (Max: 5 µg/kg/min). Peds: 0.1-0.5 µg/kg/min. Hold or reduce if heart rate < 60.

Role of Backboards – While generally speaking we are attempting to limit the use of backboards, pre-hospital and hospital providers should recognize there remain circumstances in which use of a backboard is appropriate. Backboards should be utilized to extricate patients from vehicles or other situations when they are unable to extricate themselves (critical patients, patients with lower extremity injuries, severe head injuries, etc.). In most instances, once on the EMS cot, the backboard is redundant and can be removed. However, in some settings, it may be appropriate for the backboard to remain. Those settings include, but are not limited to the following:
  - Cases in which the backboard is being utilized as an element of the splinting strategy (such as multiple long bone fractures).
  - Cases in which the patient is at risk for vomiting but unable to protect their own airway (such as intoxication, head injury, etc.) and may need to be turned to the side for airway protection during transport.
  - Cases in which the patient is unresponsive or agitated (i.e. head injury).
  - Cases in which removal of the backboard would otherwise delay transport to definitive care in a critical patient.
Background
Arterial cannulation with continuous pressure waveform display remains the accepted standard for blood pressure monitoring in hemodynamically unstable patients. The most common sites for arterial blood pressure monitoring include the radial and femoral arteries.

Management
- Ensure the pressure bag is pressurized to 300 mm Hg
- With the transducer connected to the monitor, select arterial monitor, and perform a transducer check by fast flushing the line. As you do this, you should see a change in the waveform. This is called a square wave test.
- Zero the transducer and monitor
  - Place the transducer at the phlebostatic axis of the patient.
  - Close the line off to patient and open to air.
  - Press zero on the monitor.
  - To monitor pressure, close the port off to an air and open to patient.
- Connect the catheter and fast flush to clear the catheter of blood.
- Check for good waveform

Pearls
- When changing the hemodynamic monitoring equipment for transport, use aseptic technique.
- All stopcocks should be tightly secured and covered with male end caps.
- If waveform is dampened on monitor, reassess position of the wrist or leg and check the inflation pressure in pressure bag.
- Patients with invasive monitoring in the femoral artery should have the head of stretcher maintained at less than thirty degrees with the leg straight to prevent kinking of invasive line.
- Femoral artery sites should have distal pulses reassessed with patient movement to stretcher and hospital bed.
- All Insertion sites should be reassessed for signs of bleeding or dislodgement with patient movement.
- Should the invasive line become dislodged, apply direct pressure.
- The pressure tubing should be monitored to prevent dislodgement of end caps or tubing that may result in hemorrhage.
Central Venous Catheters

Background
Central venous catheters provide access to the central venous system. Often these catheters have multiple ports, allowing for simultaneous administration of medications. The central venous system also allows for the administration of potent vasoactive medications as well as medications which would normally be painful and irritating to a peripheral vein (such as potassium chloride). Common sites include the internal jugular vein, the subclavian vein, and the femoral vein.

Management

- Use aseptic technique whenever manipulating a central line as well as before and after any medication administration.
- Before transport:
  - Inspect the insertion site of the device for redness, swelling, bleeding, and patency. If unable to directly visualize site, discuss with nursing staff the patency and condition of the site at the last dressing change.
  - Be sure you are familiar with the operation of the stopcocks and catheters in use! If not, ask the nurse to give you a bedside review of its proper use.
  - Keep insertion site covered with a sterile dressing at all times.
  - Ensure the device is adequately secured to prevent accidental removal during transport or movement of patient.
  - If the device is in the internal jugular or subclavian vein, verify that a chest x-ray has been obtained to confirm proper placement/position of the line and that no pneumothorax is present.
  - Move one pressure cable at a time to the transport monitor, ensuring that wave forms and values are similar to those that were displayed on the hospital monitor.
  - Review written transfer orders and check for orders that pertain to:
    - Any special management of the device in transit.
    - Desired values/pressure readings during hemodynamic monitoring and what steps to take (or adjustment in medications to make) if the values fall outside the desired parameters. These must be clearly understood before leaving the transferring facility.
- Should an invasive line come completely out of a patient, apply direct pressure to the insertion site and hold until bleeding stops.
- DO NOT attempt to replace a catheter that dislodges but does not come completely out of the patient.
  - Check for patency by attempting to aspirate blood from each of the lumens to determine if each remains in a blood vessel.
  - Options for continued use should be discussed with online medical control.

Continuous Venous Pressure Monitoring (CVP)

- The pressure transducer setup for CVP monitoring is identical to the setup for arterial line monitoring. Refer to the Arterial Lines device management guideline for reference.
- CVP monitoring is typically performed intermittently rather than continuously, as any infusions through the same catheter must be paused during CVP checks.
- The CVP transducer should be connected to the distal port on the catheter. This is commonly the brown port.

Pearls
- Re-assess the catheter/line/setup each time the patient is moved to assure no change in position.
- Pressure transducers MUST be re-leveled with every position change of the patient.
- All continuous infusions used to treat critical patients MUST be on an IV pump.
**Chest Tubes**

**Background**
Chest tubes are indicated for pneumothorax, hemothorax and pleural empyema (abscess). Tubes are commonly placed through the lateral chest wall, but smaller “pigtail” tubes may occasionally be placed anteriorly.

**Management**
- Assure that the chest tube is securely fastened to the patient.
- Check chest tube for patency and proper function prior to transport.
- Assure that the long flexible tubing is securely fastened to the container that acts as a drainage device, water seal and suction control device. Assure that the tubing is free of kinks.
- Make note of the fluid and blood levels in the drainage and water seal compartments.
- Obtain orders as to the water seal level and whether or not the device should be connected to suction.
- When suction is used, assure that there is bubbling in the suction control chamber. (if not, check the suction unit).
- If the water seal fails to stop bubbling after the lung is reinflated or begins to bubble again:
  - Momentarily clamp the flexible tubing near the chest. If the bubbles quit emanating from the tube while it is clamped, then the problem is either a persistent air leak in the patient’s lung or the chest tube is not sealed at the chest wall.
  - Never leave the clamp on for more than a few seconds.
  - Evaluate the insertion site.
  - Bolster the occlusive dressing at the site.
  - Evaluate the patient for distress.
  - Consult physician immediately if needed.
  - If the bubbling does not cease during the clamping of the proximal end, then suspect a leak at a connection site in the tubing or the tubing itself.
    - Check all connections and secure with tape.
    - Seal the leak with occlusive dressing and tape or replace the tubing. When replacing the tubing, remember to clamp the distal end of the chest tube to avoid the re-accumulation of a pneumothorax.
- If the water seal device becomes damaged, a temporary water seal can be accomplished by putting flexible tubing into a bottle of sterile saline. Keep this device and tubing below chest level.
- To clear clots from the tubing, squeeze the proximal end of the tubing with one hand and with the other below, squeeze the tube, stripping the material down the tube toward the drainage container.
- If the chest tube is not functioning and a tension pneumothorax is suspected, perform a needle decompression of the affected side.

**Pearls**
- Blood pressure control is important with neurologic emergencies, as the brain loses its ability to auto-regulate.
- Cerebral hemorrhage patients may require tight blood pressure control to prevent further bleeding.
- Ischemic stroke patients, however, should be allowed to run hypertensive which helps to maintain perfusion throughout the brain.
- TPA has the potential to cause life-threatening bleeding at any time during and following the infusion.
Chest Tubes

- Water seal chamber
- From patient
- To suction
- Suction control chamber
- Collection chamber
- Air leak monitor
Critical Care Device Management

Background
Intravenous medication pumps are used to deliver precise doses over a controlled time period. Any continuous infusions delivered during a critical care interfacility transport should be managed with an IV medication pump. This device management guideline applies to the Baxter Sigma Spectrum pump used by HealthPartners facilities.

Management
Starting a New Infusion Using the Dose Error Reduction System (DERS)
- Press the ON/OFF button to turn the pump on.
- If the previous setup needs to be erased, press YES soft key when prompted “New Patient?”.
- NOTE: ‘New Patient?’ Prompt – When the pump is turned on and programmed infusion data exists in memory, a screen is displayed asking the operator if the intended use for the pump is for a New Patient. Answering YES to this prompt clears the existing infusion data, answering NO retains the data and allows the operator to resume the infusion.
- Load the primed IV set.
- Select your Care Area, select drug or fluid (Type first 2 letters of drug name), confirm a Concentration if more than one is displayed, select Delivery Bag (if required), then enter and press OK to confirm all required values on the Setup Screen.
- Confirm that all clamps and vents are in the proper position.
- Press RUN/STOP to start the infusion, check and confirm proper flow.

Starting a New Infusion using the BASIC Mode (For use only when drug is not in the Drug Library)
- Press the ON/OFF button to turn the pump on.
- If the previous setup needs to be erased, press YES soft key when prompted “New Patient?”, (see “New Patient” prompt above).
- Load the primed IV set.
- Select your Care Area, select drug or fluid (Enter “B” “A” prompts to BASIC Selection), select Delivery Bag, select a Dose Mode (default is mL/hr), then enter and press OK to confirm all required values on the Setup Screen.
- Confirm that all clamps and vents are in the proper position.
- Press RUN/STOP to start the infusion, check and confirm proper flow.

Secondary Infusions
- Stop the pump if it is running.
- Lower the primary bag at least 20” below the secondary bag.
- Open secondary roller clamp.
- Press the REVIEW/PROGRAM soft key, then press the PROGRAM SECONDARY soft key.
- Select drug or fluid for the secondary infusion (type first 2 letters of drug name), select and confirm Concentration if more than one is displayed, press OK to select/confirm the secondary delivery bag, then enter and press OK to confirm all required values on the setup screen.
- Confirm that all clamps and vents are in the proper position.
- Press RUN/STOP to begin secondary infusion, check the flow and confirm drops are falling in secondary drip chamber and no drops falling in the primary drip chamber.
Background
Percutaneous drains are placed to facilitate drainage of bodily fluids where an obstruction is present, or to drain infected material from an abscess or cyst.

Management
Before transport:
- Inspect the insertion site of the device for redness, swelling, bleeding, and patency. If unable to directly visualize site, discuss with nursing staff the patency and condition of the site at the last dressing change.
- *Be sure you are familiar with the operation of the stopcocks and catheters in use! If not, ask the nurse to give you a bedside review of its proper use.*
- Determine if the insertion site should be covered with a sterile dressing.
- Ensure the device is adequately secured to prevent accidental removal during transport or movement of patient.
- Verify that the device placement has been confirmed and is functioning appropriately.
- Note the volume of drainage present in the collection bag.

- Should a drain come completely out of a patient, apply direct pressure to the insertion site and hold until bleeding stops.
- **DO NOT** attempt to replace a catheter that dislodges. Options for continued use should be discussed with online medical control.
Background

A temporary pacing electrode is utilized to increase the heart rate in the bradyarrhythmias and asystole, or to overdrive pace tachyarrhythmias. It may also be used prophylactically following a myocardial infarction and for diagnostic testing (pacing induced ischemia).

Management

- Temporary transvenous pacemakers are placed through a central venous catheter sheath. Refer to the Central Venous Catheter device management guideline for additional information.
- Verify whether a single-chamber (most common) or dual-chamber (used in cardiac cath labs) device is in use.
- Ensure battery in the pulse generator is fresh.
- If more than one set of wires is present (i.e. dual-chamber pacemaker), identify each wire set as atrial or ventricular. If a single-chamber device is in use, there will only be one set of wires.
- Attach wires to the appropriate site(s) on the pulse generator.
- Power on the pulse generator.
- Set rate based on patient’s need and physician orders (generally 70 – 90 bpm)
- Set the output (amperage):
  - Nonurgent: 10mA
  - Emergent: 15-20mA
- Set the sensitivity:
  - Start at 2 – 5 mV
  - If failure occurs (lack of pacer output due to not sensing native electrical activity) turn sensitivity DOWN
  - If pacer is sensing beats not present turn sensitivity UP
  - In emergent situations, asynchronous pacing should be used
- Observe patient for response
- Secure all wires, connections, and pacemaker in a safe location
Exclusion Criteria
If patient meets any of the following criteria, discuss options with the transferring provider. These would include further stabilization at the current facility, ventilate manually with a BVM, contact MRCC for further consultation.

- Patients requiring the following advanced modes of ventilation will require a specialty transport team (respiratory therapist):
  - Patients on ventilatory modes that cannot be replicated by the transport ventilator.
  - Patients on Pressure Control where the driving pressure plus PEEP is greater than 35 cmH₂O.
  - Patients on Volume Control where the plateau pressure is greater than 35 cmH₂O or the Peak Inspiratory Pressure (PIP) is greater than 40 cmH₂O.
- Any patient for whom the following conditions exist on their current ventilator settings:
  - SaO₂ < 95%.
  - Peak airway pressure greater than 45 cmH₂O (or greater than 30 cmH₂O with a supraglottic airway).
  - Patient is not tolerating the current ventilator settings.

Ventilator Management
- Confirm endotracheal tube placement or supraglottic airway placement
- Support ventilation as needed with BVM and O₂.
- Determine current ventilator settings and attempt to match on transport ventilator prior to switching patient over. If the transferring facility has not yet initiated mechanical ventilation, initiate with the following ventilator settings:
  - **Ventilator mode**: Assist Control (A/C)
  - **Tidal volume**: 6-8 mL/kg (based on ideal body weight) - This should be reduced to 4 - 6 mL/kg in the setting of ARDS / Acute Lung Injury
  - **Rate**: Adult 10 – 12 bpm, Children 12 – 24, Toddler/Infants 20 - 30 (titrate by 2 breaths/min as needed to maintain desired EtCO₂ – use caution with PEEP at higher respiratory rates)
  - **FiO₂**: 100% (titrate to keep SpO₂ between 93% - 99%)
  - **PEEP**: 5 cmH₂O (Titrate in increments of 2 cmH₂O (max of 10 cmH₂O) every 15 minutes to increase SpO₂ where other measures (sedation, paralysis) have failed and SBP is > 90mmHg)
- Ensure adequate sedation prior to moving the patient
- Switch patient over to the transport ventilator and observe for any distress. It may take a minute or so for the patient to become accustomed to the new ventilator.
- Contact MRCC immediately if:
  - SaO₂ < 95%
  - Peak airway pressure > 45 cm H₂O (or > 30cm H₂O with supraglottic airway).
  - Patient is not tolerating ventilator settings.

**Ideal Body Weight Calculations**
- **MALE**: 50 + 2.3 [height (in inches) - 60]
- **FEMALE**: 45.5 + 2.3 [height (in inches) - 60]

Pearls
- Hyperoxegenation may be harmful for patients with ischemic conditions. Titrate FiO₂ and PEEP to a goal SpO₂ between 93% - 97%.
- If patient becomes hypotensive, consider reducing PEEP level to reduce intra-thoracic pressure, which will enhance the venous return to the heart.
- Be aware of pneumothorax risk (especially with traumatic chest injuries, situations requiring high PEEP, or potential for auto-PEEP such as asthma or COPD)
- Maintain EtCO₂ between 35-40 for most patients; 30-35 if signs of imminent herniation are present.
Ventilation Strategies for Specific Patient Types

ARDS / Acute Lung Injury
- **Mode:** Assist Control
- **Breath type:** Pressure or Volume Ventilation can be used.
  - Pressure control ventilation ensures pressure limited breaths which also limit PIP and Plateau pressure. If compliance deteriorates, exhaled volumes will decrease. This will worsen CO2 retention.
  - Volume ventilation provides a consistent tidal volume. Appropriate alarm parameters are necessary in this context. High PIP’s are an indication of in increase the risk of barotrauma.
- **Tidal Volume:** 4 – 8 mL/kg ideal body weight (Maintain plateau pressure less than or equal to 30)
- **Breath Rate:** Adults 12 to 20 breaths/min, Children 16 to 30 breaths/min
- **PEEP:** 5 to as much as 15 cm (High PEEP may cause hypotension, particularly if the patient is hypovolemic. Permissive hypercapnia may be necessary to reduce tidal volume to reduce PIPs / Plateau pressures)
- **Inspiratory time:** 0.8 – 1.2 seconds
- **FiO2:** Titrate to maintain SpO2 90 – 95%

Asthma and COPD
- **Mode:** If the patient is breathing spontaneously, SIMV may be helpful in reduction of auto-PEEP.
- **Tidal Volume:** 4 – 8 mL/kg ideal body weight (Maintain plateau pressure less than or equal to 30)
- **Breath Rate:** Adults 6 to 25 breaths/min, Children 8 to 30 breaths/min (Adjust the breath rate to allow for full exhalation prior to the next breath being initiated)
- **PEEP:** 4 – 10 cm
- **Inspiratory Time:** 0.8 to 1.2 seconds (Keep the inspiratory time short enough to allow the patient to fully exhale prior to the initiation of the next breath)
- **FiO2:** Titrate to maintain SpO2 90 – 95%
- **Breath type:** Pressure Ventilation is preferred (Adjust to total PIP of less than or equal to 30)

Burns and Smoke Inhalation
- **Mode:** Assist Control
- **Tidal Volume:** 4 – 8 mL/kg ideal body weight (Maintain plateau pressure less than or equal to 30)
- **Breath Rate:** Adults 12 to 20 breaths/min, Children 16 to 30 breaths/min
- **PEEP:** 5 to 10 cm (Adjust based on FiO2 requirements and hemodynamics)
- **Inspiratory Time:** 0.8 – 1.2 seconds
- **FiO2:** 100% (Due to the possibility of carbon monoxide poisoning)

Alarm Troubleshooting

- Low Battery/power source (check battery or plug into wall outlet)
- Low-pressure alarm:
  - Leak or disconnected tubing (reconnect or tighten connections)
  - Cuffed tube may be leaking (check tube, inflate cuff)
  - Check O2 supply
- High-pressure alarm (Ventilator uses too much pressure to deliver the tidal volume):
  - Bronchospasm
  - Secretions in airway (suction airway)
  - Kinks in ET tube (includes biting on ET tube)
  - Coughing, gagging, breathing asynchronously, anxiety (optimize sedation)
  - Alveolar over-distension
  - Improper ventilator settings (High or low tidal volumes, excessive rate causing stacking and auto PEEP)
  - Water in the ventilator tubing (disconnect the tubing, empty water, reconnect tubing)
  - Pneumothorax

If unable to identify the cause of the ventilator alarm and/or patient’s condition deteriorates, disconnect from ventilator and assist respirations via a BVM.
Exclusion Criteria

If patient meets any of the following criteria, discuss options with the transferring provider. These would include further stabilization at the current facility or advanced airway management.

- Recurrent aspiration, vomiting, or large volumes of secretions
- Inability to protect the airway
- Obstructed bowel
- Upper airway obstruction
- Uncooperative, confused or combative patient
- ARDS
- Inability to tolerate a tight mask
- Orofacial abnormalities which interfere with mask/face interface
- Hemodynamic instability
- Untreated pneumothorax

CPAP Management

- Contact MRCC for orders for pediatric patients
- Initiate CPAP at 3 – 5 cmH₂O
- Titrate up by 1-2 cmH₂O as needed to maintain SpO₂ between 93% and 99%, max 10 cmH₂O
- If patient does not improve as expected, consider advanced airway management
- Re-evaluate every 15 minutes to titrate down or discontinue CPAP

BiPAP Management

- Contact MRCC for orders for pediatric patients
- Review current settings with respiratory therapist, nurse, or physician at transferring facility and attempt to match on transport ventilator using BiPAP (NPPV) mode.
- Do not disconnect patient from current BiPAP machine until the transport ventilator is ready
- If current settings have not been established at the transferring facility, use the following guidelines:
  - Inspiratory Pressure (top number, sometimes represented as the pressure control value): start at 10 cmH₂O, titrate up by 2 cmH₂O every 5 – 10 minutes as needed, max 20 cmH₂O
  - Expiratory Pressure (bottom number, sometimes represented as PEEP): start at 5 cmH₂O, titrate up by 1 – 2 cmH₂O every 5 – 10 minutes as needed, max 10 cmH₂O.
  - Maintain a 5 to 8 point difference between inspiratory and expiratory pressures
  - Inspiratory Time: 0.8 to 1.0 second
- If improvement in ventilation and oxygenation is not achieved, discontinue BiPAP and consider endotracheal intubation

Pearls

- BiPAP delivers CPAP but also senses when an inspiratory effort is being made and delivers a higher pressure during inspiration. This positive pressure wave during inspirations unloads the diaphragm decreasing the work of breathing.
- There have been an increased number of MIs in patients on BiPAP compared to CPAP, thus it is recommended that CPAP be attempted first.
- If patient becomes hypotensive, discontinue BiPAP and use other means to manage the airway.
BRAND NAME(S)
Activase, tPA

CLASS OF DRUG
Thrombolytics/fibrinolytics

INDICATIONS
1. Myocardial infarction
2. CVA – non-hemorrhagic
3. Pulmonary embolus

CONTRAINDICATIONS
1. Hypersensitivity
2. Recent surgery (within 10 days)
3. GI/GU bleeding
4. Uncontrolled hypertension (systolic BP >180, or diastolic BP > 110)
5. Active internal bleeding
6. History of CVA (within 2 months)
7. Recent brain, or spinal surgery (within 2 months)
8. Recent trauma

DRUG INTERACTIONS
1. Additive effect on bleeding with other anticoagulants, ASA, NSAID.

ADMINISTRATION
NOTE: Doses vary per physician direction

Acute CVA: Bolus 0.09 mg/kg IV over 1 minute
Then 0.81 mg/kg IV over next 60 minutes

Acute MI: Bolus 15mg IV over 1-2 minutes
Then 50mg IV over 30 minutes
Then 35mg IV over 60 minutes

Acute PE: 100mg IV over 2 hours

SPECIAL NOTES
➢ Monitor all puncture sites (e.g., catheters, incisions, etc.) during therapy, and subsequent heparin administration.
➢ Avoid new puncture sites or injections.
➢ When administering to the patient with AMI, (the most likely to receive this medication), watch the ECG closely for re-perfusion dysrhythmias.
➢ Allergic reactions and anaphylaxis can occur when administering this medication.
➢ Requires a dedicated infusion line.
➢ Peds – not indicated
BRAND NAME(S)
Cordarone

CLASS OF DRUG
Antiarrhythmic

INDICATIONS
1. Pulseless VF/VT refractory to initial electrical therapy
2. Unstable VT refractory to lidocaine and/or electrical therapy

CONTRAINDICATIONS
1. None, if the patient is in cardiac arrest with VF or VT.
2. High degree AV blocks or sinus node dysfunction with marked bradycardia unless a functional pacemaker is in place.
3. Congestive heart failure.

DRUG INTERACTIONS
1. Enhanced bradycardia and hypotension when given with other beta-blockers or calcium channel blockers.

ADMINISTRATION
Adult Pulseless VT/VF: 300 mg initial bolus IV after epinephrine. May re-bolus with 150mg once.
Adult Sustained VT: 150 mg over 10 minutes. May re-bolus every 10 minutes as needed up to a maximum dose of 15 mg/kg/day.
Adult Maintenance: 1.0 mg/min over first 6 hours; 0.5 mg/min, 540 mg IV over 18 hours. Maximum dose is 2.2g in 24 hours.
Peds Pulseless VT/VF: 5 mg/kg IV. May re-bolus every 3-5 minutes to a maximum of 15 mg/kg/24 hours
Peds Sustained VT: 5 mg/kg IV over 15 minutes. May repeat twice, up to 15 mg/kg /24 hours; maximum single dose 150mg.
Peds Maintenance: Contact MRCC.

Note: Expert consultation advised prior to administration in pediatrics.

SPECIAL NOTES
- Must be drawn up slowly to avoid ‘bubbles’ do not shake the ampule for the same reason.
- Must be given concurrently with epinephrine in the pulseless patient.
- Can not be administered via ET tube.
- Hypotension and bradycardia can occur on patients with a pulse.
Anti-Infectives

CLASS OF DRUG
Anti-infective

INDICATIONS
(This is not an exhausted list, just a list of the most common antibiotics).
1. Aminoglycosides: Gram negative bacteria, bone and joint, soft tissue, Post-op, UTIs, and intra-abdominal infections.
2. Cephalosporin: NOT TO BE USED IN TRIVIAL INFECTIONS. Serious infection caused by *Salmonella, Rickettsia*, and *Chlamydia*. Meningitis caused by *hemophilus influenza*, and Meningococcal meningitis.
3. Erythromycin (EES) And Macrolides: Bacteriostatic against *Streptococcus sp.*, *Staphylococcus aureus*, *Mycoplasma pneumoniae*, *Hemophilus influenza* (when used with sulfonamides), and many others.
4. Penicillin: Bactericidal against Gram negative bacteria such as *Hemophilus influenza*, *Escherichia coli*, *Proteus mirabilis*, *Neisseria gonorrhea*;
5. Polymyxin: Has potent bactericidal activity against many gram negatives such as *Pseudomonas*, *Proteus*, and *Hemophilus*.
8. Fluoroquinolones: Broad spectrum of activity against gram positive and gram negative bacteria including *Pseudomonas* (Ciprofloxacin= Cipro™)

CONTRAINDICATIONS
1. General: Contraindicated if any history of hypersensitivity to the particular class of antibiotics. Must use another class.
2. Aminoglycosides: Can cause renal or hearing impairment.
3. Cephalosporin: Use with caution with renal and hepatic impaired patients.
5. Erythromycin (EES) And Macrolides: In patients taking Seldane® and other antihistamine(s) may lead to Torsades de Pointes.
6. Penicillin: Use with caution on patients with hay fever or other allergies.
8. Sulfonamide: Third trimester pregnancy, nursing mothers, and infants under two months.
9. Anti-Fungal: None when indicated.
10. Fluoroquinolones: Children and nursing mothers.
11. Antitubercular: In Isoniazid use - Liver disease or a history of alcoholism or injection drug use is an important concern.

ADMINISTRATION
Refer to manufacturer's information.

SPECIAL NOTES
Refer to manufacturer's information.

APPROVED ANTI-INFECTIVE AGENTS

<table>
<thead>
<tr>
<th>Acyclovir</th>
<th>Ceftazidime</th>
<th>Levofloxacin</th>
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<tr>
<td>Ampicillin (+/- Sulbactam)</td>
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<td>Cefotaxime</td>
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BRAND NAME(S)
Bumex

CLASS OF DRUG
Loop diuretic

INDICATIONS
1. Heart failure
2. Pulmonary Edema
3. Hypertensive crisis

CONTRAINDICATIONS
1. Hypersensitivity to drug or sulfonamides
2. Anuria
3. Severe electrolyte imbalance

DRUG INTERACTIONS
May increase risk of digoxin toxicity from Bumetanide-induced hypokalemia

ADMINISTRATION
Adults: 1 - 2 mg IV over 1 - 2 minutes
Adult Infusion: Do not titrate during transport. Typical dosing range: 0.1 – 1 mg/hr.
Peds: Not recommended.

SIDE EFFECTS
• Muscle cramps
• Hypotension
• Dizziness
• Headache
• Nausea & vomiting

SPECIAL NOTES
➢ Larger doses may be necessary in patients with impaired renal function to obtain the same therapeutic response.
➢ Bumetanide may produce significant diuresis; it is important that patients are closely monitored for hypokalemia, hypomagnesemia, and volume depletion.
CLASS OF DRUG
Electrolyte

INDICATIONS
1. Used as antidote for calcium channel blocker overdoses
2. Magnesium sulfate overdoses
3. Black Widow spider bite
4. Hyperkalemia with widened QRS or hemodynamic instability

CONTRAINDICATIONS
1. Hypercalcemia
2. Absence of indications

DRUG INTERACTIONS
1. Increase toxicity of cardiac glycoside.
2. Calcium should be given in a dedicated IV line.
3. DO NOT mix with Sodium Bicarbonate.

ADMINISTRATION
Adults: 1 g slow IV push over 10 minutes. May push faster in cardiac arrest situations.
Peds: 0.2 ml/kg slow IV push over 10 minutes.

NOTE: RAPID INJECTION CAN CAUSE HYPOTENSION, BRADYCARDIA AND DEATH.

SPECIAL NOTES
➤ It is best to warm the drug to body temperature prior to administration.
➤ If heart is beating, rapid administration of calcium salts can produce bradycardia and/or arrest.
➤ May increase cardiac irritability, i.e., PVC's, particularly in the presence of digitalis.
➤ Local infiltration will cause tissue necrosis.
CLASS OF DRUG
Electrolyte

INDICATIONS
1. Used as antidote for calcium channel blocker overdoses
2. Magnesium sulfate overdoses
3. Black Widow spider bite
4. Hyperkalemia with widened QRS or hemodynamic instability

CONTRAINDICATIONS
1. Hypercalcemia
2. Absence of indications

DRUG INTERACTIONS
1. Increase toxicity of cardiac glycoside.
2. Calcium should be given in a dedicated IV line.
3. DO NOT mix with Sodium Bicarbonate.

ADMINISTRATION
Adults: 1 g slow IV push over 10 minutes.
Peds: 0.6 ml/kg slow IV push over several minutes.
NOTE: RAPID INJECTION CAN CAUSE HYPOTENSION, BRADYCARDIA AND DEATH.

SPECIAL NOTES
- It is best to warm the drug to body temperature prior to administration.
- If heart is beating, rapid administration of calcium salts can produce bradycardia and/or arrest.
- May increase cardiac irritability, i.e., PVC’s, particularly in the presence of digitalis.
- Local infiltration will cause tissue necrosis.
BRAND NAME(S)
Nimbex

CLASS OF DRUG
Non-depolarizing paralytic

INDICATIONS
1. Relaxation of skeletal muscles during surgery or mechanical ventilation

CONTRAINDICATIONS
None

DRUG INTERACTIONS
None

ADMINISTRATION
Load: 0.1 mg/kg IV
Maint: 0.5 – 10.2 µg/kg/min (usual dose 3 µg/kg/min)

SPECIAL NOTES
- This agent has no analgesic or amnestic properties.
- Adequate sedation must be ensured while patient is receiving this medication.
- Rare bronchospasm can occur with this medication.
**BRAND NAME(S)**
Plavix

**CLASS OF DRUG**
Anti-platelet agent

**INDICATIONS**
1. Treatment of acute coronary syndromes
2. Prophylaxis of vascular ischemic events

**CONTRAINDICATIONS**
1. Hypersensitivity to clopidogrel
2. Active bleeding

**DRUG INTERACTIONS**
1. The risk of bleeding increases when clopidogrel is combined with other anticoagulants.
2. Omeprazole and other PPIs decrease the antiplatelet effect of clopidogrel.
3. It may be more appropriate to use Ranitidine as ulcer prophylaxis in patients on clopidogrel.
4. If clopidogrel is used concomitantly with a PPI the dosages should be separated by 12 hours.

**ADMINISTRATION**

**Adults:** 600mg PO loading dose followed by 75mg PO daily

**Peds:** 1.5mg/kg daily

**SPECIAL NOTES**
- Plavix brand clopidogrel can be crushed, mixed with water and administered via a nasogastric tube.
- Thrombotic Thrombocytopenic Purpura (TTP) has been reported rarely following use of clopidogrel bisulfate, sometimes after a short exposure (<2 weeks). TTP is a serious condition that can be fatal and requires urgent treatment including plasmapheresis (plasma exchange). It is characterized by thrombocytopenia, microangiopathic hemolytic anemia, neurological findings, renal dysfunction, and fever.
BRAND NAME(S)
Precedex

CLASS OF DRUG
Alpha2-adrenoceptor agonist with sedative properties

INDICATIONS
1. Agitation

CONTRAINDICATIONS
1. Bradycardia

DRUG INTERACTIONS
1. In situations where other vasodilators or negative chronotropic agents are administered, co-administration of dexmedetomidine could have an additive pharmacodynamic effect and should be administered with caution.

ADMINISTRATION
Adults: Infuse at 0.2 – 0.7 µg/kg/hr.
Peds: Not indicated.

SPECIAL NOTES
- Cardiac Monitoring required.
- Clinically significant episodes of bradycardia and sinus arrest have been associated with dexmedetomidine administration.
Diltiazem

BRAND NAME(S)
Cardizem

CLASS OF DRUG
Calcium Channel Blocker; Coronary Vasodilator, Antidysrhythmic

INDICATIONS
1. Atrial Fibrillation or Atrial Flutter
2. Paroxysmal Supraventricular Tachycardia
3. Angina due to coronary artery spasm

CONTRAINDICATIONS
1. Sick sinus syndrome except in the presence of a functioning ventricular pacemaker.
2. Patients with second- or third degree AV block except in the presence of a functioning ventricular pacemaker.
3. Patients with severe hypotension or cardiogenic shock.
4. Patients who have demonstrated hypersensitivity to the drug.
5. Intravenous diltiazem and intravenous beta-blockers should not be administered together or in close proximity (within a few hours).
6. Patients with atrial fibrillation or atrial flutter associated with an accessory bypass tract such as in WPW syndrome or short PR syndrome.
7. Patients with ventricular tachycardia.

DRUG INTERACTIONS
1. Additive effects in prolonging AV conduction when using beta-blockers or digitalis concomitantly with diltiazem HCl.

ADMINISTRATION

**Adults:**
- Bolus: 0.25 mg/kg IV slow push over 2 minutes (Avg dose: 20 mg). If response is inadequate, a second dose may be administered after 15 minutes at 0.35 mg/kg IV slow push over 2 minutes (Avg dose: 25 mg).

- Infusion: 5 - 15 mg/hr

**Peds:** Not indicated.

SPECIAL NOTES
- When given to a conscious patient, they will almost always produce nausea, vomiting and hypotension.
Diphenhydramine

**BRAND NAME(S)**
Benadryl

**CLASS OF DRUG**
Antihistamine, H1 blocker

**INDICATIONS**
1. Allergic reactions
2. Anaphylaxis
3. Dystonic reaction to phenothiazines
4. Motion sickness (Paramedic only)
5. Anti-emetic (Paramedic only)

**CONTRAINDICATIONS**
1. Acute asthma

**DRUG INTERACTIONS**
1. Additive CNS depression with alcohol, sedatives, narcotics

**ADMINISTRATION**

**Adults:** 12.5 – 50 mg slow IV push or deep IM injection

**Peds:** 1 mg/kg slow IV push or deep IM injection (Max 50 mg)

**SPECIAL NOTES**
- May have an immediate effect in dystonic reactions.
- No early benefit in allergic reactions.
BRAND NAME(S)
Dobutrex

CLASS OF DRUG
Sympathomimetic, beta agonist

INDICATIONS
1. Primary indication is cardiogenic shock, with pulmonary edema.

CONTRAINDICATIONS
1. None when indicated. Use cautiously in acute MI and atrial fibrillation.

DRUG INTERACTIONS
1. Synergistic effect with sodium nitroprusside
2. Reduced effects with Beta-adrenergic blocker
3. Hypertensive crisis with tricyclic antidepressants

ADMINISTRATION
Dose: Start at 10 µg/kg/min. Titrate by 2.5 µg/kg/min every 5 minutes as needed. (Range 2 - 20 µg/kg/min).

SPECIAL NOTES
- Dobutamine should be titrated to effect.
BRAND NAME(S)
Intropin

CLASS OF DRUG
Potent sympathomimetic, dopaminergic

INDICATIONS
1. Primary indication is cardiogenic shock.
2. May be useful for other forms of shock.
3. May be useful, at low doses, in renal failure.
4. Used for refractory bradycardia unresponsive to atropine, and when pacing is unavailable.

CONTRAINDICATIONS
1. Tachydysrhythmias
2. Pheochromocytoma

DRUG INTERACTIONS
1. Hypotension and/or bradycardia with phenytoin
2. Reduced effects with Beta-adrenergic blocker

ADMINISTRATION
Dose: Start at 10 µg/kg/min. Titrate by 2.5 µg/kg/min every 5 minutes as needed. (Range 2 - 20 µg/kg/min).

SPECIAL NOTES
- Higher doses can cause central vasoconstriction limiting renal blood flow.
- Doses less than 5 µg/kg can lower B/P.
Epinephrine

BRAND NAME(S)
Adrenalin

CLASS OF DRUG
Sympathomimetic

INDICATIONS
1. Severe Bronchospasm
2. Bronchospasms unresponsive to albuterol
3. Anaphylaxis
4. Cardiac Arrest
5. Symptomatic bradycardia after other treatments

CONTRAINDICATIONS
1. None when indicated.

DRUG INTERACTIONS
1. Reduced effects with Beta-adrenergic blocker

ADMINISTRATION
Cardiac Arrest
Adults: 1 mg (1:10,000) every 3 - 5 minutes IV, may be given ET (2 – 2 1/2 times IV dose)
Peds: 0.01 mg/kg (1:10,000) every 3-5 minutes IV, or 0.1 mg/kg (1:1000) ET

Bradyardia
Adults: 1 mg (1:1,000) in 250mL NS or D5W, infuse at 2 - 10 µg/min
Peds: 0.01 µg/kg IV every 3-5 minutes or 0.1-0.2 µg/kg/minute (0.6 x body weight (kg) equals milligrams
to add to D5W to create a total volume of 100mL), infuse at 1mL/hr

Bronchospasm/Anaphylaxis
Adults: 0.3 mg (1:1,000) IM, or 0.1 – 0.5 mg (1:10,000) slow IV push over 5 minutes, or infusion of 2 – 10 µg/
min (concentration: 4 µg/mL – 1 mg in 250 mL NS).
Peds: 0.01 mg/kg (1:1000, max 0.3 mg) IM, or 0.01 mg/kg (1:10,000, max 0.5 mg) slow IV push over 5
minutes, or infusion of 0.01 – 1 µg/min (concentration: 4 µg/mL – 1 mg in 250 mL NS).

Second or Third line pressor
Dose: Start at 0.1 µg/kg/min, titrate by 0.05 – 0.2 µg/kg/min every 5 minutes as needed (max 1 µg/kg/min).

SPECIAL NOTES
- When used for allergic reactions, increased cardiac workload can precipitate angina and/or AMI in
susceptible individuals.
- Due to peripheral vasoconstriction, it should be used with caution on patients with peripheral vascular
insufficiency.
- Consider pulmonary edema or pulmonary embolus in wheezing patients with a history of RAD.
**BRAND NAME(S)**
Integrilin

**CLASS OF DRUG**
Glycoprotein IIb/IIIa antagonists

**INDICATIONS**
1. Treatment of acute coronary syndromes (unstable angina, non-Q-wave MI)
2. Patients undergoing percutaneous coronary interventions (PCIs)

**CONTRAINDICATIONS**
1. Hypersensitivity
2. Active internal bleeding
3. GI or GU bleeding within 6 weeks
4. Recent major surgery
5. Thrombocytopenia
6. Intracranial neoplasm
7. Intracranial bleeding within 6 months
8. Renal dialysis
9. Severe hypertension (systolic BP > 200 or diastolic BP > 110)
10. Aneurysm
11. Hemorrhagic stroke or other stroke within 30 days

**PRECAUTIONS**
1. Hypersensitivity to related compounds (abciximab, tirofiban, lamifiban)
2. Patients that have an increased risk of bleeding
3. Pregnancy and lactation

**ADMINISTRATION**

**Adults:** 180 µg/kg IV initial bolus, give over 1-2 minutes, then 2 µg/kg/min infusion for up to 72 hours

**Peds:** Not indicated

**SPECIAL NOTES**
- Use vented tubing
- Use caution in patients taking oral anticoagulants or NSAID medications
- Arterial and venous punctures, IM injections, urinary catheters, NG tubes, and nasotracheal intubation should be minimized
BRAND NAME(S)
Brevibloc

CLASS OF DRUG
Beta blocker

INDICATIONS
1. Short term treatment in the control of heart rate for patients with MI.
2. Control ventricular rate in a-fib and a-flutter
3. Stable, narrow complex tachycardias if rhythm remains uncontrolled or unconverted by adenosine or vagal maneuvers or if SVT is recurrent

CONTRAINDICATIONS
1. Hypersensitivity to Esmolol
2. Heart block greater than first degree
3. Sinus bradycardia
4. Cardiogenic shock
5. Decompensated CHF
6. Acute bronchospasm (asthma and COPD)

ADVERSE EFFECTS
1. Hypotension (dose related)
2. Bradyarrhythmias
3. Myocardial depression
4. Nausea and vomiting
5. Dyspnea
6. Bronchospasm

ADMINISTRATION
Adults: 500 µg/kg IV loading dose, give over 1 minute. Then start infusion at 50 µg/kg/min. Titrate every 5 minutes by 50 µg/kg/min until desired effect is achieved (Max 300 µg/kg/min).

Peds: Not indicated.

SPECIAL NOTES
➢ Patient must be on EKG monitor and VS should be monitored frequently.
➢ Esmolol has a very short duration of action, thus infusions are indicated if sustained response is needed.
BRAND NAME(S)
Nexium

CLASS OF DRUG
Proton pump inhibitor – diminishes daily production of acid

INDICATIONS
1. Acid related gastrointestinal disorders
2. Reduce risk of upper GI bleeding in critically ill patients

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTIONS
1. Reduced clearance of diazepam
2. Reduced bioavailability of drugs dependant on gastric pH
3. Interacts with warfarin and cyclosporin

ADMINISTRATION
Follow physician’s orders. Standard dosing:

Adults: 80 mg IV bolus over 30 minutes, followed by infusion at 8 mg/hr

Peds: Follow physician’s orders

SPECIAL NOTES
➢ Use with caution in severe liver disease.
BRAND NAME(S)
Sublimaze

CLASS OF DRUG
Opiate analgesic

INDICATIONS
1. Analgesia for patients with moderate to severe pain
2. Short term sedation
3. Anesthesia

CONTRAINDICATIONS
1. Hypersensitivity/known intolerance
2. Patients particularly sensitive to respiratory depression
3. Myasthenia gravis
4. Pregnancy

DRUG INTERACTIONS
1. Benzodiazepines Diazepam - increased risk of CV depression.
2. Sedatives/Hypnotics, other opioids, CNS depressants and alcohol - increased risk of hypotension.
3. Avoid use in patients who have received MAO inhibitors within the previous 14 days - may produce unpredictable, potentially fatal reactions.

ADMINISTRATION
Adults: Analgesia: 0.5 – 1 µg/kg (50 – 100 µg) IV, or 1 – 2 µg/kg IN. Sedation (intubated): 0.5 – 2 µg/kg IV every 10 minutes as needed.

Peds: Analgesia: 0.5 - 1 µg/kg IV, or 1 – 2 µg/kg IN. Sedation (intubated): 0.5 – 2 µg/kg IV every 10 minutes as needed.

SPECIAL NOTES
➢ Use cautiously in geriatric or debilitated patient (use lower doses), diabetics, patients with pulmonary or hepatic disease, head trauma, increased ICP, undiagnosed abdominal pain and cardiac disease.
➢ Abdominal distension, muscle rigidity, and/or urinary retention may be seen at high doses.
**BRAND NAME(S)**
Romazicon

**CLASS OF DRUG**
GABA/Benzodiazepine receptor blocker

**INDICATIONS**
1. Reversal of the sedative effects of benzodiazepines

**CONTRAINDICATIONS**
1. Hypersensitivity to flumazenil or benzodiazepines
2. Benzodiazepine dependence

**DRUG INTERACTIONS**
1. Caution is necessary when using flumazenil in cases of mixed drug overdoses as the toxic effects of other drugs taken in overdose may emerge with the reversal of the benzodiazepine effect by flumazenil.

**ADMINISTRATION**
- **Adults:** 0.2 mg IV slow push over 1-2 minutes
- **Peds:** 5 µg/kg IV slow push over 1-2 minutes (Max 200 µg)

**SPECIAL NOTES**
- The use of flumazenil has been associated with the occurrence of seizures.
- These are most frequent in patients who have been on benzodiazepines for long-term sedation or in overdose cases where patients are showing signs of serious cyclic antidepressant overdose.
Fosphenytoin

BRAND NAME(S)
Cerebyx

CLASS OF DRUG
Anti-epileptic

INDICATIONS
1. Prevention of seizures
2. Status epilepticus

CONTRAINDICATIONS
1. Hypersensitivity to fosphenytoin, phenytoin, other hydantoins.
2. Sinus bradycardia, sinoatrial block, or second- and third-degree AV block.

DRUG INTERACTIONS
1. Tricyclic antidepressants may precipitate seizures in susceptible patients and phenytoin dosage may need to be adjusted.
2. Drugs whose efficacy is impaired by phenytoin include: corticosteroids, warfarin, furosemide, oral contraceptives, rifampin, and theophylline.

ADMINISTRATION
Adults/Peds: 20 PE/kg IV infusion (max 1,500 PE, dose expressed in Phenytoin Equivalents – PE), infuse no faster than 150 PE/min

SPECIAL NOTES
- If intravenous phenytoin is given too rapidly, may result in cardiac dysrhythmias (including ventricular fibrillation or asystole) or hypotension.
- Subcutaneous extravasations of intravenous phenytoin may cause tissue necrosis or pain at the IV site.
BRAND NAME(S)
Lasix

CLASS OF DRUG
Potent loop diuretic

INDICATIONS
1. Pulmonary edema
2. Hypertensive emergencies (AMI, APE, or encephalopathy)

CONTRAINDICATIONS
1. Hypovolemia
2. Hypokalemia
3. Hypotension

DRUG INTERACTIONS
1. Severe hypotension with antihypertensives and nitrates

ADMINISTRATION
Adults: For patients not currently taking furosemide, 20 - 40 mg slow IVP or 0.5 - 1.0 mg/kg slow IV/IO. If the patient is currently taking furosemide, double their current dose and administer IV/IO. You may repeat one dose in 2 hours.

Adult Infusion: Do not titrate during transport. Typical dosing range: 20 – 160 mg/hr.

Peds: 1.0 mg/kg slow IVP. It may be repeated in 6 - 8 hours.

SPECIAL NOTES
➢ It can lead to profound diuresis with resultant shock and electrolyte depletion (particularly K+). Therefore, do not use in hypovolemic states and monitor closely, particularly after IV administration.
➢ It should be used cautiously in children or pregnant women.
➢ If patient is unconscious, must have Foley catheter in place and unobstructed urine outflow. Advise the physician if urine is bloody. Trauma to kidneys and urinary system makes the use of furosemide more hazardous.
Heparin

BRAND NAME(S)
N/A

CLASS OF DRUG
Anticoagulant

INDICATIONS
1. Adjunct to treatment for coronary occlusion
2. Thrombosis in deep vein phlebitis
3. Pulmonary emboli
4. Atrial fibrillation to prevent emboli
5. Low dose to maintain IV patency
6. Disseminated Intra-vascular Coagulation (DIC)

CONTRAINDICATIONS
1. Uncontrolled bleeding, except in DIC
2. Severe thrombocytopenia
3. Hypersensitivity to heparin, and to pork and/or beef
4. Severe hepatic disease with hypoprothrombinemia

DRUG INTERACTIONS
1. Increased risk of bleeding when used with aspirin, non-steroidal anti-inflammatory agents, dipyridamole, dextran, quinidine, cefamandole, cefmetazole, cefoperazone, cefotetan, thrombolytics, and warfarin.

ADMINISTRATION:
Cardiac Dosing
Adults: Bolus 60 units/kg (Max 4,000 units), then infuse at 12 units/kg/hr (Max 1,000 units/hr)
Peds: Contact MRCC

DVT/PE Dosing
Adults: Bolus 80 units/kg (Max 5,000 units), then infuse at 18 units/kg/hr (Max 1,300 units/hr)
Peds: Contact MRCC

SPECIAL NOTES
- It must be administered by an infusion pump.
- Monitor all puncture sites (catheter, incision, etc) for bleeding.
- Avoid new puncture sites, incisions or injections.
- Have all dosages double-checked by another Paramedic or RN.
- Protamine Sulfate must be carried on long transports with patients receiving heparin.
BRAND NAME(S)
Apresoline

CLASS OF DRUG
Antihypertensive, vasodilator

INDICATIONS
1. Hypertension

CONTRAINDICATIONS
1. Hypersensitivity to hydralazine or any component of the formulation
2. Coronary artery disease
3. Mitral valve rheumatic heart disease

DRUG INTERACTIONS
1. Concomitant administration with other antihypertensive medications increases the risk of hypotension.

ADMINISTRATION:
Adults: 10 – 20 mg IV slow push over 1-2 minutes. Repeat every 4 hours as needed.
Peds: 0.1 – 0.2 mg/kg/dose (Max 20 mg) IV slow push. Repeat every 4 hours as needed

SPECIAL NOTES
- Monitor blood pressure closely following IV administration.
- Response may be delayed and unpredictable in some patients
BRAND NAME(S)
Dilaudid

CLASS OF DRUG
Opiate analgesic

INDICATIONS
1. Analgesia for patients with moderate to severe pain
2. Sedation for procedures

CONTRAINDICATIONS
1. Hypersensitivity.
2. Hypotension is a relative contraindication to use. Remember that some people will be hypotensive in response to pain itself. Be cautious.
3. Head or abdominal injuries also contraindicated, since the analgesic effect removes the clinical signs that need to be watched.
4. Do not use in persons with respiratory difficulties because their respiratory drive might be depressed, except in pulmonary edema.
5. In the presence of major blood loss, the body’s compensatory mechanisms may be suppressed by the use of morphine, and the hypotensive effect will become very prominent. Do not use it in these circumstances.

DRUG INTERACTIONS
1. Additive effects with other CNS depressants.
2. MAO inhibitors can cause unpredictable and severe reactions reduce dose to 25% of a usual dose.

ADMINISTRATION
Adults: Analgesia: 0.2 – 1.0 mg slow IV push, repeat every 30 minutes as needed. Sedation (intubated): 0.5 – 2 mg IV every 20 minutes as needed.

Peds: Analgesia: 0.01 mg/kg (Max 1 mg) slow IV push, repeat every 30 minutes as needed. Sedation (intubated): 0.01 – 0.02 mg/kg every 20 minutes as needed.

SPECIAL NOTES
➢ Take vital signs before and 2 minutes after administration.
➢ May cause vomiting; administer slowly.
Hypertonic Saline

APPROVED SOLUTIONS
3% Sodium Chloride

INDICATIONS
1. Cerebral edema
2. Severe hyponatremia

CONTRAINDICATIONS
1. Hypovolemic state
2. Hypotension
3. Acute congestive heart failure exacerbation

DRUG INTERACTIONS
1. None

ADMINISTRATION
(Doses vary per physician direction)

Cerebral Edema
Adults: 150 mL IV infuse over 15 minutes.
Peds: 2 – 6 mL/kg (max 150 mL), infuse slowly over 10 – 15 minutes

Hyponatremia
(Follow transferring provider’s instructions)

SPECIAL NOTES
- Preferably this should be infused via a central venous catheter. A large bore peripheral line may be used in life-threatening situations.
- Monitor IV site for redness, irritation, and patency.
- Cardiac monitoring required.
CLASS OF DRUG
Hormone (natural or synthetic)

INDICATIONS
1. Diabetic ketoacidosis
2. Hyperglycemia
3. Hyperkalemia
4. Beta-blocker or calcium-channel blocker overdose

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTION
1. Beta-adrenergic blocker may block signs and symptoms of hypoglycemia.
2. Increase insulin requirements: alcohol, glucocorticoids, and thyroid preparations
3. Decreased insulin requirements: anabolic steroids, tricyclic antidepressants, and MAO inhibitors.

ADMINISTRATION
Dosages vary dependent on the type of insulin, glucose level, and clinical situation.  Typical doses:

- DKA/Hyperglycemia: 0.1 units/kg/hr
- Hyperkalemia: 10 units IV
- BB/CCB Overdose: 1 – 10 units/kg/hr

FOLLOW PHYSICIAN’S ORDERS FOR TRANSPORT.
1. Insulin is sometimes added to TPN, dosage is usually 1-5 u/liter of Regular insulin, or dosage dependent on blood sugar levels and orders of the transferring physician.

SPECIAL NOTES
- It must be monitored by infusion pump.
IV Solutions

APPROVED SOLUTIONS
0.9% Sodium Chloride, 0.45% Sodium Chloride, Lactated Ringer’s Solution, 5% Dextrose 0.9% Sodium Chloride (D5NS), 5% Dextrose 0.45% Sodium Chloride (D5 1/2NS), 5% Dextrose in Water (D5W), 10% Dextrose in Water (D10W)

INDICATIONS
1. Hypovolemia
2. Facilitate intravenous medication administration
3. Hypoglycemia (dextrose-containing solutions)
4. Hyponatremia (hypertonic solutions)
5. Hypernatremia (hypotonic solutions)

CONTRAINDICATIONS
1. Evidence of acute congestive heart failure
2. Evidence of renal failure with volume overload

DRUG INTERACTIONS
1. None

ADMINISTRATION
*Doses vary per physician direction*

SPECIAL NOTES
- Solutions containing sodium ions should be used with great care, if at all, in patients with congestive heart failure, severe renal insufficiency and in clinical states in which there exists edema with sodium retention.
- Excessive administration of potassium-free solutions may result in significant hypokalemia.
- In patients with diminished renal function, administration of solutions containing sodium ions may result in sodium retention.
- The intravenous administration of these solutions can cause fluid and/or solute overloading resulting in dilution of serum electrolyte concentrations, overhydration, congested states or pulmonary edema.
- The risk of dilutional states is inversely proportional to the electrolyte concentrations of administered parenteral solutions. The risk of solute overload causing congested states with peripheral and pulmonary edema is directly proportional to the electrolyte concentrations of such solutions.
**BRAND NAME(S)**
Ketalar

**CLASS OF DRUG**
Dissociative anesthetic

**INDICATIONS**
1. Sedation
2. RSI
3. Analgesia

**CONTRAINDICATIONS**
1. Hypersensitivity
2. Significant elevation in BP

**DRUG INTERACTIONS**
1. Hallucinations
2. Dream like feeling
3. Nausea and vomiting
4. Excessive bronchial secretions
5. Increased skeletal muscle tone
6. Hypotension
7. Bradycardia
8. Apnea

**ADMINISTRATION**

- **Analgesia:** 0.25 – 0.5 mg/kg slow IV push
- **RSI:** 3 mg/kg IV for induction
- **Sedation:** 0.5 – 1 mg/kg IV every 20 minutes as needed, or titrate continuous infusion at 1 – 4 mg/kg/hr

**SPECIAL NOTES**
- Resuscitation equipment must be readily available
- ECG, SpO₂, EtCO₂ must be in place prior to administration
- Ketamine may be harmful to an unborn baby. Use with extreme prejudice in pregnant patients
- Cardiac function should be continually monitored during the procedure in patients found to have hypertension or cardiac decompensation.
BRAND NAME(S)
Normodyne

CLASS OF DRUG
Beta-adrenergic blocker

INDICATIONS
1. Used alone or in combination with other agents in the management of hypertension.

CONTRAINDICATIONS
1. Uncompensated congestive heart failure
2. Pulmonary edema
3. Cardiogenic shock
4. Bradycardia or heart block

DRUG INTERACTIONS
1. General anesthesia, IV Phenytoin, and Verapamil may cause additive myocardial depression.
2. May decrease the beta effects of Dopamine or Dobutamine.
3. Additive bradycardia may occur with digitalis glycosides.
4. Additive hypotension may occur with other antihypertensives, alcohol or nitrates.
5. May alter effectiveness of insulin or oral hypoglycemic agents.

ADMINISTRATION
Adults: 5 – 20 mg slow IV push, or infuse at 0.5 – 3 mg/min
Peds: 0.2 – 1 mg/kg slow IV push, or infuse at 0.25 – 3 mg/kg/hr

SPECIAL NOTES
➢ Use cautiously within 14 days of MAO inhibitor therapy.
Levetiracetam

BRAND NAME(S)
Keppra

CLASS OF DRUG
Anti-convulsant

INDICATIONS
1. Status epilepticus
2. Prevention of seizures

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTIONS
1. No significant pharmacokinetic interactions were observed between levetiracetam, or its major metabolite, and concomitant medications.

ADMINISTRATION
Adults: 20 mg/kg IV (max 1,000 mg), infuse over 15 min.
Peds: 20 mg/kg IV (max 1,000 mg), infuse at 2 – 5 mg/kg/min.

SPECIAL NOTES
➢ Levetiracetam may cause behavioral abnormalities and psychotic symptoms.
➢ Monitor for development of rash and/or blistering.
Lidocaine

BRAND NAME(S)
N/A

CLASS OF DRUG:
Antidysrhythmic, local anesthetic

INDICATIONS
1. Symptomatic ventricular dysrhythmias
2. Sustained ventricular tachycardia
3. Ventricular fibrillation/pulseless ventricular tachycardia
4. Local anesthetic for nasal intubation

CONTRAINDICATIONS
1. Hypersensitivity
2. High AV Blocks

DRUG INTERACTIONS
1. Additive cardiac depression with phenytoin, quinidine, procainamide, and propranolol

ADMINISTRATION

**Adults:** Ventricular tachycardia: 1-1.5 mg/kg IV. If VT persists, 0.5-0.75 mg/kg every 3 to 5 minutes, up to 3.0 mg/kg total. Start lidocaine infusion if VT converts.

VF and pulseless VT: 1-1.5 mg/kg IV followed by defibrillation. If VF or VT persists - repeat 0.5-0.75mg/kg (up to 3.0 mg/kg total) followed by defibrillation. Start lidocaine infusion if VF converts.

Infusion: Mix 1g of lidocaine in 250 mL D5W or NS (for a concentration of 4 mg/ml). Infuse at 1 - 4 mg/min.

**Peds:** 1 mg/kg IV. For continuous infusion, mix 120 mg of lidocaine in 100 mL D5W. Start drip at 20-50 μg/kg per min (1-2.5 mL/kg/hr at current dilution).

SPECIAL NOTES
- For patients over 70 years of age, or with hepatic or renal failure, the loading dose remains the same, but maintenance infusion is run at half the normal rate.
Lipid Emulsion

APPROVED SOLUTIONS
20% Lipid Emulsion

INDICATIONS
1. Hemodynamic instability due to toxicity from lipid-soluble medications

CONTRAINDICATIONS
1. Non-toxicologic cause of hemodynamic collapse

DRUG INTERACTIONS
1. None

ADMINISTRATION
Dose: 1.5 mL/kg (approx 100 mL for average adult) IV over 1 minute. Then infuse at 0.25 mL/kg/min for up to 60 minutes, or 10 minutes after attaining hemodynamic stability (whichever comes first).

SPECIAL NOTES
- Patients who are candidates for this treatment are generally too unstable for transport and at imminent risk of cardiac arrest. Discuss the case with the transferring physician to ensure that the benefits of transport outweigh the risks of reduced resources during transport, and that the receiving facility has accepted the transfer and is aware of the critical status of the patient.
BRAND NAME(S)
Ativan

CLASS OF DRUG
Anticonvulsant, anti-anxiety, sedative, muscle relaxant

INDICATIONS
1. Control of seizures.
2. Sedation for cardioversion.
3. Reduction of anxiety.
4. Skeletal muscle relaxant.

CONTRAINDICATIONS
1. Hypersensitivity
2. CNS depression

DRUG INTERACTIONS
1. Additive effect to other CNS depressants such as alcohol, narcotics, etc

ADMINISTRATION
Adults: Anxiolysis: 0.5 – 1 mg IV. Seizure: 1 – 2 mg IV. Sedation (intubated): 1 – 4 mg IV
Peds: Anxiolysis: 0.02 mg/kg (Max 1 mg). Seizure: 0.05 mg/kg (Max 2 mg). Sedation (intubated): 0.15 mg/kg (Max 4 mg)

SPECIAL NOTES
➢ Should not be mixed with other agents, or diluted with intravenous solutions. Give through the proximal end of IV tubing, then flush well.
➢ Most likely to produce respiratory depression in patients who have taken other depressant drugs, especially alcohol and barbiturates.
➢ It can cause local venous irritation. Use relatively large veins.
➢ Versed has short half-life. Additional doses may be necessary.
Magnesium Sulfate

BRAND NAME(S)
N/A

CLASS OF DRUG
CNS depressant; antidysrhythmic; electrolyte; smooth muscle relaxant

INDICATIONS
1. Initial treatment of seizures associated with eclampsia, and seizures, refractory to benzodiazepines.
3. First-line antidysrhythmic in the treatment of Torsades de Pointes.
4. To control contractions in pre-term labor.
5. Acute asthma refractory to other more conventional treatment, or when the effects of betaadrenergic medications contraindicate their use.

CONTRAINDICATIONS
1. Hypermagnesemia
2. Hypocalcemia
3. Anuria
4. Heart blocks

DRUG INTERACTIONS
1. Potentiates neuromuscular blocking agents

ADMINISTRATION

Refractory ventricular arrhythmias: 2 g IV (slow push diluted in 10 mL of NS if pulse is present).
Pre-term labor: 2 - 4 g slow IV push, then start infusion at 1 - 2 g/hr.
Pre-eclampsia/eclampsia: 2 - 4 g slow IV push, then start infusion at 1 - 2 g/hr.
Refractory asthma: 1 - 2 g slow IV push, diluted in 10 mL of NS, infuse over 10 minutes.
Hypomagnesemia: 2 g IV, infuse over 1 hour.
Peds: 40 mg/kg (Max 2,000 mg), slow IV push diluted in 10 mL of NS

SPECIAL NOTES
- Monitor deep tendon reflexes often, especially those patients receiving a maintenance infusion.
- Calcium gluconate or calcium chloride will reverse the toxic effects of magnesium sulfate.
- Monitor for hypotension.
BRAND NAME(S)
Osmitrol

CLASS OF DRUG
Osmotic diuretic

INDICATIONS
1. Cerebral edema
2. Increased intra-cranial pressure

CONTRAINDICATIONS
1. Hypersensitivity
2. Anuria
3. Hypovolemia/dehydration
4. Active intra-cranial bleeding
5. Pulmonary edema

DRUG INTERACTIONS
1. None

ADMINISTRATION
Elevated ICP: 0.25 – 1 g/kg slow IV infusion over 20 minutes

SPECIAL NOTES
- Should be run through an in-line filter.
- Incompatible with most other drugs.
- May crystallize at low temperature.
Methylprednisolone

BRAND NAME(S)
Solu-Medrol

CLASS OF DRUG
Anti-Inflammatory; immunosuppressant

INDICATIONS
1. Reactive airway disease with no response to Albuterol and other treatments
2. Allergic reactions

CONTRAINDICATIONS
1. Absolute – Hypersensitivity
2. Relative – Immunocompromised state; serious infections; psychotic disorders

DRUG INTERACTIONS
1. None

ADMINISTRATION
Adults: 125 mg IV every 6 hours
Peds: 1 - 2 mg/kg (max 125 mg) IV every 6 hours

SPECIAL NOTES
➢ Adverse effects – hyperglycemia; psychosis.
BRAND NAME(S)
Reglan

CLASS OF DRUG
Anti-emetic

INDICATIONS
1. Nausea
2. Gastroparesis

CONTRAINDICATIONS
1. Parkinsons disease
2. Hypersensitivity to metoclopramide
3. Mechanical obstruction

DRUG INTERACTIONS
1. The effects of metoclopramide on gastrointestinal motility are antagonized by anticholinergic drugs and narcotic analgesics.
2. Additive sedative effects can occur when metoclopramide is given with alcohol, sedatives, hypnotics, narcotics, or tranquilizers.

ADMINISTRATION
Adults: 10 mg slow IV push over 2 minutes every 6 hours
Peds: 0.15 - 0.30 mg/kg slow IV push every 6 hours

SPECIAL NOTES
- Extra-pyramidal symptoms may be treated by administering diphenhydramine 50 mg IV (Peds: 1 mg/kg, max 50 mg) over 2 minutes
BRAND NAME(S)
Lopressor

CLASS OF DRUG
Beta-adrenergic blocker

INDICATIONS
1. Used alone or in combination with other agents in the management of hypertension or tachycardia.

CONTRAINDICATIONS
1. Uncompensated congestive heart failure
2. Pulmonary edema
3. Cardiogenic shock
4. Bradycardia or heart block

DRUG INTERACTIONS
1. General anesthesia, IV Phenytoin, and Verapamil may cause additive myocardial depression.
2. May decrease the beta effects of Dopamine or Dobutamine.
3. Additive bradycardia may occur with digitalis glycosides.
4. Additive hypotension may occur with other antihypertensives, alcohol or nitrates.
5. May alter effectiveness of insulin or oral hypoglycemic agents.

ADMINISTRATION

Adults: 2.5 – 5 mg slow IV push over 2 minutes, may repeat every 5 minutes as needed (max 15 mg)

Peds: Not indicated

SPECIAL NOTES
- Use cautiously within 14 days of MAO inhibitor therapy.
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BRAND NAME(S)

Versed

CLASS OF DRUG

Anticonvulsant, anti-anxiety, sedative, muscle relaxant

INDICATIONS

1. Control of seizures.
2. Sedation for cardioversion.
3. Reduction of anxiety.
4. Skeletal muscle relaxant.

CONTRAINDICATIONS

1. Hypersensitivity
2. CNS depression

DRUG INTERACTIONS

1. Additive effect to other CNS depressants such as alcohol, narcotics, etc.

ADMINISTRATION

Adults: Anxiolysis: 1 – 2 mg IV, or 2 – 4 mg IN, every 30 minutes as needed. Seizure: 2 mg IV or 5 mg IM. Sedation: 1 – 5 mg slow IV push over 2 minutes, repeat as needed.

Peds: Anxiolysis: ≤ 5 yrs 0.05 mg/kg slow IV push, > 5 yrs 0.025 mg/kg slow IV push, or any age 0.1 mg/kg IN, every 30 minutes as needed. Seizure: 0.1 mg/kg IV (max 2 mg) or 0.2 mg/kg IM (max 5 mg). Sedation: 0.05 – 0.1 mg/kg slow IV push, repeat as needed.

SPECIAL NOTES

➢ Should not be mixed with other agents, or diluted with intravenous solutions. Give through the proximal end of IV tubing, then flush well.
➢ Most likely to produce respiratory depression in patients who have taken other depressant drugs, especially alcohol and barbiturates.
➢ It can cause local venous irritation. Use relatively large veins.
BRAND NAME(S)
Mucomyst

CLASS OF DRUG
Mucolytic

INDICATIONS
1. Antidote to acetaminophen overdose

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTIONS
1. None

ADMINISTRATION

Loading dose: 150 mg/kg (max 15 g), IV infusion over 60 minutes
Second dose: 50 mg/kg (max 5 g), IV infusion over 4 hours
Third dose: 100 mg/kg (max 10 g), IV infusion over 16 hours

SPECIAL NOTES
➢ 100% effective if initiated within 8 hours of an ingestion.
Naloxone

BRAND NAME(S)
Narcan

CLASS OF DRUG
Narcotic antagonist

INDICATIONS
1. Reversal of narcotic effects, particularly respiratory depression, due to narcotic drugs, whether ingested, injected, or administered in the course of treatment. Narcotic drugs include agents such as morphine, Demerol, heroin, hydromorphone, Percodan, codeine, Lomotil, propoxyphene (Darvon), pentazocine (Talwin).
2. For unconsciousness of unknown etiology to rule out (or reverse) narcotic depression of CNS.

CONTRAINDICATIONS
1. Hypersensitivity
2. Absences of indication

DRUG INTERACTIONS
1. May induce narcotic withdrawal

ADMINISTRATION
Adults: 0.4 mg – 2 mg IV or IN, titrate to respiratory effort/rate. May be repeated at 2 - 3 minutes, if needed.
Peds: 0.1 mg/kg (< 5 yrs or ≤ 20 kg), 2 mg (≥5 yr or > 20kg) IV. May be repeated at 0.1 mg/kg if no response.
Neonate: 0.1 mg/kg slow IV push. Repeat in 2-3 minutes, if needed. Mix 1 mL of naloxone, 0.4 mg, in 9 mL of D5W, which gives 0.04 mg/mL.

SPECIAL NOTES
➢ The patient may quickly become conscious and combative.
BRAND NAME(S)
Cardene

CLASS OF DRUG
Calcium Channel Blocker; Coronary Vasodilator, Antidysrhythmic

INDICATIONS
1. Hypertension

CONTRAINDICATIONS
1. Sick sinus syndrome except in the presence of a functioning ventricular pacemaker.
2. Patients with second- or third degree AV block except in the presence of a functioning ventricular pacemaker.
3. Patients with severe hypotension or cardiogenic shock.
4. Patients who have demonstrated hypersensitivity to the drug.
5. Intravenous calcium-channel blockers and intravenous beta-blockers should not be administered together or in close proximity (within a few hours).
6. Patients with atrial fibrillation or atrial flutter associated with an accessory bypass tract such as in WPW syndrome or short PR syndrome.
7. Patients with ventricular tachycardia.
8. Severe aortic stenosis

DRUG INTERACTIONS
1. Additive effects in prolonging AV conduction when using beta-blockers or digitalis concomitantly with calcium-channel blockers.

ADMINISTRATION
Adults: Start at 5 mg/hr, titrate by 2.5 mg/hr every 5 – 10 minutes as needed (Max 15 mg/hr).
Peds: Not indicated.

SPECIAL NOTES
- Carefully monitor for hypotension/excessive bradycardia or new A/V block
- PVC’s can occur with conversion to NSR
- Don’t use in the presence of a WIDE COMPLEX TACHYCARDIA
- May be contraindicated in severe Aortic Stenosis as nicardipine may decrease preload.
BRAND NAME(S)
Nitrostat

CLASS OF DRUG
Anti-anginal agent/vascular dilating agent

INDICATIONS
1. Chest pain, anginal pain
2. Congestive heart failure with severe pulmonary edema

CONTRAINDICATIONS
1. Hypersensitivity
2. Severe hypotension
3. Pericardial tamponade
4. Increased intra-cranial pressure
5. Hypovolemia/severe anemia

DRUG INTERACTIONS
1. Additive hypotension with beta-adrenergic blockers, antihypertensives, calcium channel blockers, and phenothiazines.
2. Tricyclic antidepressants and antihistamines may interfere with buccal absorption.
3. Can cause a lethal drop in blood pressure in patients taking Sildenafil citrate (Viagra) within 48 hours of ingestion.

ADMINISTRATION
Adults: Sublingual: 0.4 mg tablet or metered dose spray. Repeat every 3 - 5 minutes as needed
Infusion: Start at 50 µg/min, titrate by 5 – 10 µg/min every 3 – 5 minutes (Range 10 - 250 µg/min). The infusion dose is leveled off when desired effect is reached or a decrease in blood pressure of more than 10 mmHg over baseline or less than 90 mmHg systolic is observed.

Peds: Not indicated.

SPECIAL NOTES
- Common side effects may include: throbber headache, flushing, dizziness, and burning under the tongue (if these side effects are noted, the pills may be assumed potent, not outdated).
- Less common effect: marked hypotension, particularly orthostatic.
- Paramedics should use their supply of nitroglycerin, not the patient's.
- Use with caution with patient not previously receiving nitroglycerin.
- Generalized vasodilation may cause profound hypotension and reflex tachycardia.
- NTG tablets loose potency easily, should be stored in a dark glass container with a tight lid, and not exposed to heat. NTG spray does not have this problem.
- Use only with Medical Control on patients with systolic BP below 100 mm Hg.
- Nitroglycerin can be absorbed into standard PVC IV tubing sets. If available, specialized nitroglycerin infusion tubing sets should be used.
BRAND NAME(S)  
Levophed

CLASS OF DRUG  
Sympathomimetic

INDICATIONS  
1. Forms of shock with low or normal peripheral vascular resistance (e.g., spinal shock, sepsis).
2. Second-line vasopressor for cardiogenic shock during inter-facility transports.

CONTRAINDICATIONS:  
1. Hypovolemia (relative)
2. Vascular thrombosis, unless no alternative
3. Hypoxia or hypercapnia

DRUG INTERACTIONS  
1. Cyclopropane or halothane anesthesia, cardiac glycosides, doxapram and cocaine may increase myocardial irritability.
2. MAO inhibitors, methyldopa, doxapram, and tricyclic antidepressant may produce severe hypertension.
3. Alpha-adrenergic blockers may negate effects.
4. Beta-adrenergic blockers may exaggerate hypertension, and block cardiac simulation.
5. Ergot alkaloids or oxytocin may result in enhanced vasoconstriction.

ADMINISTRATION  
Infusion:  Start at 0.1 µg/kg/min, titrate by 0.05-0.2 µg/kg/min every 5 minutes as needed (Max: 1 µg/kg/min)

SPECIAL NOTES  
- Use with an infusion pump only.
- Must be infused through a central venous catheter.
- Incompatible with alkaline solutions, aminophylline, barbiturates, phenytoin.
Octreotide

BRAND NAME(S)
Sandostatin

CLASS OF DRUG
Hormone (gastrointestinal)
Antidiarrheal

INDICATIONS
1. Treatment of active GI bleeds during transport.

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTIONS
1. May alter insulin and oral hypoglycemic agent requirements.
2. May interfere with beta-adrenergic blocking agents, calcium channel blockers, and agents to control fluid and electrolyte balance.

ADMINISTRATION
Adults: 50 µg IV bolus, then infuse at 25-50 µg/hr, no titration necessary.
Peds: Not indicated.

SPECIAL NOTES
➢ Use with caution in diabetics, patients with gallbladder disease, severe renal failure requiring dialysis and during lactation.
BRAND NAME(S)
Pitocin

CLASS OF DRUG
Pituitary hormone - uterine vasoconstrictor

INDICATIONS
1. Control of post-partum hemorrhage, when other methods fail

CONTRAINDICATIONS
1. Potential of a remaining fetus

DRUG INTERACTIONS
1. Hypertension with vasopressors

ADMINISTRATION
Injectable oxytocin (PITOCIN®) contains 10 USP units (20 mg) per ml
Adults: 10 - 40 units in 1,000 mL NS. Infuse at 125 mL/hr, titrate to severity of hemorrhage and uterine response.

SPECIAL NOTES
None
BRAND NAME(S)
Pavulon

CLASS OF DRUG
Non-depolarizing paralytic

INDICATIONS
1. Relaxation of skeletal muscles during surgery or mechanical ventilation

CONTRAINDICATIONS
None

DRUG INTERACTIONS
None

ADMINISTRATION
Dose: 10 mg/kg, may repeat every 1-2 hours as needed

SPECIAL NOTES
- This agent has no analgesic or amnestic properties.
- Adequate sedation must be ensured while patient is receiving this medication.
- Rare bronchospasm can occur with this medication.
BRAND NAME(S)
Protonix

CLASS OF DRUG
Proton pump inhibitor – diminishes daily production of acid

INDICATIONS
1. Acid related gastrointestinal disorders
2. Reduce risk of upper GI bleeding in critically ill patients

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTIONS
1. Reduced clearance of diazepam
2. Reduced bioavailability of drugs dependant on gastric pH
3. Interacts with warfarin and cyclosporin

ADMINISTRATION
Follow physician’s orders. Standard dosing:

Adults: 80 mg IV bolus over 5 minutes, followed by infusion at 8 mg/hr

Peds: Follow physician’s orders

SPECIAL NOTES
➢ Use with caution in severe liver disease.
BRAND NAME(S)
Neosynephrine

CLASS OF DRUG
Alpha-adrenergic agent, vasoconstrictor

INDICATIONS
1. Shock, pathophysiologic states with low systemic vascular resistance but normal cardiac output

CONTRAINDICATIONS
1. Known hypersensitivity
2. Severe hypertension
3. Ventricular tachycardia

DRUG INTERACTIONS
1. May decrease effectiveness of insulin, and oral hypoglycemic agents.
2. Use with beta blockers may result in initial hypertension followed by bradycardia.
3. MAO inhibitors – hypertension.

ADMINISTRATION
Adults: Start at 0.5 µg/kg/min, titrate by 0.1-0.2 µg/kg/min every 10 minutes as needed (Max: 5 µg/kg/min).

Peds: 0.1-0.5 µg/kg/min.

SPECIAL NOTES
- Use with extreme caution in geriatric patients, severe arteriosclerosis, bradycardia, partial heart block, pregnancy and lactation.
- Produces pure alpha- stimulation, no effect on cardiac contractility or output.
**BRAND NAME(S)**
Dilantin

**CLASS OF DRUG**
Anti-epileptic

**INDICATIONS**
1. Prevention of seizures
2. Status epilepticus

**CONTRAINDICATIONS**
1. hypersensitivity to fosphenytoin, phenytoin, other hydantoins.
2. Sinus bradycardia, sinoatrial block, or second- and third-degree AV block.

**DRUG INTERACTIONS**
1. Tricyclic antidepressants may precipitate seizures in susceptible patients and phenytoin dosage may need to be adjusted.
2. Drugs whose efficacy is impaired by phenytoin include: corticosteroids, warfarin, furosemide, oral contraceptives, rifampin, and theophylline.

**ADMINISTRATION**
Adults/Peds: 20 mg/kg IV infusion (max 1,500 mg), infuse no faster than 50 mg/min (or 1 mg/kg/min).

**SPECIAL NOTES**
- If intravenous phenytoin is given too rapidly, may result in cardiac dysrhythmias (including ventricular fibrillation or asystole) or hypotension.
- Subcutaneous extravasations of intravenous phenytoin may cause tissue necrosis or pain at the IV site.
BRAND NAME(S)
N/A

CLASS OF DRUG
Electrolyte

INDICATIONS
1. IV preparations are used for treatment or prophylaxis of hypokalemia.

CONTRAINdications
1. Severe renal impairment
2. Hyperkalemia
3. Untreated Addison’s disease
4. Severe tissue trauma

DRUG INTERACTIONS
1. None

ADMINISTRATION
Adults: 10 to 20 mEq/hour IV
Peds: 2 - 3 mEq/kg/day IV

SPECIAL NOTES
- Cardiac Monitoring required.
- Infusion rates greater than 10 mEq/hour require central venous access.
BRAND NAME(S)
Pronestyl

CLASS OF DRUG
Antidysrhythmic

INDICATIONS
1. Sustained ventricular tachycardia (with pulse) refractory to lidocaine
2. Premature ventricular contractions refractory to lidocaine
3. Management of ventricular dysrhythmias when lidocaine contraindicated
4. Chemical conversion of atrial fibrillation

CONTRAINDICATIONS
1. Pre-existing QT prolongation or torsades de pointes
2. High AV blocks unless a pacemaker is in place.
3. Hypersensitivity

DRUG INTERACTIONS
1. Additive effect with other antidysrhythmics.
2. Antihypertensives may produce hypotension.
3. Additive anticholinergic effects with other anticholinergics.
4. Neurological toxicity with lidocaine.

ADMINISTRATION
Stop administration if:
• The arrhythmia disappears.
• Hypotension ensues.
• The QRS is widened by 50% of its original width.
• A total of 17 mg/kg of the medication has been administered.

Adults: Infuse 1 g in 250 mL D5W or NS over 60 minutes. Alternatively, infuse at 1 – 4 mg/min.
Peds: Not indicated.

SPECIAL NOTES
➢ May cause severe hypotension, bradycardia and heart blocks.
➢ Nausea and vomiting are common.
BRAND NAME(S)
Compazine

CLASS OF DRUG
Antiemetic

INDICATIONS
1. Nausea/vomiting
2. Migraine headache

CONTRAINDICATIONS
1. Hypersensitivity
2. Comatose patients
3. Patients that have received large amounts of CNS depressants
4. Do not use in pediatric patients under 2 years of age or under 20 lbs.

DRUG INTERACTIONS
1. Use caution when administering with other anti-psychotic or dopaminergic medications.

ADMINISTRATION
Adults: 5 – 10 mg slow IV push over 2 minutes, every 4 hours as needed.
Peds: Not indicated.

SPECIAL NOTES
➢ May potentiate the effects of narcotics, sedatives, hypnotics, and alcohol.
➢ Extra-pyramidal symptoms may be treated by administering diphenhydramine 50 mg IV over 2 minutes.
BRAND NAME(S)
Phenergan

CLASS OF DRUG
Anti-emetic

INDICATIONS
Treatment and prevention of nausea and vomiting.

CONTRAINDICATIONS
1. Hypersensitivity to phenothiazines
2. Comatose patients
3. CNS depression due to drugs
4. Children < 2 yrs old, or critically ill or dehydrated.
5. Lactation

DRUG INTERACTIONS
1. CNS depressants - may increase, prolong or intensify the sedative action.
2. Anticholinergics - use caution.
3. MAO inhibitors - use caution.

ADMINISTRATION
Adults: 6.25 – 25 mg IV every 4 hours as needed.
Peds: > 2 years: 0.25 – 0.5 mg/kg (max 25 mg) IV every 4 hours as needed.

SPECIAL NOTES
- Use cautiously in patients with hypertension, epilepsy, sleep apnea, cardiovascular disease, impairment of the liver, and pregnancy.
- May caused marked drowsiness.
BRAND NAME(S)
Diprivan

CLASS OF DRUG
Anesthetic

INDICATIONS
1. Maintenance of sedation in intubated, mechanically ventilated patients.

CONTRAINDICATIONS
1. Not recommended in children ≤ 3 years old.
2. Avoid in patients with severe systemic disease.

DRUG INTERACTIONS
1. Additive CNS and respiratory with alcohol, antihistamines, opiates and sedative/hypnotics.

ADMINISTRATION
Adults: 5 – 80 µg/kg/minute, titrate by 5-10 µg/kg/minute every 5 minutes to maintain adequate sedation.
Peds: 5 – 150 µg/kg/minute, titrate by 5-10 µg/kg/minute every 5 minutes to maintain adequate sedation.

SPECIAL NOTES
➢ May cause hypotension and/or bradycardia.
➢ Patient should be continuously monitored for early signs of hypotension, apnea, airway obstruction, and/or oxygen desaturation.
BRAND NAME(S)
Zemuron

CLASS OF DRUG
Non-depolarizing paralytic

INDICATIONS
1. Relaxation of skeletal muscles during surgery or mechanical ventilation

CONTRAINDICATIONS
None

DRUG INTERACTIONS
None

ADMINISTRATION
Load: 0.6 mg/kg IV
Repeat: 0.2 mg/kg IV every 30-45 minutes
Infuse: 5 – 15 µg/kg/min

SPECIAL NOTES
➢ This agent has no analgesic or amnestic properties.
➢ Adequate sedation must be ensured while patient is receiving this medication.
➢ Rare bronchospasm can occur with this medication.
Sodium Bicarbonate

BRAND NAME(S)
N/A

CLASS OF DRUG
Alkalinizing agent

INDICATIONS
1. To correct metabolic acidosis found during prolonged cardiac arrest, after initial interventions.
2. May be used as an adjunct in other causes of metabolic acidosis.
3. Overdoses of tricyclic antidepressants or phenobarbital.

CONTRAINDICATIONS
1. Suspected metabolic or respiratory alkalosis

DRUG INTERACTIONS
1. Inactivates most drugs, and must not be given in the same IV at the same time.
2. Causes calcium preparations to precipitate.

ADMINISTRATION
Cardiac Arrest: 1 mEq/kg IV initially, then 0.5 mEq/kg (max 50 mEq every 10 minutes until ROSC)
Overdose situations: 1 mEq/kg IV, repeat every 10 minutes until QRS duration < 100 ms.
Hyperkalemia: 1 mEq/kg/IV (max 100 mEq)
Adult Infusion: 150 mEq in 1,000 mL D5W, infuse per transferring provider’s orders. Typical starting dose is 25 mL/hr.

SPECIAL NOTES
- This agent is no longer a first-line drug for cardiac arrest as per ACLS algorithms.
- Each amp of bicarbonate contains 44 or 50 mEq of sodium. In persons with cardiac disease this will increase intra-vascular volume and further stress the heart.
- Hyperosmolality of the blood can occur because the NaHCO3 is concentrated. This results in cerebral impairment.
- These dosages are a very rough guide. Blood gasses should be obtained as soon as possible to direct further therapy.
- Correct CPR, hyperventilation, defibrillation and drug therapy are more important than bicarbonate.
Sodium Nitroprusside

**BRAND NAME(S)**
Nipride

**CLASS OF DRUG**
Potent antihypertensive agent; vasodilator

**INDICATIONS**
1. Hypertensive emergencies
2. Reduction of cardiac pre-load and after-load
3. It is often used with vasopressor agents to maintain a blood pressure while decreasing the pre-load and after-load.

**CONTRAINDICATIONS**
1. Hypersensitivity
2. Decreased cerebral perfusion

**DRUG INTERACTIONS**
1. Additive effect with other antihypertensives

**ADMINISTRATION**

*Dose:* Start at 0.25 µg/kg/min, increase by 0.25 – 0.5 µg/kg/min every 5 minutes as needed (Max 10 µg/kg/min)

**SPECIAL NOTES**
- Solution bag line must be covered in opaque material.
- Solution is stable for only 24 hours.
BRAND NAME(S)
Terbutaline Sulfate

CLASS OF DRUG
Bronchodilator, uterine smooth muscle relaxant

INDICATIONS
1. Control of pre-term labor

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTIONS
1. Additive effect with other adrenergic drugs.
2. Beta-adrenergic blockers may negate effects.

ADMINISTRATION
Adults: 2.5 to 5 µg/min, titrate by 2.5 to 5 µg/min every 20 – 30 minutes (Max 20 µg/min).
Peds: Not indicated

SPECIAL NOTES
➤ None
TPN

BRAND NAME(S)
N/A

CLASS OF DRUG
Total Parenteral Nutrition

INDICATIONS
1. Need for intravenous nutrition

CONTRAINDICATIONS
1. Infection at site of infusion

DRUG INTERACTIONS
1. Requires a dedicated line. Do not infuse any other medications through the same line.

ADMINISTRATION
*Maintain infusion at rate specified by transferring facility.*

SPECIAL NOTES
- Requires infusion pump.
- Should not be titrated.
- Some TPN solutions may contain insulin. Discuss frequency of glucose checks with transferring provider.
- Should be infused through a central venous catheter or PICC line.
Valproic Acid

BRAND NAME(S)
Depakote

CLASS OF DRUG
Anti-epileptic

INDICATIONS
1. Prevention of seizures
2. Status epilepticus

CONTRAINDICATIONS
1. Hypersensitivity.
2. Hepatic disease.

DRUG INTERACTIONS
1. Aspirin may increase the level of valproic acid due to decreased metabolism.
2. Carbapenem antibiotics may decrease the level of valproic acid due to an unknown mechanism.

ADMINISTRATION
Adults: 20 – 40 mg/kg IV infusion, infuse no faster than 6 mg/kg/min.
Peds: 20 – 40 mg/kg IV infusion, infuse no faster than 3 mg/kg/min. A continuous infusion may be initiated at 5 mg/kg/hr until a 6 hour seizure-free period, then reduced at a rate of 1 mg/kg/hr every 2 hours.

SPECIAL NOTES
- May cause CNS depression.
BRAND NAME(S)
Pitressin

CLASS OF DRUG
Hormone (antidiuretic)

INDICATIONS
1. May be used as an alternative pressor to epinephrine in the treatment of adult shock-resistant Ventricular Fibrillation.
2. Useful in hemodynamic support in vasodilatory shock (e.g. septic shock).

CONTRAINDICATIONS
1. Chronic renal failure
2. Known hypersensitivity to beef or pork proteins

DRUG INTERACTIONS
1. Vasopressor effect may be increased by concurrent administration of ganglionic blocking agents.

ADMINISTRATION
Cardiac Arrest
Adults: 40 units IV x 1 dose. May replace either 1st or 2nd dose of epinephrine.
Peds: Not indicated.

Shock (Second or Third line pressor agent)
Adults: Infuse at 0.03 units/min, no titration.
Peds: Not indicated.

GI Bleed
Adults: Start at 0.4 units/min, titrate by 0.1 units/min every 5 minutes as needed. (Range 0.2 – 0.8 units/min)
Peds: Not indicated.

SPECIAL NOTES
1. Potent vasoconstrictor. Increased peripheral vascular resistance may provoke cardiac ischemia and angina.
2. Do not use in responsive patients with coronary artery disease.
**Vecuronium**

**BRAND NAME(S)**
Norcuron

**CLASS OF DRUG**
Non-depolarizing paralytic

**INDICATIONS**
1. Relaxation of skeletal muscles during surgery or mechanical ventilation

**CONTRAINDICATIONS**
None

**DRUG INTERACTIONS**
None

**ADMINISTRATION**
- **Load:** 0.1 mg/kg IV
- **Repeat:** 0.1 mg/kg IV every 20 – 30 minutes
- **Infuse:** 0.01 mg/kg/min

**SPECIAL NOTES**
- This agent has no analgesic or amnestic properties.
- Adequate sedation must be ensured while patient is receiving this medication.
- Rare bronchospasm can occur with this medication.
BRAND NAME(S)
Phytonadione

CLASS OF DRUG
Essential cofactor for precursors of coagulation factors

INDICATIONS
1. Correction of elevated INR due to administration of warfarin or liver impairment

CONTRAINDICATIONS
1. Hypersensitivity

DRUG INTERACTIONS
None

ADMINISTRATION
Adults: 1 – 10 mg slow IV infusion
Peds: 0.1 mg/kg (max 5 mg) slow IV infusion

SPECIAL NOTES
- Allergic reactions can occur during IV administration.
- Pro-coagulant effects are not immediate.